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Original Research Article

BACTERIAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF PATHOGENS CAUSING OSTEOMYELITIS IN PATIENTS ATTENDING A TERTIARY CARE HOSPITAL

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Abstract

Background: Osteomyelitis is a progressive infection which results in inflammation of the bone and causes bone destruction, necrosis and deformation. The various pathogens were identified as agents for causing osteomyelitis. Early diagnosis of Acute osteomyelitis is crucial because prompt antibiotic may prevent the necrosis of bone and hence, the adverse sequalae. The aim & objective is to study the Bacterial profile and Antibiotic susceptibility pattern in patients with osteomyelitis. **Materials and Methods:** The study was conducted from April 2018 to September 2018 at Institute of Microbiology in association with Institute of Orthopaedics, Madras Medical College, Rajiv Gandhi Government General Hospital, Chennai. Detailed proforma including the patient's clinical and treatment details were obtained. Blood and appropriate samples were collected from 75 patients with osteomyelitis after getting informed consent as per the standard sample collection protocols. All the samples were processed for culture isolation and the non-duplicate isolates were subjected to antimicrobial susceptibility tests as per the standard guidelines (CLSI 2018). The results were analysed in correlation with the clinical details. **Result:** Among 75 patients in the study group, men were predominant (91%), age group ranging from 41 to 50 years. 44% of the patients had culture proven osteomyelitis, in which, Staphylococcus aureus was the predominant (36.3%) pathogen followed by Gram negative bacilli. Among the Staphylococcus aureus, 53.8% were Methicillin-resistant Staphylococcus aureus (MRSA) and45.5% of Gram-negative bacteria were drug resistant. None of the Blood cultures were positive. **Conclusion:** The increased incidence of Methicillin-resistant Staphylococcus aureus (MRSA) osteomyelitis complicates antibiotic selection. Surgical debridement is usually necessary in chronic cases. The recurrence rate remains high despite surgical intervention and long-term antibiotic therapy. Osteomyelitis caused by GNB remains a serious therapeutic challenge, especially when associated to non-fermenting bacteria. We emphasize the need to consider these agents in diagnosed cases of osteomyelitis, so that an ideal antimicrobial treatment can be administered since the very beginning of the therapy.

INTRODUCTION

Osteomyelitis is a progressive infection which results in inflammation of bone and causes bone destruction, necrosis and deformation.[1,2] Two classification systems of osteomyelitis are currently in use; The Waldvogel classification and the Cierny- Mader classification.[3,4]

The Waldvogel classification is based on the pathogenesis of disease. Categories are defined by the duration of illness (acute/chronic), the source of infection (eg contiguous focus originating from local infected tissue) and vascular insufficiency (eg. diabetic foot infection).[3,5]

Osteomyelitis due to local spread from a contiguous contaminated source of infection follows trauma, bone surgery, or joint replacement.[6] There is also an increasing number of osteomyelitis associated with prosthetic implants. It implies an initial infection that gains access to bone. It can occur at any age and can involve any bone. In this group, identification of

patients with a foreign-body implant is important, both because of their high susceptibility to infection and because of treatment challenges.

The common etiological agents causing implant related osteomyelitis are the metabolic consequences of diabetes, bone and soft-tissue ischaemia and peripheral motor, sensory, and autonomic neuropathy.[7]

Haematogenous osteomyelitis has been described in prepubertal children. It involves mostly the metaphysis of long bones,[8] (particularly tibia and femur), in most cases as a single focus. Although rare in adults, it most frequently involves the vertebral bodies. organisms most encountered in neonates and infants include Staphylococcus aureus, Group-B streptococci, coagulase-negative staphylococci, and streptococci species. In adults, Staphylococcus aureus predominates, where as in Geriatric group, with advancing age, Gram-negative bacteraemia as an extension of Gram-negative sepsis.

Skeletal tuberculosis8 is the result of hematogenous spread of Mycobacterium tuberculosis early in the course of a primary infection.

