

Antibiotic Sensitivity Pattern Of Bacterial Isolates In Chronic Osteomyelitis In A Tertiary Care Teaching Hospital Of North India.

Rohini Gupta^{1*}, Akhil Kumar Gupta², Sanjeev Gupta³

¹Lecturer, Deptt. of Pharmacology & Therapeutics, Government Medical College, Jammu, J&K

²Senior resident, Deptt. of Orthopaedics, Government Medical College, Jammu, J&K

³Professor&Head, Deptt. of Orthopaedics, Government Medical College, Jammu, J&K

*Corresponding Author: Dr. Rohini Gupta

¹Deptt. of Pharmacology & Therapeutics, Government Medical College, Jammu (J&K) E.mail: rohinigupta299@gmail.com

DOI: 10.47750/pnr.2022.13.508.abc

Abstract

Background: Chronic Osteomyelitis is a debilitated disease and is characterized by persistent and prolonged infection of the bone and its management remained an increasing challenge to clinicians due to growing resistances to antibiotics.

Objective: The proposed study was conducted to ascertain the antibiotic sensitivity pattern of bacterial isolates in chronic osteomyelitis patients.

Materials and methods: This descriptive study was conducted for a period of six months from June to November 2021. A total of 80 samples of pus and other exudates were collected from all the patients ≥ 18 years of age with either gender and diagnosed with chronic osteomyelitis >6 weeks duration. The samples were sent for microbiological examination and culture. Various organisms were identified by standard methods. Antibiotic sensitivity pattern of detected microorganisms was also analysed. Patients with other form of arthritis, implant related osteomyelitis and who had antibiotic usage in last one week were excluded from our study.

Results: Out of 80 patients, 73 (91%) showed growth of microorganisms whereas remaining 7 (9%) samples were sterile. The commonest bone affected in the study was tibia 53 (66.3%). Staphylococcus aureus was the most common bacteria isolated in 57 (78%) of patients. Maximum antibiotic sensitivity pattern was noted for vancomycin and clindamycin (>90%) while maximum resistance was noted for penicillin in 22 (31%) of patients.

Conclusion: Our study will thereby guide the clinicians in choosing appropriate antibiotics which not only contribute to better treatment but the judicious use of such antibiotics will also help in preventing emergence of resistance to drugs, which are still sensitive.

Key words: Chronic Osteomyelitis, Antibiotic, Susceptibility, Resistance, culture sensitivity

INTRODUCTION

Chronic Osteomyelitis is a debilitated disease and is characterized by persistent and prolonged infection of the bone followed by low-grade inflammation, presence of sequestrum, involucrum and sinus tracks.¹ Usually the infection is caused by blood borne organisms that are carried to the bone or sometimes by direct inoculation into the bone by open fracture or wound.² Commonest pathogen responsible for chronic osteomyelitis remains Staphylococcus aureus³⁻⁷ while Methicillin resistant S.Aureus (MRSA) rates range from 10% to 59%.⁸⁻¹¹ Gram negative and polymicrobial infections were also commonly reported.¹² Osteomyelitis can develop in any bone but long bones, vertebra and foot bone are frequently involved by the disease and in diagnosis of this condition radiographs prove to very useful.¹³

A wide range of microorganisms that cause chronic osteomyelitis has been shown to develop resistance to commonly used antibiotics most probably due to empirical antibiotics that clinicians prescribe to their patients before the result of culture.¹⁴ Thus this condition presents complex therapeutic challenges and imposes a high cost on healthcare provision. In contrast to developed countries, in low-resource countries, chronic osteomyelitis is much more common.¹⁵⁻¹⁷ Inadequate health-care setting frequently combined with patient malnutrition makes chronic osteomyelitis long lasting and causing more severe disability.^{5,6}

