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# Sculpting Treatment Strategies: The Art of Managing Chronic Osteomyelitis with Culture and Sensitivity

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## ABSTRACT

**Background**: Chronic osteomyelitis is a common infection especially in developing country like India. This is very common in younger children and in majority of the time it is due to hematogenous spread of bacteria. Osteomyelitis is still continued as a major problem due to treatment failure and multidrug resistance. This study was conducted to determine the pus culture of chronic osteomyelitis and their susceptibility pattern to various antimicrobial drugs.
**Methods**: This is prospective study in 63 patients over a period of 8 months. Cases attending orthopaedic department with chronic osteomyelitis were subjected to pus culture and sensitivity testing.
**Results**: Incidence of osteomyelitis in male is 73.01% and female is 26.98%. Incidence of chronic osteomyelitis following trauma is 61.90%. The most common bone involved was tibia 44.44%. The most commonly isolated organism was staph aureus 55.93 % followed by coagulase negative staph 16.95% and Pseudomonas aeruginosa 11.86 %. Staph aureus showed 100% sensitivity against Vancomycin and Linezolid.
**Conclusions**: Continued surveillance for incidence of drug resistance among microorganism causing chronic osteomyelitis should be done and also antimicrobial policy should be updated based on sensitivity pattern.

**Key Words**: *Chronic osteomyelitis, Staph aureus, antibiotic policy*

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## INTRODUCTION

Osteomyelitis is primarily caused by bacteria. It can also be caused by fungal and even viral agents. It is usually common in pediatrics age group. Hematogenous osteomyelitis is most common in children.Commonly the infection is monomicrobial. Osteomyelitis from post trauma, post operative conditions and diabetic ulcer are commonly seen in elderly age group [1,2].

Chronic osteomyelitis is a relapsing and persistent infection and is characterized by low-grade inflammation, presence of dead bone (sequestrum), new bone apposition, and fistulous tracts [3]. Chronic osteomyelitis commonly involves long bones like femur and tibia [4].

Staph. aureus constitute 50%- 75% cases of chronic osteomyelitis [5]. There is emergence of Gram-negative bacilli as predominant pathogen following injury, prolonged hospital stay of patient and adjacent septic focus. The mortality, morbidity as a result of osteomyelitis is difficult to treat and the occurrence of relapse is very high even after successful treatment.

Inappropriate and excessive use of antibiotics is considered as the main cause of development of drug resistance. The use of oral antibiotics in paediatric osteomyelitis is successful. In adults the duration of treatment is more than 6 weeks given parenterally for the drug to reach adequate concentrate in the bone due to vascular insufficiency. So, to prevent morbidity and mortality due to chronic osteomyelitis prompt culture and antibiotic sensitivity report plays important role. Proper management of chronic osteomyelitis requires accurate microbial isolation and appropriate antibiotic administration [6].

Present study is carried out to determine organisms responsible for chronic osteomyelitis and their antibiotic sensitivity testing to provide guidelines for empirical antibiotic treatment.

## METHODS

Prospective study covering bacteriological profile of chronic osteomyelitis and antibiotic susceptibility pattern was conducted over a period of 8 months in a tertiary care hospital. Consent was obtained from all patients. Ethical committee clearance was obtained before the start of the study. A total of 63 patients out of which 46 were males and 17 females who were diagnosed clinically and radiologically as chronic osteomyelitis were included in the study.

All the cases of chronic osteomyelitis with clinical features were included in study. Cases of acute osteomyelitis, tuberculous osteomyelitis and osteomyelitis due to anaerobic organisms were excluded from the study.Pus, sinus discharge or exudate were collected under all aseptic conditions in the orthopaedic ward or in orthopaedic OT were sent to microbiological laboratory. Two Pus samples were collected from depth of the wound under strict aseptic conditions. Direct smear examination was done. In the laboratory, sample was plated on Nutrient Agar, Mac Conkey Agar, Blood Agar for bacterial isolation [7, 8]. The plates were incubated overnight at $37^0$C. The bacteria were identified with standard biochemical tests. Antibiotic sensitivity testing was done by Kirby Bauer disc diffusion methods [9].Staph. aureus, CONS and Enterococci were also tested for sensitivity against Vancomycin and Linezolid.