Pathogenesis and Microbial virulence factors:[9]

The development of osteomyelitis is related to microbial and host factors. Among pathogenic microorganisms, Staphylococcus aureus is by far the most commonly involved. This organism elaborates a range of extracellular and cell-associated factors contributing to its virulence. First are factors promoting attachment to extracellular matrix proteins, called bacterial adhesins. The ability of Staphylococcus aureus to adhere is thought to be crucial for the early colonisation of host tissues, implanted biomaterials, or both. Staphylococcus aureus expresses several adhesins (MSCRAMM, microbial surface components recognising adhesive matrix molecules) on its surface, each specifically interacting with one host protein component, such as fibrinogen, fibronectin, collagen, vitronectin, laminin, thrombospondin, bone sialoprotein, elastin, or von Willebrand factor. The second set of factors promote evasion from host defences (protein A, some toxins, capsular polysaccharides).

Clinical Features: Acute hematogenous osteomyelitis9 results from bacteremic seeding of bone. The clinical symptoms of haematogenous osteomyelitis in long bones are chills, fever, and malaise reflecting the bacteraemic spread of microorganisms as shown by positive blood cultures; pain and local swelling are the hallmarks of the local infectious process. More than a million hip replacements are done each year worldwide, and the number of other artificial joints (knees, elbows) inserted is also rising.

Diagnosis[10]

The diagnosis of osteomyelitis usually requires a combination of a full clinical assessment, plain X-rays and further imaging (eg MRI scan, CT scan, ultra-sound), blood cultures (particularly in acute haematogenous osteomyelitis), bone and/or soft tissue biopsies and/or surgical sampling. Imaging is useful to characterize the infection and to rule out other potential causes of symptoms. As Culture isolation is the gold standard method to diagnose osteomyelitis, pus samples were collected from discharging sinuses under aseptic precautions. Then the swabs were subjected to direct gram stain, culture and antibiotic susceptibility tests. The inflammatory markers are especially likely to be elevated in children with acute osteomyelitis. A persistently normal erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) level virtually rule out osteomyelitis. The C-reactive protein level correlates with clinical response to therapy and may be used to monitor treatment.

Treatment

Treatment of osteomyelitis depends on appropriate antibiotic therapy and often requires surgical removal of infected and necrotic tissue. Choice of antibiotic therapy should be determined by culture and susceptibility results. The treatment currently recommended for osteomyelitis caused by Staph aureus6 is a long course of a parenterally administered semisynthetic penicillin or vancomycin, based on the antibiogram. Several studies have shown that oral treatment with cloxacillin, ofloxacin, cotrimoxazole,[11-14] is effective in prosthetic joints and implant associate osteomyelitis due to Staphylococcus aureus. Clindamycin has excellent bone penetration and recommends for long term oral therapy in infections with susceptible organisms.

The increased incidence of methicillin-resistant Staphylococcus aureus (MRSA) osteomyelitis complicates antibiotic selection. Vancomycin, Linezolid or Teicoplanin given based on susceptibility testing. Acute hematogenous osteomyelitis,[5] in children can be treated with a four-week course of antibiotics. In adults, the duration of antibiotic treatment for chronic osteomyelitis is typically several weeks longer.

Aim & Objectives

- To isolate and identify the aerobic bacterial pathogens in patients with clinical diagnosis of osteomyelitis.
- To study the bacterial profile in patients with culture confirmed osteomyelitis and the antibiotic susceptibility pattern of isolates.
- To study the distribution of infections caused by drug resistant bacteria.

MATERIALS AND METHODS

This was a Prospective Cross-sectional study conducted at the Institute of Microbiology in association with Institute of Orthopaedics, Madras Medical College, Chennai for the period of 6 Months [July 2018 to December 2018] among 75 patients with clinical and radiological diagnosis of Osteomyelitis. Those who are clinically diagnosed patients with Osteomyelitis were included in the study and patients those who are not given consent to

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participate in the study were excluded in the study. Institutional ethics committee approval was obtained with Ref.no : l40620l8 on 05.06.20l8.

Specimen collection: Blood, joint aspirates and Pus samples were collected under aseptic precaution after obtaining informed consent. Two swabs were collected, one for Gram stain and the another for aerobic bacterial culture.