The treatment of chronic osteomyelitis remains a challenge and multidisciplinary approach including adequate surgery and antibiotics are required.^{18,19} With the rapid development of antimicrobial resistance and expression of virulence factors regardless of patients' immune status, the bacterial distribution, bacterial culture positive rate and antibiotic resistance pattern of osteomyelitis has changed gradually.²⁰

Due to increase in the incidence of chronic osteomyelitis the present study was planned to evaluate the changing trends of positive rate, causative organisms and antibiotic sensitivity patterns of these bacterial isolates in patients of chronic osteomyelitis. Moreover, there are no reports of such studies on the bacteriological profile of osteomyelitis in or around this region. Also due to the poverty and illiteracy prevailing in this region, there are more chances of acute osteomyelitis turning into chronic cases and presenting in the hospital. The present study was therefore undertaken to determine the bacteriological profile and antibiotic sensitivity pattern of these cases of osteomyelitis. This will go a long way in helping the clinicians in deciding upon the treatment regimen for these patients. The data generated by these studies will also help in formulating hospital antibiotic policies. This would help not only in eradicating the infections but would prevent development of resistance to the most commonly and relatively expensive antibiotics.

MATERIALS AND METHODS

It was a cross-sectional, prospective, observational study. The study was conducted in the department of pharmacology in collaboration with department of Orthopaedic Government Medical College, Jammu (J&K). The study was conducted for a period of six months from June 2021 to November 2021. Ethical approval was obtained from Institutional Ethics Committee (IEC) before commencement of the study. Patients of either gender with age 18 years and above with pain, swelling, fever, discharge and radiological evidence of osteomyelitis of long bones for more than six weeks duration were included in the study. Patients with other forms of arthritis, implant related osteomyelitis and who had antibiotic usage in last one week were excluded from our study. Samples like pus or exudates were taken from all the patients diagnosed with chronic osteomyelitis and sent for microbiological examination and culture. Various organisms were identified by standard methods. Antibiotic sensitivity pattern of detected microorganisms was also analysed. The data so obtained was analyzed using descriptive statistics.

RESULTS

A total of 80 cases of chronic osteomyelitis were studied to ascertain the bacteriological profile and their culture sensitivity pattern. Out of 80, 73(91%) showed growth of various organisms and remaining 7 (9%) showed no microbial growth as shown in Table I.

Table I. Showing growth of microorganisms on culture

Culture report	No. of samples studied	Percentage (%)
Culture positive	73	91
Culture negative	7	9
Total	80	100

The most common factor leading to chronic osteomyelitis was trauma in 44(55%) followed by immunocompromised state in 18 (22%) of patients as shown in Table II. Tibia was the most common bone affected in 34 (42.5%) followed by femur shaft as documented in 23 (29%) of cases as shown in Table III.

Table II. Predisposing factors for chronic osteomyelitis

Predisposing factor	No. of cases (n=80)	Percentage (%)
Trauma	44	55
Postoperative	12	15
Orthopaedic implants	6	8
Immunocompromise	18	22
Idiopathic	0	0

Table III: Frequency of bones affected

Bones involved	No. of cases (n=80)	Percentage (%)
Tibia	34	42.5
Femur	23	29
Ulna	4	5
Radius	11	14
Humerus	8	10

Staphylococcus aureus was the most common organism isolated in 46 (63%) of cases followed by Pseudomonas aeruginosa in 14 (19%) and Klebsiella in 6 (8.2%) as shown in Table IV. The antibiotic sensitivity and resistant reports are shown in Table V and it can be seen that from the various organisms isolated staphylococcus aureus which was the commonest organism isolated and was sensitive to Imipenem in 56(98%) of patients followed by Vancomycin and Linezolid in 55 (96%).

