



## Epidemiology of Chronic Osteomyelitis in Kashmiri Population and Its Management

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### ABSTRACT

**Background:** The purpose of this study was to review the epidemiology, clinical features and the management of chronic osteomyelitis in Kashmiri Population.

**Methods:** We retrospectively reviewed patients who were diagnosed and treated for chronic osteomyelitis at a tertiary care hospital at Srinagar, Kashmir. Medical records for all patients were analysed and details on gender, age, anatomical site, infecting organisms, levels of inflammatory markers, and the various treatment modalities were evaluated.

**Results:** A total of 90 patients (66 males and 24 females) were included in this study. The median age at first diagnosis was 17 years for all. Infections caused by hematogenous osteomyelitis was found to be more than those of traumatic origin. All patients had single site infections with a majority of lesions affecting the lower extremities. The tibia was the most common site in traumatic osteomyelitis while the femur was mostly involved in hematogenous osteomyelitis. The positive rate for all cultures was at 72.2% with the most commonly encountered organism being *Staphylococcus aureus*. Treatment methods used in our study included radical debridement with the use of local and systemic antibiotics and reconstruction of bony or soft tissue defects. The overall infection control rate was 96.18%.

**Conclusions:** The findings from this study can provide information for early diagnosis and treatment of this form of bone infection particularly in this part of the country.

**Keywords:** Chronic osteomyelitis, Bone infection.

### I. INTRODUCTION

Osteomyelitis is an ancient disease, which has been present for the last 250 million years and was first described in humans by Hippocrates.<sup>1</sup> It is

a progressive inflammatory process caused by pathogens, resulting in bone destruction and sequestrum formation.<sup>2,3</sup> The infection can be limited to the bone, or it can propagate to the bone marrow, the periosteum and the surrounding soft tissues.<sup>2,4</sup> It represents a major financial burden for every health system and substantially affects the quality of life of the affected patients and their families. Chronic osteomyelitis may present as a recurrent or intermittent disease. The symptoms and their duration may vary considerably, whereas periods of quiescence can also be of variable duration. The incidence of relapse following an apparently 'successful' treatment remains high, making its management challenging for the treating physician.<sup>5</sup> Assumed 'remission' should only be claimed after at least 12 months of follow-up, while 'cure' of the disease cannot be safely declared. Prompt diagnosis and aggressive management of chronic osteomyelitis are critical to the prognosis and final outcome. Treatment aims to achieve the resolution of the infection and restoration of function.<sup>6</sup> Historically, lengthy antibiotic regimes in combination with extensive surgical debridement have been used for its management.<sup>6</sup> Even though the antibiotic choice, delivery type and duration remains controversial,<sup>7</sup> it is generally accepted that adequacy of debridement with wide excision remains the most important clinical predictor of a successful outcome.<sup>8</sup>

The management of chronic osteomyelitis is a challenge, for both patient and surgeon demanding utmost perseverance from both to ensure eradication. Clinicians are required to make an early diagnosis and provide timely intervention in order to prevent recurrence and improve the overall quality of life of the patients. It is important therefore to understand the aetiology of the



infection, as well as the pathophysiology of its chronicity.

II. MATERIALS AND METHODS

This study was conducted at the Bone and Joint Hospital Srinagar, a tertiary care centre and an associated hospital of Government Medical College Srinagar. We retrospectively reviewed patients who were diagnosed with chronic osteomyelitis and were treated at our hospital from 1 January 2017 to 31 July 2022. Patients' data was collected from the hospital medical records department. The information gathered from these patients included, gender, age at first diagnosis, laterality and site of infection, intraoperative microorganism cultures, preoperative serum values of white blood cells (WBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and the treatment modalities that followed.

SPSS 17.0 software (SPSS Inc, Chicago, IL) was used for statistical analysis. P value below 0.05 were considered significant.

III. RESULTS

The present study included 90 patients of whom 66 (73.33%) were males and 24 (26.66%) females giving a gender ratio of 2.75 for a male predilection. The median age on first diagnosis was 17 years while the mean age was approximately 21 years. The top three age groups involved were from 1 to 20 years (59.5%), 21 to 40 years (27.5%), and 41 to 60 years (12.2%) respectively. According to the Waldvogel classification, 68 (75.55%) cases of the total 90 cases were of hematogenous origin, the highest percentage 83.8% of which were in the 1 to 20 years age group. 22 (24.44) cases were of post traumatic origin of which 44.4% were in the 21 to 40 years age group (p<0.001). The oldest patient in this study was a 66 years old male with traumatic osteomyelitis.

TABLE 1: TYPES OF INFECTION ACCORDING TO AGE GROUPS

Table with 3 columns: AGE(YEARS), HEMATOGENOUS OSTEOMYELITIS, TRAUMATIC OSTEOMYELITIS. Rows include age groups (1-20, 21-40, 41-60, 61-80) and a TOTAL row.