Specimen processing: The pus samples were inoculated onto Mac Conkey agar plate and 5% sheep blood and chocolate agar plates. Blood samples wereinoculated into BHI broth and subcultured after 48 hours into 5% sheep blood and chocolate agar plates, then incubated for 18-24hrs at 37°C. The bacterial isolates were identified by colony morphology, Gram stain, motility, culture characteristics and biochemical reactions as per the standard operating procedures.

Identification of isolates of Staphylococcus species were based on following characteristics:[11-15]

Staphylococcus aureus were phenotypically identified by standard protocols namely, colony characteristics, Catalase test, coagulase test (Slide and Tube method)) and biochemical reactions for further confirmation. The biochemical reactions were showed Fermentative pattern on Hugh-Leifson's oxidation fermentation media, urea hydrolysis test was positive and mannitol was fermented with gas production.

Staphylococcus epidermidis were Gram positive cocci in clusters, catalase positive, coagulase test negative (both Slide and Tube method) were subjected to biochemical reactions for further confirmation. The biochemical reactions were Fermentative pattern on Hugh-Leifson's oxidation fermentation media, urea hydrolysis test was positive and mannitol was not fermented. The isolate was sensitive to Novobiocin(30µg) and resistant to Polymyxin B(300IU). [Figure 1-6]

Phenotypic identification of isolates belonging to family Enterobacteriaceae:[11,15]

The bacterial isolates were identified by colony morphology, Gram stain, Catalase, Motility, culture characteristics and biochemical reactions as per the standard operating procedures. The bacterial colonies showing Gram negative bacilli in Gram stain were subjected to the following biochemical reactions like catalase test, oxidase test, Nitrate reduction test, Hugh-Leifson'sOxidation fermentation test, Indole test, Methyl red test, Voges-proskauer test, Simmon'sCitrate utilisation test, Christensen's Urease test, Triple sugar iron agar test, Mannitol Motility test, 1% sugar fermentation tests with Glucose, Lactose, Sucrose, Maltose, Mannitol, Phenyl pyruvic acid test, SLysine decarboxylation test, Ornithine decarboxylation test and Arginine dihydrolase test for identification of isolates using standard microbiological techniques.

Identification of isolates of Acinetobacter baumannii was based on following characteristics:[11,15]

Colony morphology: The isolates were subjected to preliminary test like Gram stain, catalase test, oxidase test and motility by hanging drop method. The biochemical reactions: Nitrate not reduced, oxidative pattern on Hugh-Leifson's oxidation fermentation media, indole not produced, Citrate utilised, urea not hydrolysed, triple sugar iron agar showed alkaline slant/alkaline but without gas or H2S production and 10% OF lactose was fermented. The isolate showed positive growth at 42ºC.

Identification of isolates of Pseudomonas aeruginosa was based on following characteristics:[2]

Colony morphology

The isolates were subjected to preliminary test like Gram stain, catalase test, oxidase test and motility by hanging drop method. The isolates which were Gram negative slender bacilli, catalase positive, oxidase positive and motile and subjected to biochemical reactions for further confirmation.

The biochemical reactions: Nitrate reduced, oxidative pattern on Hugh-Leifson's oxidation fermentation media, indole not produced, Citrate utilised, urea not hydrolysed, triple sugar iron agar showed alkaline slant/alkaline but without gas or H2S production and arginine was dihydrolysed. The isolate showed positive growth at 42ºC.

Antimicrobial Sensitivty Testing

Disc Diffusion Method: Antimicrobial sensitivity testing was performed for all the isolates by Kirby-Bauer disc diffusion method on Mueller-Hinton agar plates. Three to four colonies were inoculated in peptone water and incubated for two hours at 37ºC, to bring the organism to logarithmic phase. The turbidity of the suspension was adjusted to 0.5 McFarland standards. Within fifteen minutes of preparation of the suspension, a sterile cotton swab was immersed in the suspension and the excess suspension is removed by rotating the swab against the wall of the test tube. A lawn culture of the inoculum was made by streaking the swab over the surface of the plate in three directions. After about 10 to 15 minutes, the antibiotic discs were placed, five on each plate and incubated at 37ºC for 20 to 24 hours. Zone of inhibition of bacterial growth around the antibiotic discs were measured using the Himedia scale. Interpretations were made using the Clinical and Laboratory Standards Institute (CLSI), USA guidelines – January 2018, M100S.