Table IV: Various organisms isolated

Organisms	No. of isolates (n=73)	Percentage (%)
Staphylococcus aureus	46	63
Enterococcus sp.	4	5.5
Pseudomonas aeruginosa	14	19
E.coli	1	1.4
Proteus	2	2.7
Klebsiella	6	8.2

Table V : Antibiotic sensitivity and resistance report of different microorganisms

Antibiotic	Staphylococcus aureus	Enterococcus	Pseudomonas	E.coli	Proteus	Klebsiella
	n=57	n=4	n=8	n=1	n=2	n=1
Penicillin	39 (69%)	1 (25%)	3	0	0	0
Amikacin	46 (80%)	1 (25%)	6	1	1	1
Ceftriaxone	38 (67%)	2 (50%)	4	0	0	0
Clindamycin	51 (89%)	3 (75%)	1	1	2	1
Ciprofloxacin	44 (77%)	2 (50%)	2	0	1	0
Erythromycin	51 (89%)	3 (75%)	6	1	2	1
Imipenem	56 (98%)	4 (100%)	7	1	2	1
Vancomycin	55 (96%)	4 (100%)	7	1	2	1
Linezolid	55 (96%)	4 (100%)	7	1	2	1

DISCUSSION

Osteomyelitis is one of the major chronic diseases amongst people in developing countries like India, due to emerging rise in the drug resistant bacterial strains that not merely complicates the treatment but also lead to increase in the use of surgical debridement in such cases. Because chronic osteomyelitis require antibiotic therapy for months to years, therefore chronic osteomyelitis is one of the major financial burden and substantially affects quality of life. Hence, area wise studies on bacteriological profiles and monitoring of antibiotic susceptibility pattern needs to be carried out in individual setting, which would guide to develop a policy on appropriate use of antibiotics.²¹

In the present study, out of 80 samples, 73(91%) showed growth of microorganisms whereas 7 (9%) of samples were culture negative. This is consistent with the findings of the study done by Wadekar DM et al.²² Various factors play a crucial role in establishing a microbial culture to come as positive or negative. Collection of specimen before the administration of antibiotic, use of proper transport media, incubation and other laboratory conditions play an important role in the incidence of positive culture.²² Failure to incubate anaerobic cultures for sufficient time might also have contributed to the culture negative rate.²³ Although all kinds of organisms including bacteria, viruses, parasites, fungi and tuberculosis may cause osteomyelitis, bone infection was mainly caused by pyogenic bacteria and mycobacteria. So, one of the reasons of culture negative specimens may be because of the tuberculosis and fungal infection which should require further investigations using specialized techniques.¹⁹

In our study, the most common factor leading to osteomyelitis was trauma in 44(55%) of cases followed by immunocompromised state in 18(22%) and post-operative osteomyelitis in 12 (15%) of cases. These findings are similar to other studies.²⁴ The patients with post- traumatic osteomyelitis require repeated surgeries and long time usage of different antimicrobial agents which may lead to increase in the incidence of bacterial resistance strains. In our study, tibia was the main bone affected in 34(42.5%) of cases followed by femur in 23(29%) of cases. This is similar to the findings of Kaur J et al.²⁵

In the present study, staphylococcus aureus was the commonest bacteria isolated from 46 (63%) of specimens followed by Pseudomonas aeruginosa in 14(19%) of cases. These findings are similar to that of Khalid et al.¹ It has been documented that coagulase negative staphylococci often gain access to the target site of infection in association with foreign bodies such as during accidents or in prosthetic joints.²⁶ However, the findings of the present study are in contrary to the study done by Malik et al²⁷ in which he reported a different frequency of bacteriological profile of isolated microorganisms. Enterobacteriaceae was the commonest bacterial group in 33% followed by Staphylococcus aureus in 29.5% of patients. The difference in findings may be because of open fractures, chronic osteomyelitis bed sores and patients with spinal instrumentation in which E.coli is the main bacteria isolated in such cases. Moreover, E.coli is a commensal of the gut, and as many orthopaedic patients are bedridden for prolonged periods, contamination of wounds, dressings, linen, clothes and even hands during perineal hygiene plays a major role in increasing chances of transmission of infection.²⁸

