Frequency of Different Bacteria and their Antibiotics Sensitivity Pattern in Chronic Osteomyelitis

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ABSTRACT

Objective: To determine the frequency of different bacteria and their antibiotic sensitivity patterns in patients presenting with chronic Osteomyelitis.

Methods: This descriptive study was conducted in Orthopedics and Trauma unit District Headquarter Hospital Daggar, Bunir, Khyber Pakhtunkhwa and Lady Reading Hospital Peshawar from 12th August 2016 to 3rd February 2019. Bone biopsy or sequestrum was taken from all patients of long bones of chronic osteomyelitis fulfilling the inclusion criteria and sent to laboratory for culture and sensitivity.

Results: The total number of patients enrolled in our study were 193. Majority (78.76%, n=152) of patients yielded positive growth on culture while no growth was documented in 41(21.24%) patients. Staphylococcus aureus was the most common bacteria(64.36%, n=97) followed by Pseudomonas Aeruginosa (17.10%,n=26), E. Coli (11.84%,n=18) and Proteus Mirabilis(7.24%,n=11).Maximum antibiotic sensitivity(> 90%) was noted for Vancomycin and Fusidic Acid while maximum resistance(35.05%,n=34) was noted for Penicillin.

Conclusion: Staphylococcus Aureus was the most common bacteria isolated. Majority of isolated bacteria were sensitive to Vancomycin and Fusidic acid.

Key words: Osteomyelitis, Culture, Sensitivity, Antibiotics, Frequency

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INTRODUCTION

Chronic osteomyelitis has been defined as a disease of persistent and prolonged infection of the bone and is characterized by low-grade inflammation, presence of sequestrum, involocrum and sinus tracks.[1] Usually the infection is caused by blood borne organisms that are carried to the bone or sometime by direct inoculation into the bone by open fracture or wound.[2] Chronic osteomyelitis causes bone necrosis and the dead bone harbor microorganisms and form a nidus.[3] Although the prevalence of chronic osteomyelitis in the general population is 1:5,000 studies had reported 16% cases of chronic osteomyelitis after puncture wound on foot.[4] Osteomyelitis can develop in any bone but long bones, vertebra, and foot bone are more frequently involved by the disease and radiographs are often helpful in diagnosis.[5]

The predominant cause of osteomyelitis is Staphylococcus Aureus all over the world.[6,7] A wide range of microorganisms that causes chronic osteomyelitis has been shown to developed resistance to commonly used antibiotics most probably due to empirical antibiotics that clinicians prescribe to their patients before the result of culture.[8] The usual

treatment of chronic osteomyelitis includes irrigation, debridement, dead space management, repair of bone defect and administration of systemic antibiotics.[9] However, antibiotics should be given according to the report of culture and sensitivity.[10] Most of the antibiotics are given intravenously but oral antibiotic like Quinolones can be used in the management of osteomyelitis if reported on culture sensitivity result.[11] Orthopaedic surgeons may face a lot of challenges in treating patients of chronic osteomyelitis with segmental bone loss that may also cause a limb-threatening situation for the patient especially if it is resistant to commonly used antibiotics.[12] Chronic osteomyelitis not only affect the quality of life but causes huge financial burden on the patient and his family because of prolonged and expensive treatment.[13]

The objective of our study was to determine the frequency of different bacteria and their antibiotic sensitivity patterns in patients presenting with chronic osteomyelitis of the long bones. The results of our study will be utilized in formulating standard guidelines regarding the proper usage of empiric antibiotics in patients of chronic osteomyelitis. This would help not only in eradicating the infection but would prevent development of resistance to the most commonly and relatively expensive antibiotics.

