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Evaluation of Aerobic Bacterial Isolates and its Drug Susceptibility Pattern in Orthopaedic Infections

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Abstract Orthopaedic infections are associated with a high morbidity, often require an aggressive antibiotic therapy, so increased substantial cost. Bone infections remains a serious therapeutic challenge and and increasing resistance has complicated management of these infections. Delayed or ineffective treatment causes significant morbidity in terms of pain, loss of function and the need for further surgery and antibiotics.

Objective: To study the aerobic bacteriological spectrum and antibiotic susceptibility pattern of isolates of orthopaedic infections

Materials And Methods: We performed a retrospective review of clinical and microbiological data sets using the access database of patients admitted in orthopedic ward for one year.

Results: Out of 98 samples, 72(73.46%) yielded pure growth, 21(21.42%) mixed growth, 5(5.1%) showed no growth. Out of 115 bacterial strains isolated 56(48.69%) were Staphylococci and 59(51.3%) were Gram negative bacilli.

Among the Staphylococcus spp, MRSA(50%), MSSA(33.9%), MSCONS (9%) and MRCONS(7.1%). Susceptibility pattern of MRSA isolates were 68% to cotrimaxozole, 43% to clindamycin,29% to erythromycin, 18% to gentamycin and all MRSA strains were sensitive to Vancomycin and Linezolid.

Among Gram negative bacilli, Pseudomonas(25.4%), Escherichia coli(22%), Enterobacter (22%), Klebsiella (15.3%), Citrobacter (8.4%), Acinetobacter (3.3%) and Proteus (3.3%). Pseudomonas strains showed100%

sensitivity to imipenem, 87% to piperacillin-tazobactum,73% to amikacin,66% to cefotaxime,47% to ciprofloxacin,27% to gentamycin.
Conclusion: Knowing the prevalence and the antibiotic susceptibility pattern of the isolates, helps us to guide the clinician to select the most appropriate antibiotics thereby preventing indiscriminate use of antibiotics.
Keywords- orthopaedic infection, antibiotics, drug resistance, MRSA, Gram negative bacilli,

INTRODUCTION

The problem of changes in pathogenic microbiological flora and the emergence of bacterial resistance has created major problems in the management of orthopaedic diseases and fractures. Due to the use of implants for open reduction and internal fixation, which are foreign bodies to the body, orthopaedic trauma surgery is at grave risk of microbiological contamination and infection[1].

The pathogenesis of infection in fractures, fixation devices is related to microorganisms, which grow in biofilm, and therefore its eradication is difficult[2]. In human the most common route by which bacteria reach the bone is blood stream[3],[4]. However, traumatic modes as penetrating injury[5], fractures and intra-medullary nailing[6], implants and postsurgical complications[7] have been identified. Intravenous drug users[8],[9] and the presence of foreign body[10] also predispose to bone infection.

The various factors influence the nature and frequency of infection like low resistance of patients, contact with infectious persons, contaminated environmental sites and drug resistance of endemic organisms[11]. The source of an infecting organism may be present in patients body i.e. endogenous or exogenous in which organisms may be from another patient or a member of the hospital staff or from the inanimate environment of the hospital. The environmental sources like air, water, food, medication, equipment/instrumentation, soiled linen, hospital waste and contamination of wounds during the time of injury by dirt, soot, grease etc. play an important role in orthopaedic infections[1].

During the past few years, there has been remarkable improvement in the field of diagnosis of infection due to newer techniques, better health care systems, increasing awareness of patients; and invention of newer, more effective, and less toxic antimicrobials for combating osteo-articular infections[1].Orthopaedic wound infections are difficult to treat or eradicate completely in the absence of early diagnosis and prompt treatment or failure of antibiotic therapy due to development of drug resistance, these infections are still an important cause of high morbidity. Proper management requires accurate microbial isolation and appropriate antibiotic administration.

Keeping this in mind we decided to evaluate the data to know the aerobic bacterial etiological agents

in orthopaedic wound infections and their antimicrobial susceptibility pattern. The analysed information can be utilized for starting empirical treatment.

MATERIALS AND METHODS

* We performed a retrospective review of clinical and microbiological data using the access database of samples received in our department from orthopaedic wound infection cases admitted in orthopaedic ward.
* The following information were noted – name, age, sex, case history, pre-operative antibiotics used, organism isolated and the antibiotic susceptibility.