Detection of antimicrobial resistance mechanisms:

Detection of Methicillin Resistance in Staphylococcus aureus by using Disc diffusion method:[15]

Inoculum preparation: 0.5 Macfarland turbidity standardised inoculum of S.aureus from blood agar plate was used.

QC Recommended: S.aureus ATCC 25923

Test procedure:

The inoculum is swabbed on to the surface of Mueller –Hinton agar (MHA) in three dimension and

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cefoxitin30 µg disk is placed and incubated for16-18 hrs at 33 °c- 35 ° c.

Result is interpreted if the zone size ≤ 21 mm = mecA positive and ≥ 22 mm = mecA negative.

Cefoxitin is used as a surrogate marker for mec-A mediated oxacillin resistance. Isolates that test as mec A positive should be reported as oxacillin [methicillin] resistant strains.

D test: Detection of Inducible Clindamycin resistance.[11,15]

Procedure: Five to six colonies of the test isolate grown on nutrient agar plate is directly suspended in peptone water and is matched with 0.5 McFarland turbidity standard. A lawn culture of the test organism is made on Mueller Hinton Agar plate.

Erythromycin (15 □g) and Clindamycin (2 □g) Disks are placed 15 -26 mm apart and incubated at 35°C□ 2°C for16 to 18 hrs. The results were interpretated as Flattening of the zone of inhibition adjacent to the erythromycin Disk → Inducible Clindamycin resistance.

Hazy growth within the zone of inhibition around Clindamycin -Clindamycin resistance even if no D-zone apparent.

Quality control: Staphylococcus aureus ATCC-BAA- 976 (D-Zone test Negative)

Staphylococcus aureus ATCC –BAA-977 (D-Zone Test Positive)

Vancomycin screen agar (VSA),[11,15]

VSA was used for screening vancomycin susceptibility for MRSA. BHI agar with vancomycin 6µg/ml was the medium used. Bacterial suspension matching with 0.5 McFarland suspension were inoculated and incubated at 350C for 24 hours. Presence of more than one colony indicates vancomycin resistance.

ESBL Screening and Confirmation test:[11,15]

The isolates which were resistant to cefotaxime/ceftazidime [(30µg) <23mm] were considered as ESBL producers. Ceftazidime (30µg) and ceftazidime-clavulanic acid (30µg/10µg) discs-(Himedia), were placed at a distance of 20mm centre to centre on the Mueller-Hinton agar plate, incubated at 37ºC for 20-24 hours. The tested isolates were confirmed to be ESBL producers if the zone of inhibition around the ceftazidime-clavulanic acid disc was ≥5mm that the zone around ceftazidime disc alone.

RESULTS

The results were discussed below. Most of the patients are in the age group 41 to 50 years and 31 to 40 years, followed by others. About 93.3% were males. [Table 1].

The most common risk factor for osteomyelitis was traumatic fractures with implants& devices constituting 60% of osteomyelitis, followed by diabetes in 20% of patients. Others include vascular insufficiency and immunosuppressive therapy. Osteomyelitis most commonly involved in Lower limbs 61 (81%), of which 55% (34/61) of the lower limb osteomyelitis occurred in tibia. Upper limb bones were affected in 20% of patients. [Table 2].

Among the 45 patients with traumatic fractures with implants &devices, 40% were culture positive, whereas 60 % of the 15 diabetic patients had culture confirmed osteomyelitis. Among the osteomyelitis patients with surgical interventions as predisposing factor, 40% of them were culture positive. 44% of the patients had culture proven osteomyelitis, whereas 56% of the patients had culture negative osteomyelitis. None of the blood cultures were positive. [Table 3] The risk factor wise culture positive was mentioned in [Table 4].