METHODS

This descriptive study was carried out in Orthopedics and Trauma unit, District Headquarter Hospital Daggar Bunir and Lady Reading Hospital Peshawar from 12th August 2016 to 3rd February 2019. Patients of either gender age 18 years and above with pain, swelling, fever, discharge and radiological evidence of osteomyelitis of long bones for more than 6 weeks durations were included in our study. Patients with diabetic foot, decubitus ulcers, septic arthritis, implant related osteomyelitis, previous tissue biopsy and those patients who had antibiotics usage in last one week were excluded from our study. The Ethical committee of both hospitals had given written permission to conduct this study. Informed written consent was taken from all the patients. In the included subjects complete history, physical examination and relevant investigations were carried out. X rays of the affected bone was taken to detect signs of chronic osteomyelitis like sequestrum, involocrum and sinus tract. Under general anaesthesia bone biopsy from representative zone or sequestrum was taken and sent to the hospital laboratory for reporting the culture and sensitivity report under the supervision of a qualified microbiologist preferably a fellow of college of physician and surgeon with minimum of three years post fellow ship experience. The specimen was inoculated on specific plates and medium to detect Staphylococcus Aureus, Escherichia Coli, Pseudomonas Aeruginosa and Proteus Mirabilis. The detected microorganisms were tested for the antibiotic sensitivity of Fusidic Acid, Amikacin, Ciprofloxacin, Vancomycin Gentamicin, Erythromycin, and Penicillin.

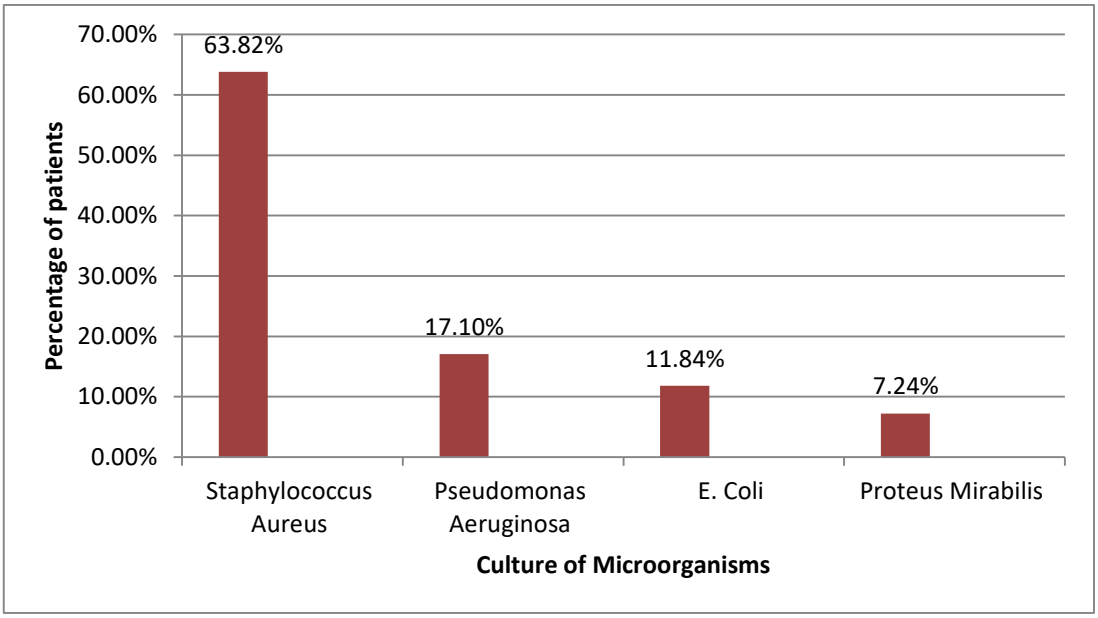
We analyzed our data with SPSS version 20. Quantitative variables like age was represented as mean and standard deviation while categorical variables like gender, common bacteria and antibiotic sensitivity as frequency and percentage. Data presented in tables and graph where necessary.