Antibiotic therapy of chronic osteomyelitis depends upon sensitivity of commonly used antibiotics to the bacterial isolates. In our study, Staphylococcus aureus which was the commonest organism isolated was sensitive to imipenem in 56(98%) of patients followed by Vancomycin and Linezolid in 55 (96%) of patients. These findings are similar to Khalid et al.¹ Many of the bacterial isolates like Staph.aureus, E.coli showed resistance to penicillins in maximum

number. This may be because of indiscriminate use of these antibiotics even prior to culture sensitivity for the last many years. Infection of multidrug resistant bacteria presents a serious clinical challenge for physicians in healthcare setting. Treatment options for these infections are limited and the use of inappropriate empirical antibiotic therapy or delayed appropriate antibiotic therapy can lead to worse outcomes. The study suffers from few limitations of being less duration, decreased sample size and single centric. Further studies are therefore, recommended to address these limitations.

CONCLUSION

The presented antibiotic susceptibility pattern in chronic osteomyelitis with very high rate of resistance to penicillin group of antibiotics is alarming. Therefore, it needs updation of antibiotic therapy guidelines. Our study will thereby guide the clinicians in choosing appropriate antibiotics which not only contribute to better treatment but the judicious use of such antibiotics will also help in preventing emergence of resistance to drugs, which are still sensitive. It is therefore, important to undertake studies to see the antibiotic sensitivity pattern in a particular geographical area that will not only enable appropriate selection of antibiotics but would also limit the drug-resistant strains in the future to treat the disease successfully.

CONFLICT OF INTEREST:

There is no conflict of interest.