Staphylococcus aureus was the predominant pathogen (36.3%) followed by Pseudomonas aeruginosa. [Table 5]

Out of 12 Staphylococcus aureus,5were Methicillin sensitive Staphylococcus aureus (MSSA) and 7 were Methicillin resistant Staphylococcus aureus (MRSA). One Coagulase negative Staphylococcs (S.epidermidis). Among the 12 Staphylococcus aureus, 5 isolates were MSSA and 7 isolates were MRSA.

Majority of the isolates (>92%) were susceptible to carbapenems. Susceptibility to Aminoglycosides was variable ranging from (25% to71%) and the Proteus species were least susceptible to aminoglycosides. Third generation cephalosporins were sensitive only in a maximum of 37.5% of isolates. Among the 11 Enterobacteriaceae isolated, 6 were ESBL producers and 5 were susceptible.

Non fermenters were 100% sensitive for Imipenem.

Identification of isolates of Staphylococcus species were based on following characteristics:

Figure 1: Staphylococcus aureus – Blood Agar Plate

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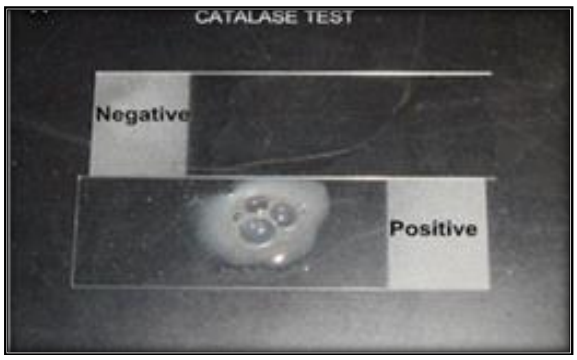

Figure 2: Slide Catalase test

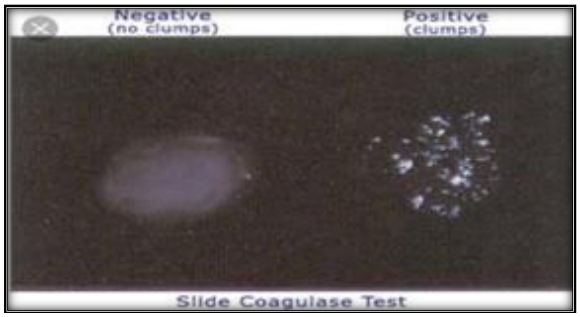

Figure 3: Slide Coagulase test

Antibiotic susceptibility test

Figure 4: Staphylococcus aureus - MSSA

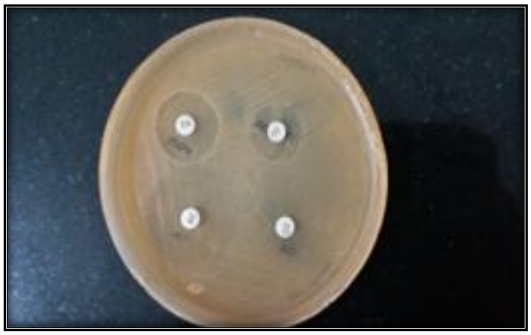

Figure 5: Staphylococcus aureus – MRSA

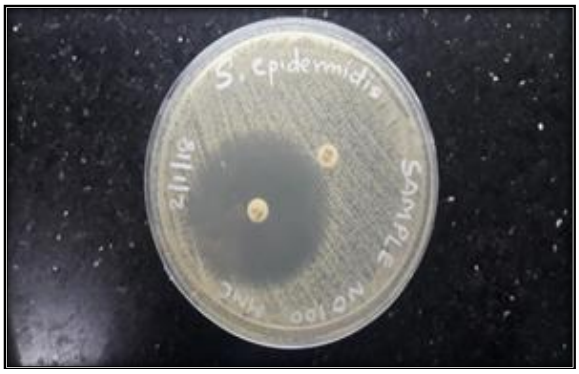

Figure 6: Staphylococcus epidermidis (CONS)

Table 1: Socio demographic details (n=75)