RESULTS

We included 193 patients in our study Majority(67.35%, n=130) of patients were male while female were 63(32.64%). The mean age was 31.61±11.35 years. Maximum(22.80%, n=44) patients of chronic osteomyelitis belonged to the age group 31 to 40 years followed by 41(21.24%) patients to 21 to 30 years age group and 40(20.73%) patients to 30 to 41 years age group. Chronic osteomyelitis of femur shaft was documented in 88(45.59%) patients, tibia in 45(23.31%), ulna in 18(9.3%)humerus in 15(7.77%), radius in 16(8.29%) and ulna in 11(5.69%) patients. In majority(73%,n=141) patients representative bone pieces from infected sites were taken and sent to laboratory for culture and sensitivity test. Sequestrum was sent to laboratory in 52(26.94%) patients. Culture report revealed growth of microorganisms in 152(72.76%) patients and no growth in 41(21.24%) patients. Most(78%,n=32) of the negative results were reported from bone specimen while negative results of the sequestrum was noted only in 9(21.95%) patients. Majority(61.18%, n=93) of the patients with positive culture were male while 59(38.82%) were female. Staphylococcus Aureus was the most common bacterial growth in 97(63.82%) patients followed by Pseudomonas Aeruginosa in 26 (17.10%), E. Coli in 18 (11.84%) and Proteus Mirabilis in 11(7.24%) patients as shown in graph I. About 61(62.89%) male and 36(37.11%) female patients had Staphylococcus Aureus while 12(66.67%) male and 6(33.33%) female patients had E. Coli isolated. Table I shows age wise distribution of different bacteria isolated in culture and it can be seen that Staphylococcus Aureus was the predominant bacteria isolated in most age groups.

The antibiotic sensitivity and resistant report is shown in table II and it can be seen that isolated Staphylococcus Aureus was sensitive to Vancomycin in

97(100%) patients followed by Fusidic Acid in 90(92.78%) patients and Gentamicin in 83(85.57%) patients. Staphylococcus Aureus however, showed resistance to Penicillin in 34(35.05%) patients, Erythromycin in 28(28.87%) patients, Ciprofloxacin in 24(24.74%), Amikacin in 17(17.53%) and to Fusidic Acid in 7(7.22%) patients.



Graph I: Frequency of different bacteria isolated in patients of long bones chronic osteomyelitis.

Table I: Age wise distribution of bacteria isolated on culture.

Age Groups	**Staphylococcus Aureus**			**E. Coli**	**Pseudomonas Aeruginosa**	**Proteus Mirabilis**
(years)		**n=97**		**n=18**	**n=26**	**n=11**
10-20	8	(8.25%)	12	(66.67%)	3 (11.54%)	2 (18.18%)
21-30	24	(24.74%)	2	(11.11%)	9 (34.62%)	5 (45.45%)
31-40	24	(24.74%)	2	(11.11%)	6 (23.07%)	2 (18.18%)
41-50	22	(22.68%)	1	(5.56%)	8 (30.77%)	1 (9.09%)
51-60	13	(13.40%)	1	(5.56%)	0 (0%)	1 (9.09%)
61 and above	6	(6.19%)		0 (0%)	0 (0%)	0 (0%)

Table II: Sensitivity and resistance report of different bacteria isolated in patients of Chronic Osteomyelitis.

	Staphylococcus Aureus		**E. Coli**		**Pseudomonas Aeruginosa**		**Proteus mirabilis**	
Antibiotic	**n=97**		**n=18**		**n=26**		**n=11**	
	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
Fusidic acic	90	7	17	1	24	2	10	1
	(92.78%)	(7.22%)	(94.44%)	(5.56%)	(92.31%)	(7.69%)	(90.91%)	(9.095)
Amikacin	80	17	15	3	20	6	8	3
	(82.47%)	(17.53%)	(83.33%)	(16.67%)	(76.92%)	(23.08%)	(72.73%)	(27.27%)
Ciprofloxacin	73	24	13	5	18	8	9	2
	(75.26%)	(24.74%)	(72.22%)	(27.78%)	(69.23%)	(30.77%)	(81.82%)	(18.18%)
Vancomycin	97	0	17	1	26	0	11	0
	(100%)	(0%)	(94.44%)	(5.56%)	(100%)	(0%)	(100%)	(0%)
Gentamicin	83	14	15	3	21	5	9	2