The right side accounted for 58.88% (53) of the total infection sites, and the left side accounted for 41.11% (37). None of the patients had bilateral involvement. 77 (85.5%) cases had a lesion in a lower limb while 13 (14.4%) cases involved the upper limb. The most frequent single

site of infection was the femur (44 cases, 48.8%) followed by the tibia (32 cases, 35.5%), humerus (5 cases, 5.5%), radius (3 cases, 3.3%). (Table 3). In addition, the tibia was the most common site in traumatic osteomyelitis while the femur was the most common site for hematogenous osteomyelitis.

TABLE 2: THE DISTRIBUTION AND PERCENTAGE OF AFFECTED SITES.

Table with 3 columns: SITE, NUMBER, PERCENTAGE. Rows list affected sites: FEMUR, TIBIA, HUMERUS, RADIUS, ULNA, FIBULA, METATARSALS.



The laboratory cut-off values for the various serum inflammatory markers used in this study were WBC: 11000/L, ESR: 20mm/1h and CRP: 5mg/l. A pre-operative comparison of the values of these 3 markers among the different types of osteomyelitis did not reveal any differences. The mean WBC and CRP levels were found to be more elevated in the hematogenous type of osteomyelitis. In contrast, mean ESR levels were found to be

elevated in traumatic infections. The overall positive rates for these three serum inflammatory markers showed that ESR was the highest (86.3%,78\90) followed by CRP (65.6%,59\90). Positive rates of WBC were the lowest (26.6%,24\90). The positive rates for all three inflammatory markers was higher among the hematogenous osteomyelitis group than among the post-traumatic osteomyelitis group.

**TABLE3: MEAN SERUM LEVELS OF PREOPERATIVE INFLAMMATORY MARKERS.**

VARIABLES	HEMATOGENOUS OSTEOMYELITIS	TRAUMATIC OSTEOMYELITIS
ESR	55.0	60.7
WBC	10.8	9.0
CRP	13.6	11.2

All 90 patients had records of organism cultures in our study. The positive rate for all was 72.2% (65 cases). The most common bacteria to

account for both hematogenous and traumatic infections was Staphylococcus aureus(48 cases, 53.3%), 23 of which were of MRSA strain.

**TABLE 4: COMMON ORGANISMS FOUND IN POSITIVE CULTURES.**

ORGANISM	PERCENTAGE
STAPHYLOCOCCUS AUREUS	53.3
STREPTOCOCCUS SPECIES	4.7
PSEUDOMONAS SPECIES	3.7
ESCHERICHIA COLI	6.3
ENTERIOBACTERIACEAE	2.2
ACINETOBACTER BUAMANNII	1.1
KLEBSIELLA PNEUMONIEA	0.9

Treatment methods for chronic osteomyelitis used in our study included radical debridement with the use of local and systemic antibiotics and reconstruction of bony or soft tissue defects either with free bone grafts or using bone transport. Limb amputation was reserved only for those with severe infections. 60 patients underwent

radical debridement alone. All patients were followed up for at least 18 months. The total infection control rate was 84.4% (76 cases). 4 cases were treated conservatively and had a satisfactory outcome, one patient had to undergo an amputation.

**TABLE 5:TREATMENT STRATIGIES**

TREATMENT STRATIGIES	NUMBER
RADICAL DEBRIDEMENT	60
RADICAL DEBRIDEMENT AND BONE GRAFTING	17
RADICAL DEBRIDEMENT AND BONE TRANSPORT	8
AMPUTATION	1
CONSERVATIVE TREATMENT	4



The protocol for intravenous antibiotics followed at our institute consists of an average of 14 days followed by another 4 weeks of oral antibiotics. The most commonly used intravenous antibiotic in our study were cephalosporins followed by linezolid.

#### IV. DISCUSSION

The etiology and morbidity of osteomyelitis is linked to many factors, including ethnicity, lifestyle and economic conditions.<sup>9</sup>Traditionally, chronic osteomyelitis has been thought of as a sequela of acute osteomyelitis. However, over the past decades; reports suggest that trauma, fracture-fixation devices/prosthesis and diabetic foot infection are now the leading causes of chronic osteomyelitis.<sup>10</sup>The present study involving 90 patients established a male predominance. This male preponderance was evident throughout all age groups. In a recent study, Kremers et al also reported an annual incidence higher in men and this male dominance

was evident in all ages.<sup>11</sup> In our study, the median age at first diagnosis was 17 years while the mean age was approximately 21 years. Our median reported age was much lower than those reported by both Kremers et al and Jiang et al.<sup>11, 12</sup>

Unlike many other reported studies, the most frequent type of chronic osteomyelitis in our study was that of hematogenous origin (51.9%) which was slightly higher than that of post traumatic origin (48.1%). Both Jiang et al and Wang et al reported 76.85% and 80.1% respectively reported post traumatic osteomyelitis as the predominant type.<sup>9,12</sup> We consider that the vast difference may be a consequence of the different age distributions of the osteomyelitis types in between the studies. Approximately 60% of our patients were below 20 years of age of which 70% of them had hematogenous osteomyelitis, comparable to a study by Perez et al.<sup>13</sup>

Though the most common site of extremity chronic osteomyelitis in our study was the femur (48.8%), the most common site for post traumatic osteomyelitis was the tibia while the femur remained the favoured site for hematogenous osteomyelitis. These findings were consistent with those of Wang et al.<sup>9</sup> The unique anatomical location of the tibia and its blood supply all contribute to its susceptibility. Adversely, the rich blood supply of the femur makes it more prone to hematogenous osteomyelitis.