REFERENCES

1. Khalid, Ihsanullah, Inam M, Shabir M. Frequency of Different bacteria and their antibiotic sensitivity pattern in Chronic Osteomyelitis. *J Pak Orthop Assoc.* 2020;32(2).
2. Lowenberg DW, Debaun M, Suh GA. Newer perspectives in the treatment of chronic osteomyelitis: A preliminary outcome report. *Injury.* 2019;56-61.
3. Wirbel R, Hermans K. Surgical treatment of chronic osteomyelitis in children admitted from developing countries. *Afr J Paediatr Surg* 2014;11(4):297-303.
4. Yeargan SA III, Nakasone CK, Shaieb MD, Montgomery WP, Reinker KA. Treatment of chronic osteomyelitis in children resistant to previous therapy. *J Pediatr Orthop* 2004; 24(1) :109-22.
5. Kinik H, Kraduman M, Cierny-Mader Type III chronic osteomyelitis: the results of patients treated with debridement, irrigation, vancomycin beads and systemic antibiotics. *Int Orthop* 2008; 32(4):551-8.
6. Alonge TO, Ogunlade SO, Omlolu AB, Fashina AN, Oluwatosin A. Management of chronic osteomyelitis in a developing country using ceftriaxone-PMMA beads: An initial study. *Int J Clin Pract* 2002; 56(3): 181-3.
7. Aytac S, Schnetzke M, Swartman B et al. Posttraumatic and postoperative osteomyelitis: Surgical revision strategy with persisting fistula. *Arch Orthop Trauma Surg* 2014; 134(2): 159-65.
8. Mantero E, Carbone M, Calevo MG, Boero S. Diagnosis and treatment of paediatric chronic osteomyelitis in developing countries: prospective study of 96 patients treated in Kenya. *Musculoskeletal Surg* 2011; 95(1):13-8.
9. Chen AF, Schreiber VM, Washington W, Rao N, Evans AR. What is the rate of methicillin-resistant *Staphylococcus aureus* and Gram-negative infections in open fractures? *Clin Orthop Relat Res* 2013; 471(10): 3135-40.
10. Kini AR, Shetty V, Kumar AM, Shetty SM, Shetty A. Community-associated, methicillin-susceptible, and methicillin-resistant *Staphylococcus aureus* bone and joint infections in children: Experience from India. *J Pediatr Orthop B* 2013; 22(2): 158-66.
11. Motsisi NS. Management of infected nonunion of long bones: The last decade (1996-2006). *Injury* 2008; 39(2): 155-60.
12. Carvalho VC, Oliveira PR, Dal-Paz K, Paula AP, Felix CdaS, Lima AL. Gram-negative osteomyelitis: Clinical and microbiological profile. *Braz J Infect Dis* 2012; 16(1): 63-7.
13. Fiorenza F, Durox H, EI Balkhi S, Denes E. Antibiotic-loaded porous alumina ceramic for one-stage surgery for chronic osteomyelitis. *J Am Acad Orthop Surg Glob Res Rev.* 2018;2; 2(11):79-84.
14. Jersey K, Francis H. Chronic osteomyelitis- Bacterial Flora, Antibiotic Sensitivity and Treatment Challenges. *Open Orthop J.* 2018;30;12:153-163.
15. Ali AM, Maya E, Lakhoo K. Challenges in managing paediatric osteomyelitis in the developing world: analysis of cases presenting to a tertiary referral centre in Tanzania. *Afr J Paediatr Surg* 2014; 11(4):308-11.
16. Onche II, Obiano SK. Chronic osteomyelitis of long bones: reasons for delay in presentation. *Niger J Med* 2004; 13(4): 355-8.
17. Stanley CM, Rutherford GW, Morshed S, Coughlin RR, Beyeza T. Estimating the healthcare burden of osteomyelitis in Uganda. *Trans R Soc Trop Med Hyg* 2010; 104(2): 139-42.
18. Zimmerli W, Sendi P. Orthopaedic biofilm infections. *APMIS.* 2017; 125(4): 353-64.
19. Liu C, Zhang X, Li Z, Xu Y, Liu T. Bone transport with a unilateral external fixator for femoral infected nonunion after intermedullary nailing fixation: a case control study. *Medicine (Baltimore).* 2019; 98(20):e15612.
20. Chihara S, Segreti J. Osteomyelitis. *Dis Mon.* 2010; 56(1):5-8.
21. Singh A, Biswas PP, Sen A. Bacteriological profile of osteomyelitis cases with special reference to antibiotic susceptibility pattern of isolates in a tertiary care hospital of eastern India. *J Evolution Med Dent Sci.* 2016; 5(53) :3496-3501.
22. Wadekar MD, Anuradha K, Venkatesh D. Chronic osteomyelitis: aetiology and antibiotic susceptibility pattern. *Int J Recent Trends in Science and Technology* 2014;9(3):337-340.
23. Butler-Wu SM, Burns EM, Pottinger PS, Magaret AS, Rakeman JL, Matsen FA 3rd, Cookson BT. Optimization of periprosthetic culture for diagnosis of *Propionibacterium acnes* prosthetic joint infection. *J Clin Microbiol.* 2011; 49(7): 2490-5.
24. Mader JT, Cripps MW, Calhoun JH. Adult posttraumatic osteomyelitis of the tibia. *Clin Orthop Relet Res.* 1999;360:14-21.
25. Kaur J, Gulati VL, Aggarwal A et al. Bacteriological profile of osteomyelitis with special reference to staphylococcus aureus. *Indian J for the practicing doctors* 2008; 4(6):1-9.
26. Chihara S, Popovich KJ, Weinstein RA et al. *Staphylococcus aureus* bacteria as a prognosticator for outcome of staphylococcus aureus bacteremia: a case control study. *BMC Infect Disease* 2010;10(1):225.
27. Malik F. Bacterial aetiology of osteomyelitis cases at four hospitals of Lahore. *J Ayub Med Coll Abbottabad* 2003. 15(2):24-7.
28. Agarwal AC, Jain S, Jain RK et al. Pathogenic bacteria in an orthopaedic hospital. *J Infect Developing Countries* 2008;2(2):120-123.