	(85.57%)	(14.43%)	(83.33%)	(16.67%)	(80.77%)	(19.23%)	(81.82%)	(18.18%)
Erythromycin	69	28	13	5	20	6	8	3
	(71.13%)	(28.87%)	(72.22%)	(27.78%)	(76.92%)	(23.08%)	(72.72%)	(27.27%)
Penicillin	63	34	11	7	16	10	7	4
	(64.95%)	35.05%)	(61.11%)	(38.89%)	(61.54%)	(38.46%)	(63.64%)	(36.36%)

DISCUSSION

Chronic Osteomyelitis is usually caused by virulent microorganisms and results in necrosis of bone.[14] Treatment of chronic Osteomyelitis has always been a challenge to Orthopaedic surgeons.[15] In our study male patients were in majority(67.35%, n=130) with male to female ratio of 2.06:1.Other studies [2,16] also reported male predominance. Positive growth of bacteria was noted in 152(72.76%) patients and no growth in 41(21.24%) patients in our study. Staphylococcus Aureus was the commonest bacteria isolated from 97(63.82%) specimens followed by Pseudomonas Aeruginosa in 26 (17.10%), E. Coli in 18 (11.84%) and Proteus Mirabilis in 11(7.24%). Lowenberg and colleague[2] documented 65.71% positive culture and 34.28% negative culture in their study. They noted Staphylococcus Aureus in 69.56% patients, E.Coli and Pseudomonas Aeruginosa in 17.39% patients each, Proteus in 13.04% and Coliform in 4.34%. Qureshi[16] reported positive growth in 89(53.94%) patients in his study with growth of Staphylococcus Aureus in 48(54%) samples, Enterobacteriaceae in 20(23%), Pseudomonas Aeruginosa in 16(18%) and anaerobes in 2(2.5%) samples. Qureshi however, was of the opinion that the increased frequency of Pseudomonas Aeruginosa was due to rising nosocomial osteomyelitis. Alonge and his colleague[17] reported positive culture in 78.33% of their study participants. Alam[18] reported 68.6% Staphylococcus Aureus isolated in his study. Shah[19] also reported that Staphylococcal Aureus was the predominant(44%, n=11) bacteria in his study. Malik[20] however, reported a different frequency of bacteriological profile of isolated microorganisms. He noted that Enterobacteriaceae was the commonest bacterial group noted in 32.8% of his patients followed by Staphylococcus Aureus(29.5%),Pseudomonas Aeruginosa(15.5%),Anaerobes(2.6%) and miscellaneous(19.3%).

Antibiotic therapy of chronic osteomyelitis depends upon sensitivity of commonly used antibiotics to the bacterial isolates. Our results showed that Staphylococcus Aureus was sensitive to Vancomycin in 97(100%) patients followed by Fusidic Acid in 90(92.78%) patients and to Gentamicin in 83(85.57%) patients. Mahmood[21] reported that Cephalosporins were the drug of choice to treat chronic osteomyelitis initially in 57.14% patients, Fusidic Acid and Linezolid in 34.28%,Penicillin and Fluoroquinolones in 20% and Aminoglycosides in 8.57% patients.

In our study we took only bone or sequestrum specimen for microbiological analysis. Non-bone specimens had been shown to report 52% false negative and 36% false positive results.[22] Many studies therefore, recommend only bone specimens as ideal for getting higher percentage of positive cultures. Zuluaga[23] reported 94% positive culture from bone while Shah[19] reported 92% positive culture from sequestrum.

Our study had few limitations. Although our sample size was adequate but we could not calculate the accurate sample size according to formula. The design of our study was descriptive and we could not compare the frequency of positive cultures from bone versus non bone specimens. Further studies are therefore recommended to address these limitations.

CONCLUSION

Staphylococcus aureus was the most common bacteria isolated. Majority of isolated bacteria were sensitive to Vancomycin and Fusidic acid. The empirical antibiotic treatment of chronic osteomyelitis must include these antibiotics to avoid resistance to antibiotics and eradicate the infection completely.

Conflict of Interest: None
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