Our positive rate of microbial culture was about 72% which was comparable to previous reports.<sup>9</sup> Several factors have been known to play a crucial role in deciding the positive rate of culture

such as culture time and conditions, antibiotic use before culture, and biofilm associated bacterial strains.<sup>14</sup> A number of our patients( 22% )had undergone antibiotic treatment prior to admission, which may have led to changes in drug resistance.<sup>12</sup>Kremers et al in their study noted that Staphylococcus aureus infections were responsible for 44% of their cases, followed by Staphylococcus epidermidis(17%) and Streptococcus infections (16%).<sup>11</sup> Arias et al recognised in their study of 193 patients. Staphylococcus aureus(28.7%) as the most common organisms and 31% were of polymicrobial strain.<sup>15</sup>In our study, the most prevalent bacteria detected was Staphylococcus aureus(53.3%) including 23 strains of MRSA. Similar to the study by Wang et al, we found that among our patients with monomicrobial infection, the proportion of Staphylococcus aureus was higher(41.3 %)in the hematogenous osteomyelitis patients compared to post traumatic osteomyelitis patients( 9.92%), while the rates of Escherichia coli, Enterobacter cloacae and Pseudomonas aeruginosa were elevated in the latter.<sup>9</sup>

The diagnosis of chronic osteomyelitis based on patient history and examination is generally straightforward. To assist in the diagnosis, there are pre-operative levels of serum inflammatory markers. In our study, we noted that the positive rates of these markers differed between the two categories of osteomyelitis. While the mean WBC and CRP levels were found to be marginally elevated in the hematogenous type of osteomyelitis. In contrast, mean ESR levels were found to be elevated in traumatic infections. It was seen that the positive rates for all three inflammatory markers were elevated among the hematogenous osteomyelitis group compared to the post-traumatic osteomyelitis group. The indefinite characteristic of these markers warrants a guarded approach when using them to diagnose the various forms of osteomyelitis. Reports are confirming approximately 20% of patients still having infections even when all these markers were in their normal ranges.<sup>16</sup>

The management of extremity chronic osteomyelitis should be based on both systemic and local factors and hinges on the decision of the treating surgeon.<sup>15</sup> Treatment methods for extremity chronic osteomyelitis used in our study included radical debridement with the use of local and systemic antibiotics and reconstruction of bony or soft tissue defects either with free bone grafts or using bone transport. Though surgical intervention was the mainstay of our treatment, 4 patients with



hematogenous origin were treated conservatively and had an acceptable outcome. The grounds for conservative management were mainly because patients opposed undergoing operative intervention. At an average follow-up of 18 months, the total infection control rate attained was 96.18%. Jiang et al described cure rates that differed with regards to diverse treatment strategies, ranging from 26.92% to 100%.<sup>12</sup>

The majority of our patients who were on intravenous antibiotics received cephalosporins. The frequent selection of cephalosporins is probably associated with their broad antimicrobial spectrum.<sup>12</sup> Antimicrobial therapy was administered for an average minimum of 6 weeks, 2 weeks intravenously. With regards to the duration of antibiotic therapy, several studies state that there is no evidence that antibiotic therapy for more than 4 to 6 weeks improving outcome compared to a shorter regimen.<sup>16,17</sup> As for the route of antibiotic administration (oral versus parenteral), Spellberg et al in their study concluded that oral therapy with a highly bioavailable agent was an acceptable and equally effective alternative to parenteral therapy.<sup>17</sup> A systemic review affirmed similar clinical efficacy between oral and parenteral antibiotics for the management of osteomyelitis provided the bacteria were sensitive to the antibiotic used.<sup>18</sup>

There are several notable limitations to this study. The study is retrospective with a small sample size. The study was conducted in a single hospital in Kashmir. Therefore, it may not well depict the extent of chronic osteomyelitis in this part of the country. Thus, a large multi-centre prospective study should be performed to gain more precise information.

## V. CONCLUSION

To summarize, our present study involving 90 patients observed that chronic extremity osteomyelitis largely involved males and was more common in the lower limbs. Osteomyelitis of hematogenous origin was higher than that of post traumatic origin and the most prevalent bacterial strain was *Staphylococcus aureus*. Results from this study can provide information for early diagnosis and treatment of this form of bone infection particularly in this part of the country. Further multi-centre research is warranted to replicate these findings in a larger population and this would help us gain better understanding about the burden of this disease

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