## RESULTS

**Table 1: Age and sex distribution (n= 63)**

| Sr. No. | Age groups | Male | Female |
|---|---|---|---|
| 1. | 1-15 years | 3 | 3 |
| 2. | 16-30 years | 15 | 2 |
| 3. | 31-45 years | 18 | 7 |
| 4. | 46-60 years | 10 | 5 |
| Total | | 46(73.01%) | 17(26.98%) |

Incidence of osteomyelitis in male is 73.01% and female is 26.98% and male to female ratio is 2.7:1.

**2:Causes of chronic osteomyelitis (n= 63)**

| Causes of chronic osteomyelitis | No. of patients (%) |
|---|---|
| Trauma | 39(61.90%) |
| Postoperative osteomyelitis | 19(30.16%) |
| Hematogenous osteomyelitis | 5(7.93%) |
| Total | 63(100%) |

Predisposing factors responsible for chronic osteomyelitis were trauma, postoperative and hematogenous. Incidence of chronic osteomyelitis due to trauma is 61.90%Trauma without diabetes (30 cases) is more common than trauma with diabetes (9 cases)

**Table 3: % of bones involved in chronic osteomyelitis**

| Bones involved | No. of patients (%) |
|---|---|
| Tibia | 28(44.44%) |
| Femur | 19(30.16%) |
| Tibia +fibula | 3(4.76%) |
| Femur +tibia | 4(6.34%) |
| Radius+ ulna | 5(7.93%) |
| Humerus | 3(4.76%) |
| Acetabulum | 1(1.59%) |
| Total | 63(100%) |

The most common bone involved was tibia 44.44% followed by femur 30.16%.

**Table 4: Percentile of bacterial isolates (No. of isolates = 59)**

| Bacterial isolates | Percentage (%) |
|---|---|
| **Gram- positive bacteria** | **44(74.58%)** |
| Staphylococcus aureus | 33 (55.93%) |
| Coagulase negative staphylococci | 10(16.95%) |

| | |
|---|---|
| Enterococci | 1(1.7%) |
| **Gram- negative bacteria** | **15(25.42%)** |
| Pseudomonas aeruginosa | 7(11.86%) |
| Klebsiellaaerogenes | 3(5.08%) |
| Escherichia coli | 3(5.08%) |
| Proteus species | 2(3.39%) |
| Total | 59(100%) |

In a total of 63 swab culture, 59 (93.65%) organisms were isolated. Analysis of isolated organisms showed preponderance of Gram-positive cocci. The most commonly isolated organism was staph aureus 55.93 % followed by coagulase negative staph 16.95% and Pseudomonas aeruginosa 11.86 %

**Table 5: Antibiogram of bacterial isolates in osteomyelitis (in %)**

| Isolates | E | AMP | AMC | GEN | AMK | CIP | CTX | CFX | IPM | CAZ-C | CPX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Staph.aureus | 75 | 74 | 80 | 65 | 98 | 85 | 78 | 72 | 50 | 50 | 100 |
| CONS | 60 | 82 | 60 | 60 | 80 | 50 | 80 | 74 | 50 | 40 | 60 |
| Enterococci | 100 | 100 | 100 | 100 | - | - | 100 | - | - | - | 100 |
| Pseudomonas aeruginosa | - | -- | - | 80 | 100 | 90 | 81 | 90 | 100 | 100 | 80 |
| Klebsiella | - | 83 | 60 | 100 | 50 | 70 | 76 | 70 | 40 | 80 | 60 |
| E. coli | - | 82 | 65 | 80 | 65 | 65 | 80 | 75 | 50 | 80 | 60 |
| Proteus | - | 60 | 50 | 100 | 60 | 80 | 70 | 60 | 65 | 90 | 60 |

[E-Erythromycin, AMP-Ampicillin, AMC- Amoxicillin Clavulanic acid, GEN- Gentamicin
AMK- Amikacin, CIP- Ciprofloxacin, CTX- Ceftriaxone, CFX- Cefuroxime,
IMP- Imipenem, CAZC- Ceftazidime clavulanic acid, CPX- Cephalexin]

**Table 6: Antibiogram of Gram-positive cocci (Linezolid, Vancomycin)**

| Organism/ drug | Staph. aureus | CONS | Enterococci |
|---|---|---|---|
| Vancomycin | 100 | 50 | 100 |
| Linezolid | 100 | 100 | - |

Staph aureus and Enterococci were 100% sensitivity against Vancomycin.

