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Osteomyelitis in Children from Rural Population of Uttar Pradesh

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Abstract

Occurrence of *Staphylococcus aureus* in children with osteomyelitis. This study was conducted at K. M. M. C. & Hospital, Mathura (UP). A total of 60 patients with osteomyelitis contributed to this study from October 2017 to October 2019. Patients with known immunodeficiency syndromes were excluded. Specimen collections were meticulously performed to avoid contamination which was accomplished by needle aspiration or surgical sampling. *Staphylococcus aureus* was recovered in more than half of the cases of osteomyelitis in both infants and children. Amikacin, Clindamycin and Cefazolin were effective in such cases. The distal end of the femur and upper-end tibia were the most common sites of infection where boys were more infected than girls. The haematogenous route was the main cause of the transmission of osteomyelitis in children. Principally *Staphylococcus aureus* causes the majority of cases of osteomyelitis in children followed by *H. influenza, Group B Streptococcus, P. aeruginosa, E. coli* and *Serratia marcescens*.

Keywords: Osteomyelitis, *Staphylococcus aureus*, Methicillin Resistant *Staphylococcus aureus*

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INTRODUCTION

Osteomyelitis is an inflammation in bone which is caused by various bacteria[1]. Bacteria can infect bone in three ways that are haematogenous route, direct inoculation through trauma and local invasion[2]. Haematogenous is the main route of causing osteomyelitis in children whereas non-haematogenous route is not common[3]. *Staphylococcus aureus* is one of the main causes of osteomyelitis, accounting approximately 70–90% cases. Infections caused by methicillin resistant *Staphylococcus aureus* (MRSA) are very common globally which is also responsible for causing invasive infections in children which may lead to higher morbidity and mortality[4-6]. Hematogenous-osteomyelitis occurs in the long tubular bone's metaphysis (femur, tibia and humerus). The pathogenesis of hematogenous osteomyelitis differs with different age groups[7]. In children, hematogenous-osteomyelitis begins with bacterial deposition in the metaphysis because of stasis of blood in hair pin like arrangement of blood vessels, deficiency of reticuloendothelial cells at metaphysis, high vascularity at metaphysic and predisposition to trauma[8]. Cellulitis develops in the bone marrow from foci of infection in the metaphysis. Lack of treatment in such infection lead to necrosis of bone and marrow[9,10]. No data is available on osteomyelitis in this part of Uttar Pradesh. Therefore this study was conducted to find out the incidence of osteomyelitis so that better clinical management could be provided to children.

MATERIAL AND METHODS

All confirmed patients of osteomyelitis willing for the treatment attending K. M. medical college and hospital, participated in this study from October 2017 to October 2019. Eligible participants were all the patients who were previously untreated. A detailed clinical history was taken in all patients. Standard anteroposterior and lateral radiographic views of the elbow were obtained in all cases. Total numbers of 60 patients with osteomyelitis contributed into the study. Antibiotic administration was withheld until the specimen collection was done except in those who were critical and required immediate treatment and intervention. Specimen collections were accomplished by needle aspiration, wound and bone biopsy. All the specimens were cultured on routinely used media (5% Blood and MacConkey agar) and incubated aerobically at 37oC for 24hrs. All isolates were identified by using standard biochemical tests followed by antibiotic susceptibility testing. Detection of MRSA was done by Cefoxitin disc diffusion test by using Clinical & Laboratory Standards Institute (CLSI) guidelines. Antibiotic discs (HiMedia Laboratories) used were: Ampicillin (10µg), Amoxicillin/Clavulanic acid (20/10µg), Cotrimoxazole (1.25µg/23.75µg), Gentamicin (10µg), Ciprofloxacin (5µg), Amikacin (30µg), Tetracycline (30 µg), Cefoxitin (30µg), Cefazolin (30µg), Erythromycin (5µg), Clindamycin (2µg), Linezolid (30µg), Teicoplanin (30µg), Vancomycin Minimum inhibitory concentration (0.5 to 32 µg/ml)[11].

RESULTS

Out of 60 patients, most common organism involved in osteomyelitis is *Staphylococcus aureus* in forty eight patients (80%) including MRSA in 4 patients. Other bacterial isolates were *H. influenzae* in three patients, Group B *Streptococcus*