Age	**Patients**	**Percentage (%)**
11 to 20	7	9 %
21 to 30	13	17%
31 to 40	18	24.4%
41 to 50	20	27%
51 to 60	14	18.6%
61 to 70	3	4%
Gender	Patients	Percentage (%)
Male	70	93.3%
Female	5	7.7%

Table 2: Osteomyelitis related details (n=75)

Risk factors	**Patients**	**Percentage (%)**
Traumatic fractures with implants & devices	45	60%
Diabetes	15	20%
Post surgical infections	10	13.3%
Others	5	6.6%
Sites	Patients	Percentage (%)
Upper limb	15	20%
Humerus	3	4%
Radius	5	6.6%
Ulna	7	9.3%
Lower limb	60	80%

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Femur	19	25.3%
Tibia	34	45.3%
Fibula	4	5.3%
Bones of feet	3	4%

Table 3: Culture positivity among the patients with clinically diagnosed osteomyelitis (n=75)

	Pus culture	Blood culture
Culture Positive	33(44%)	Nil
Culture Negative	42(56%)	75

Table 4: Correlation of risk factors and culture positivity (n=33)

Risk factors	Total	Culture Positive
Traumatic fractures with implants & devices	45	(n=45) 18 (40%)
Diabetes	15	(n=15) 9 (60%)
Post surgical infections	10	(n=10) 4 (40%)
Others	5	(n=5) 2 (40%)
Total	75	33 (44%)

Table 5: Distribution of bacterial isolates (n=33)

S.NO	Organisms isolated	Number
1	Staphylococcus aureus	12 (36.3%)
2	Staphylococcus epidermidis	1 (3%)
3	Escherichia coli	1 (3%)
4	Klebsiella pneumoniae	5 (15%)
5	Klebsiella oxytoca	1 (3%)
6	Proteus spp	4 (12%)
7	Pseudomonas aeruginosa	7 (21.2%)
8	Acinetobacter spp	2 (6%)
Total		33 (44%)

Table 6: Antimicrobial susceptibility pattern of Staphylococcus spp. (n=13)

S.NO	Antibiotics	S.aureus (MSSA) (n=5)	S.aureus (MRSA) (n=7)	S.epidermidis (n=1)
1	Penicillin	2 (40%)	3 (42.8%)	0
2.	Erythromycin	2(40%)	0	0
3	Cefoxitin	5 (100%)	0	1(100%)
4	Ciprofloxacin	3 (60%)	2 (28.6%)	-
5	Linezolid	5 (100%)	6 (85.7%)	1(100%)
6	vancomycin	5(100%)	7(100%)	1(100%)
7	Tetracycline	5(100%)	6(85.7%)	1(100%)

Table 7: Antimicrobial susceptibility pattern of Enterobacteriaceae (n=11)

Antibiotics	Klebsiella spp (n=6)	Proteus spp (n=4)
Ampicillin	-	-
Cotrimoxazole	28.5%	23%
Amikacin	71.4%	25.8%
Gentamicin	71.4%	50%
Cefotaxime	35.7%	37.5%
Imipenem	92.8%	100%

Table 8: Antimicrobial susceptibility pattern of Non-fermenters (n=9)

Antimicrobial Agent	Pseudomonas spp. (n=7)		Acinetobacter spp.(n=2)	
	Sensitive	Resistant	Sensitive	Resistant
Gentamicin	71.4%	28.6%	50%	50%
Amikacin	85.7	14.3%	50%	50%
Ciprofloxacin	71.4%	28.6%	50%	50%
Ceftazidime	71.4%	28.6%	50%	50%
Piperacillin Tazobactam	85.7%	14.3%	50%	50%
Imipenem	100%	0%	100%	0%

DISCUSSION

This study was conducted in a tertiary care hospital, where 75 patients with clinical diagnosis of osteomyelitis were included to study the clinical and microbiological profile of osteomyelitis. Appropriately collected blood, and aspirated & swabbed pus samples were processed for culture isolation, identification and antimicrobial susceptibility testing. Clinical and epidemiological data were analysed in correlation with bacterial profile. Clinical outcome of the patients was analysed in correlation with drug susceptibility or resistance pattern.