## DISCUSSION

Microorganisms play dominant role in development of osteomyelitis. Host factors responsible for chronic osteomyelitis are destruction of cartilage, resorption of bone. In this study occurrence of hematogenous osteomyelitis was only 7.93%. Most common pathogen in hematogenous osteomyelitis is staph aureus. It coincides with finding of Lipsky et al. [10]

In this study incidence of osteomyelitis in male is 73.01% and females 26.98%. Male female ratio is 2.7:1 whereas it is 1.9:1 according to study done by Mousa H et al. [11].

In present study, the predominantly affected age group was between 31-45 years followed by 16-30years. Similar finding were shown by Padminietal[12].

In this study occurrence of staph aureus is 55.93% and coagulase negative staph is 16.95%. These organisms express proteins called adhesin that facilitate their attachment to the bone and are usually incorporated into a relatively impermeable glycocalyx biofilm, a slime layer, which shields the bacteria from antimicrobial agents. The organisms are internalized by the osteoblasts and survive intracellularly (sometimes in a metabolically altered state in which they appear as so-called small colony variants) resulting in persistence of bone infections [13].

This study correlate with study of Maderetalwhere Staph aureus and Coagulase negative staph is 75% followed by aerobic Gram-negative bacilli and anaerobes [14]. Various other studies by Rao etal and Zuluaga et al also reported Staph aureus as major isolate [15, 16& 17].

In another study done bySaurabh Agrawal et al, Staph aureus is the most common organism followed by Streptococcus, Pseudomonas, Proteus, E. coli and Klebsiella [18]. EspersenF Observed 43% Staph aureus and Sheehy SH (2010) et al observed 32% of Staph aureus [19,20] whereas MitaWadekar et al observed Staph aureus in 43% followed by Pseudomonas 10%, Proteus 6%, Klebsiella 5%, E. coli 5%, Staph. epidermidis 4%, Enterobacter 3% and Enterococci 2% [15].

In our study Coagulase negative Staph is second commonest pathogen with 16.95% occurrence. Similar finding was observed by A. K.AKO-Nai, I C Ikem, A. Aziba et al[21],similarly in this study occurrence of Enterococci is 1.7%. This study correlates with the study of Kaur et al [5].

In our study occurrence of gram negative bacilli is Pseudomonas 11.86%, E. coli 5.08%, Klebsiella 5.08%, Proteus 3.39%. These findings are similar to Mita D Wadekar et al [15].

Whereas Haider Abdul Lateef Mousa et al found Pseudomonas 25%, Proteus 12.9% [11].In our study 4 out of 63 cases didn't show any growth. It may be due to anaerobic organisms.

In this study bacterial pathogen responsible for infection were monomicrobial which is in accordance with Zuluaga et al. [3].

In our study Staph aureus showed 100% sensitivity to vancomycin, Linezolid and cephalexin. The sensitivity to Amikacin was 98% and Ciprofloxacin was 85%.

In present study Pseudomonas shows 100% sensitivity to Imipenem, Ceftazidime and Amikacinand the sensitivity to Gentamicin and Ciprofloxacin were 80% and 90% respectively. This is in accordance with a study by Suguneswari et al.[22]where proteus was 100% sensitive to Gentamicin and 90% sensitive to Ceftazidime.

## CONCLUSION

Chronic osteomyelitis is a chronic disease involving long bones especially femur and tibia. In this study Staph aureus is the commonest organism causing chronic osteomyelitis showing sensitivity to Cephalexin, Amikacin, Ciprofloxacin. The injudicious use of antibiotics such as cotrimoxazole,doxycycline anderythromycin has led to development of MRSA. Coagulase negative Staph, Pseudomonas are the second most important agents responsible to osteomyelitis. They are showing resistance to commonly used antibiotics. As a routine orthopaedician should ask for culture and sensitivity for chronic osteomyelitis cases.

Continued surveillance for incidence of drug resistance among microorganism causing chronic osteomyelitis should be done and also antimicrobial policy should be updated based on sensitivity pattern.

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## DECLARATIONS

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