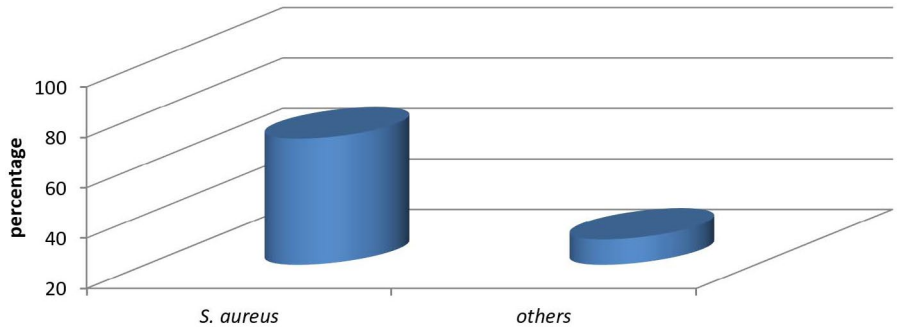

Fig. 1. Distribution of organism causing osteomyelitis

Table 1. Antibiotic sensitivity pattern of *Staphylococcus aureus*

Antibiotics	Breakpoints (mm)	S (%)
Ampicillin	S > = 29	70
Amoxicillin/ Clavulanic acid	S > = 20	80
Amikacin	15-16	90
Gentamycin	13-14	86
Ciprofloxacin	16-20	50
Trimethoprim/ Sulfamethoxazole	11-15	85
Clindamycin	15-20	81
Erythromycin	14-22	45
Cefazolin	15-17	92
Linezolid	S > = 21	100
Vancomycin	MIC	100
Teicoplanin	11-13	100
Tetracycline	15-18	78

in two patients, *Pseudomonas aeruginosa* in two patients, *E. coli* in two patients and Serratia marcescens in one patient and no growth was obtained in two patients (Fig. 01).

All *Staphylococcus aureus* were 100% sensitive for Linezolid, Teicoplanin and Vancomycin followed by cefazolin (92%), Amikacin (90%), Gentamycin (86%), and Trimethoprim/ Sulfamethoxazole (85%) whereas Erythromycin (45%), Ciprofloxacin (50%) were less sensitive as described in Table 01.

Maximum patients belonged to age group 6 to 10 (37%) followed by age group 11 to 15 (33%).

Table 2. Age Distribution

Age (Years)	Male	Female	Total
≤1 to 5	12	2	14
6 to 10	12	10	22
11 to 15	16	4	20
16 to 18	4	0	4
TOTAL	44	16	60

Table 3. Distribution of the Bones Affected

S. No.	Bone involved	No. of Patients (60)
01	Femur	21
02	Tibia	20
03	Iliac bone	04
04	Vertebral	01
05	Humerus	04
06	Calcaneus	04
07	Foot and hand bones	03
08	Forearm bones	02
09	clavicle	01

Least patient were from age group 16 to 18 (7%). Among 60 patients, 44 (73%) patients were male and 16 (27%) were female. Male-to-female ratio = 2.75:1 (Table 02).

Predominant involvement of lower limbs was with femur (35%) and tibia (33%) whereas other sites combined accounts for 32% as shown in table 03 and Fig. 02.

Fig. 2. Distribution of the Bones Affected

DISCUSSION

In the current study, most of the osteomyelitis cases were diagnosed with *S. aureus* (80%). Other studies also documented that *S. aureus* is the most common causative organism in osteomyelitis which accounted within the range of 50% to 82%[12-14]. Our study showed 8% occurrence of MRSA which was lower compared to other studies as described by Senneville et al. (11%) and Mita et al. (40%)[15,16]. In our study linezolid, teicoplanin and vancomycin were showing 100% sensitivity against *S. aureus*, other studies also revealed the same results[17,18]. In our study, more than 70% of the patients were found sensitive to cefazolin, amikacin and clindamycin. The isolates were sensitive either to all the three antibiotics in most cases or to one of them in a few cases. Therefore, a policy was framed in our hospital to start the empirical treatment with cefazolin and amikacin for the patients with hematogenous osteomyelitis until the bacterial culture and sensitivity reports comes. If sensitivity was confirmed to these two antibiotics (in case of *Staphylococcus aureus*, amikacin was discontinued), they were continued for two weeks and the patients would then receive oral clindamycin or were continued with intravenous cefazolin in case child could not take the oral clindamycin for six to eight weeks. Both these cefazolin and amikacin antibiotics are easily available and are of low cost and safe without many serious adverse reactions. In the current study, the male to female ratio is 2.75:1. Most studies[19-22] invariably demonstrated that majourity of the infection was in male patient. Zaoutis et al.[23] also found that 62% of the male patients were most affected. In the current study, 32% of the infection was seen in femur bone whereas 33% was seen in tibia bone. Authors from different countries[19,20] also concluded that most frequently affected sites were femur (34-36%), tibia (28-33%) and humerus (14%).

CONCLUSION

Haematogenous-osteomyelitis is a serious infection among children, particularly those in pre-school or school. *S. aureus* was commonest causative organism involved and most of them were sensitive to cefazolin, amikacin and clindamycin. Therefore a policy was framed in our hospital to start empirical treatment with cefazolin and amikacin till bacterial culture and sensitivity reports come. These two antibiotics are affordable, available and safe without many serious adverse reactions.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTION

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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None.

DATA AVAILABILITY

All datasets analysed during this study are included in the manuscript.

ETHICS STATEMENT

This article does not contain any study with human participants or animals performed by any of the authors.

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