RESULTS

Out of 98 cases studied, 74 (75.5%) were males and 24 (24.5%) were females. The cases were more in the age group of 31-40 years i.e.33 (33.7%) and 18 (18.4%) cases were of age group 41-50 years shown in Table 1

Table – 1: Showing age and sex distribution

Age group (in years)	Males No(%)	Females No(%)	Total No(%)
0-10	0(0)	0(0)	0(0)
11-20	11(15)	2(8.5)	13(13.3)
21-30	10(13.5)	3(12.5)	13(13.3)
31-40	21(28.4)	12(50)	33(33.7)
41-50	15(20.3)	3(12.5)	18(18.4)
51-60	9(12.1)	1(4)	10(10.2)
61-70	5(6.7)	3(12.5)	8(8.1)
71 and above	3(4)	0(0)	3(3)
Total (%)	74(100)	24(100)	98(100)

Wound infections were most common in fracture leg and foot accounting to 57.1% followed by fracture neck and shaft of femur(24.5%).(Table 2)

Table 2: Distribution of Wound Infection by Bone Fracture Site

Bones affected	Number	Percentage
# Neck and shaft of Femur	24	24.5
# Leg and Foot	56	57.1
# Humerus	8	8.2
# Forearm and Hand	4	4.1
Infected implant in situ	6	6.1
Total	98	100

Out of 98 samples, 72(73.46%) yielded pure growth, 21(21.42%) mixed growth, 5(5.1%) showed no growth (Figure1)

ANTI BIOTICS	MRSA	MSSA	MRCONS	MS CONS
Linezolid	28(100%)	19(100%)	4(100%)	5(100%)
Vancomycin	28(100%)	19(100%)	4(100%)	5(100%)
Cotrimaxozole	19(68%)	10(53%)	2(50%)	3(60%)
Clindamycin	12(43%)	14(74%)	3(75%)	5(100%)
Erythromycin	8(29%)	8(42%)	2(50%)	3(60%)
Gentamycin	5(18%)	8(42%)	1(25%)	4(80%)

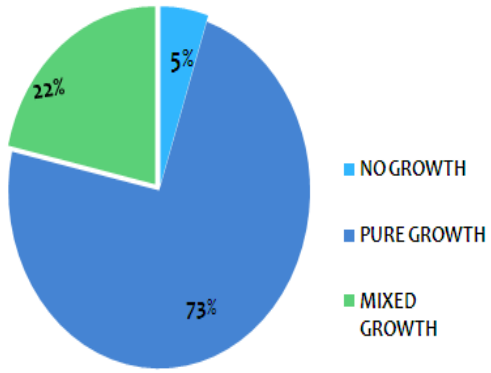

Figure1: Distribution of growth of pathogens in specimens

Out of 115 bacterial strains isolated 56(48.69%) were Staphylococci and 59(51.3%) were Gram negative bacilli.

Among the Staphylococcus spp, Methicillin Resistant *Staphylococcus aureus*(MRSA)50%, Methicillin Sensitive *Staphylococcus aureus* (MSSA)33.9%, Methicillin Sensitive Coagulase Negative Staphylococcus(MSCONS) 9% and Methicillin Resistant Coagulase Negative Staphylococcus(MRCONS)7.1%. (Figure 2)

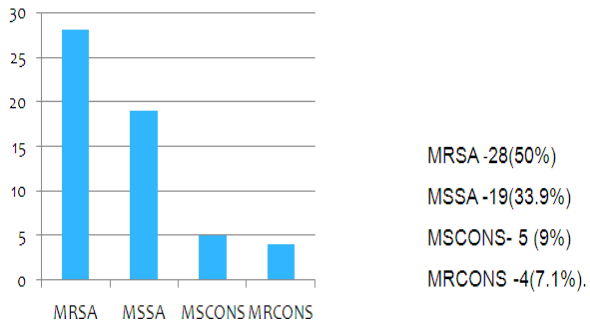

Figure 2 : Distribution of Staphylococcal species

Methicillin resistant *staphylococci* were found be resistant to routinely used antibiotics compared to Methicillin Sensitive *Staphylococci*. All of them were found to be sensitive to Vancomycin and Linezolid (Table 3)

Table3:Susceptibility pattern of MRSA, MSSA, MRCONS AND MSCONS

Among Gram negative bacilli, Pseudomonas 15(25.4%), Escherichia coli 13(22%), Enterobacter 13(22%), Klebsiella 9(15.3%), Citrobacter 5(8.4%), Acinetobacter 2(3.3%) and Proteus 2(3.3%). (Table 4)