In this study, patients in 3rd and 4th decades of life were predominantly affected. Osteomyelitis most involved lower limbs (ie) in 60 patients (80%), of which 55% of lower limb osteomyelitis was

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involving tibia. On analysis of pathogenesis, the most common risk factor for osteomyelitis was traumatic compound fractures with implants or other devices insitu (60%).

Diabetes with poor glycemic control was a risk factor in 20% of patients. Osteomyelitis post-surgical interventions was found in 13.3% of patients.

The culture isolation rate was higher in patients with diabetes (60%) when compared to the culture positivity in traumatic cases (40%) and post-surgical (40%).

This study was similar to the studies conducted by Anupama singh et al,[16] and Ruchi shah et al,[3] who reported the incidence of osteomyelitis in patients with trauma or accidents and 49.5% and 46% respectively.

Overall culture positivity, observed in this study was 44% and only from pus samples, bacteria were isolated. This was lower when compared to the study done by Anupama singh et al,[16] and Ruchi et al,[3] who showed a culture positivity of 86.6% and 64% respectively. The sensitivity of culture isolation depends on various factors like prior antibiotic exposure and collection of appropriate samples etc.

Like in many other studies, the predominant pathogen in the aetiology of osteomyelitis was determined to be Staphylococcus aureus (36.3%) followed by Gram negative enteric bacilli (33.3%). Pseudomonas aeruginosa and other non-fermenters were the causative agents in 21.2% of the cases.

This finding was in line with the studies done by V Shah et al, Naseer saleem et al and Raziabkhatoon et al where the predominant pathogens isolated was Staphylococcus aureus at 60%, 33% and 41% respectively.[17-19]

Of the 12 Staphylococcus isolates 7 (58%) were methicillin resistant Staphylococcus aureus (MRSA) and 5 (41%) were methicillin susceptible. Various Indian studies have reported percentage of methicillin resistant Staphylococcus aureus ranging from 31%-63%.

Most of the methicillin sensitive Staphylococcus aureus were sensitive to the commonly used first line antibiotics including the oral ones, whereas only 58.3% of methicillin resistant Staphylococcus aureus were sensitive to ciprofloxacin and other oral antibiotics, making the long-term therapy difficult. Majority of methicillin resistant Staphylococcus aureus isolates were susceptible to linezolid and tetracycline 85.7% and 100% of methicillin resistant Staphylococcus aureus (MRSA) were susceptible to vancomycin.

About 6 of the 11 Gram negative enteric bacilli isolated were drug resistant ESBL (extended spectrum beta lactamase) producers restricting the therapeutic options only to carbapenams, the susceptibility ranging from 84 %– 100%. About 100% of the non-fermenter isolates were susceptible to Imipenem, but for the other drugs, the susceptibility ranged between 30% and 90%. Razhia khatoon et al,[19] in their study have reported methicillin resistance in 43%, ESBL producing Gram negative bacilli in 51% and metallo beta lactamases production (MBL) in 14.5% respectively. The prevalence of drug resistant pathogens has consistently increased over the decades limiting the therapeutic options and complicating the clinical outcome.

CONCLUSION

Osteomyelitis is a common and debilitating infection, the treatment of which remains a significant clinical challenge. Long bone osteomyelitis is difficult to treat and is responsible for significant morbidity with forbidding treatment costs. The goal of treatment is to arrest its spread and repair the damage it has caused. The key to successful management is early diagnosis, most importantly culture and drug susceptibility test directed antibiotic therapy and operative debridement of all necrotic bone and soft tissue.

There has been an increase in the incidence of GNB in aetiology of osteomyelitis in the recent years with many reports on MDR GNB,[20] limiting the therapeutic options. Specific and early bacteriological diagnosis of orthopaedic infections is very much essential to treat the osteomyelitis patients in the initial stages to reduce complications and hence sequalae.

With meagre newer antibiotic discovery in the pipeline, in the present scenario, the most logical option in the prevention and treatment of osteomyelitis would be stringent infection control practices, in addition to strengthening the diagnostic and antimicrobial stewardship.

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