Table 4: Distribution of various Gram negative bacilli

ORGANISMS	Number	Percentage
Pseudomonas	15	25.4
Escherichia coli	13	22
Enterobacter	13	22
Klebsiella	9	15.3
Citrobacter	5	8.4
Acinetobacter	2	3.3
Proteus	2	3.3
TOTAL	59	100

The data of antimicrobial susceptibility of gram negative bacilli showed reduced susceptibility to cefotaxime, gentamicin and ciprofloxacin. They showed better susceptibility to amikacin and piperacillin-tazobactum. Most effective antimicrobial agent was imipenem(Table 5)

Table 5: Susceptibility pattern of Gram negative bacterial isolates

Antibiotics	*Pseudomonas*	*Escherichia coli*	*Enterobacter*	*Klebsiella*	*Citrobacter*	*Acinetobacter*	*Proteus*
Cefotaxime	10 (66%)	4 (31%)	5 (38%)	5 (56%)	2 (40%)	1 (50%)	1 (50%)
Piperacillin-Tazobactum	13 (87%)	7 (54%)	9 (69%)	8 (89%)	4 (80%)	2 (100%)	2 (100%)
Gentamycin	4 (27%)	8 (62%)	4 (31%)	5 (56%)	4 (80%)	2 (100%)	1 (50%)
Amikacin	11 (73%)	10 (77%)	6 (46%)	6 (67%)	4 (80%)	2 (100%)	2 (100%)
Ciprofloxacin	7 (47%)	5 (38%)	8 (62%)	4 (44%)	3 (60%)	2 (100%)	2 (100%)
Imipenem	15 (100%)	11 (85%)	11 (85%)	8 (89%)	5 (100%)	2 (100%)	2 (100%)

DISCUSSION

Analyzing our data base, we could find 98 cases of orthopaedic wound infection in which 75% were males and 25% were females. Most of the patients were between the age group of 31-40 years in both the genders 50% of the females belong to this age group. This is the age at which they are employed and they travel with stress to their work place in the two wheelers so vulnerable for road traffic accidents which leads to orthopaedic problems and admitted in the hospital predispose them to infection. This correlates with the study conducted by Faria Malik, Zuluana AF etal[12][13].

Wound infections were most common in lower limbs(81.6%) followed by upper limbs(12.3%) in the present study. Probably lower limbs are more prone for injuries and contamination by soil and maintenance of hygiene is difficult all these predisposes for infections. A study conducted by Samuel B A et al also showed the lower limbs were affected in 71.5% of cases, the upper limbs in 22.1%, and the head and neck in 3.5%[14].

A study conducted by Samuel B A et al in 2008 showed *Staphylococcus aureus*(37.6%) as the most common isolate followed by Coliforms (11.2%) in chronic osteomyelitis[14]. This correlates with our study wherein *Staphylococcus aureus* (41%)and *Pseudomonas* species (13%)were the most common organisms associated with wound infections which is in line with other studies and standard patterns. A Retrospective French Multicenter study by Jacques Merrer, Alain -Jacob, Philippe Montravers showed MRSA (32%) as the most common isolate, followed by *Pseudomonas aeruginosa* (23%) in orthopaedic infections[15] but the study conducted by Sule ,Thanni, Olusanya showed *Pseudomonas aeruginosa*(26%) as the most common isolate followed by *Staphylococcus aureus*(17%) and *Klebsiella*(17%) in orthopaedic wound infections[16].

The pathogens isolated showed marked resistance to the routinely used antimicrobial agents. Gram positive isolates 60% showed sensitivity to

Cotrimoxazole and Clindamycin. All the isolates were susceptible to Vancomycin and Linezolid. Among the gram negative isolates maximum susceptibility was observed towards Imipenem followed by Piperacillin-Tazobactum, Amikacin and Gentamycin.

CONCLUSION

Orthopaedic wound infections are usually the sequel of trauma. Our study has helped us to know about the organisms responsible for infection and its susceptibility pattern. Every hospital will have diverse microbial flora which are responsible and exhibit different susceptibility pattern. Isolation of causative organism and performance of antibiotic sensitivity studies are critical in the selection of antimicrobial agents. This type of study helps to assess etiological agents in orthopedic wound infections and comparison of effects of different antibiotics on microorganisms in vitro in order to utilize its results for quick and appropriate antibiotic selection before the availability of culture and antibiogram results. Thus it will help in selection of correct treatment and prevents development of drug resistance by indiscriminate use of antibiotics.

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