



## Microbial Isolates from Wound Swabs: Antibiotic Resistance and Culture & Sensitivity Patterns

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### Abstract

Wound infections continue to be problematic in clinical practice where empirical treatment of infections is routine. A retrospective study was carried out where records of wound swab samples from patients with different kinds of wounds receiving treatment at the department of Surgery in a peripheral hospital in Nasik were analysed. All non-healing ulcers, burn wounds, diabetic foot ulcers, traumatic wounds, abscesses, surgical site infections were included in the study and wound swabs were obtained and culture and sensitivity tests were carried out. Out of 119 wound swabs sent for culture and sensitivity, 110 samples (92.43%) revealed significant bacterial growth indicative of wound infection whereas 9 samples (7.56%) showed no growth. Most patients from whom micro organisms grew were males (83.19%) and the age group most commonly involved was 30-40 years (28.57%). No sample grew more than one organism. *Staph aureus* was the most commonly isolated organism (66.36%). The bacterial isolates exhibited a high degree of resistance to the antibiotics tested with most isolates showing resistance from 5.56% as in Chloramphenicol to 90.90% as seen in Imipenem. High resistance levels were found with Imipenem, Ampicillin, Augmentin, Cloxacillin, Carbenicillin, Ceftriaxone, Ceftazidime. The study showed moderate resistance to Ofloxacin, Ciprofloxacin, Azithromycin and Ticoplanin. Low antibiotic resistance was seen with Chloramphenicol, Gentamycin, Amikacin, Clindamycin, Erythromycin, Levofloxacin, Linezolid, Polymyxin B, Piperacillin, Tobramycin, Vancomycin, Tetracyclin and Netilmycin.

### Introduction

Wound infections continue to be problematic in clinical practice where empirical treatment of infections is routine. Most of the wound swabs revealed significant bacterial growth indicative of wound infection. No sample grew more than one organism. *Staph aureus* was the most commonly isolated organism. The bacterial isolates exhibited a high degree of resistance to the antibiotics tested with most isolates.

### Aim

The aim of this study was to analyse wound swab samples from patients with different kinds of wounds being treated and study their culture and sensitivity reports and report the antibiotic resistance levels.

### Materials and Methods

This was a retrospective study where records of wound swab samples obtained from Sep 2016 to

Jul 2018 from patients with different kinds of wounds receiving treatment at the department of Surgery in a peripheral hospital in Nasik were analysed.

#### Exclusion and inclusion criteria

All non healing ulcers, burn wounds, diabetic foot ulcers, traumatic wounds, abscesses, surgical site infections were included in the study. Very ill patients and patients already on antibiotics were excluded.

#### Sample collection

Sample was collected by the operating / treating Surgeon in the Operating room under sterile conditions and after cleaning the wound with Normal Saline to prevent surface contamination. Commercially available cotton swabs were used and the sample was transported to the lab within

one hour of collection to prevent drying of the swabs.

#### Statistical Analysis

Differences in antibiotic resistance between wound types and between sexes and age groups were analysed.

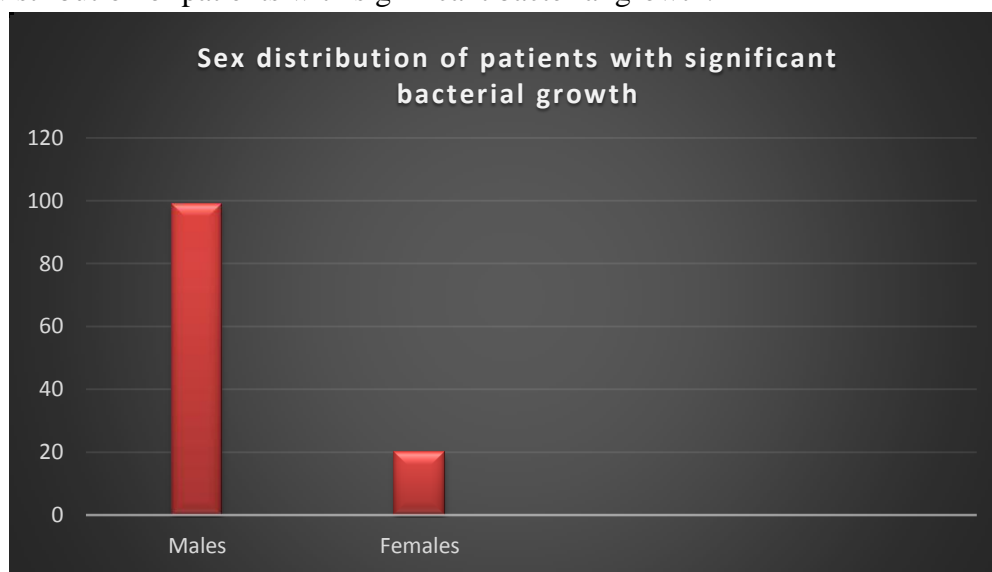
#### Results

##### Prevalence of wound infection

A total of 119 wound swabs were received by the lab of a peripheral hospital in Nasik, India sent from the operating room by department of General Surgery over a period of 2 years from Sep 2016 to Sep 2018 and were analysed.

99 patients (83.19%) were males and 20 patients (16.80%) were females from whom wound swabs were taken.

**Figure1:** Sex distribution of patients with significant bacterial growth:



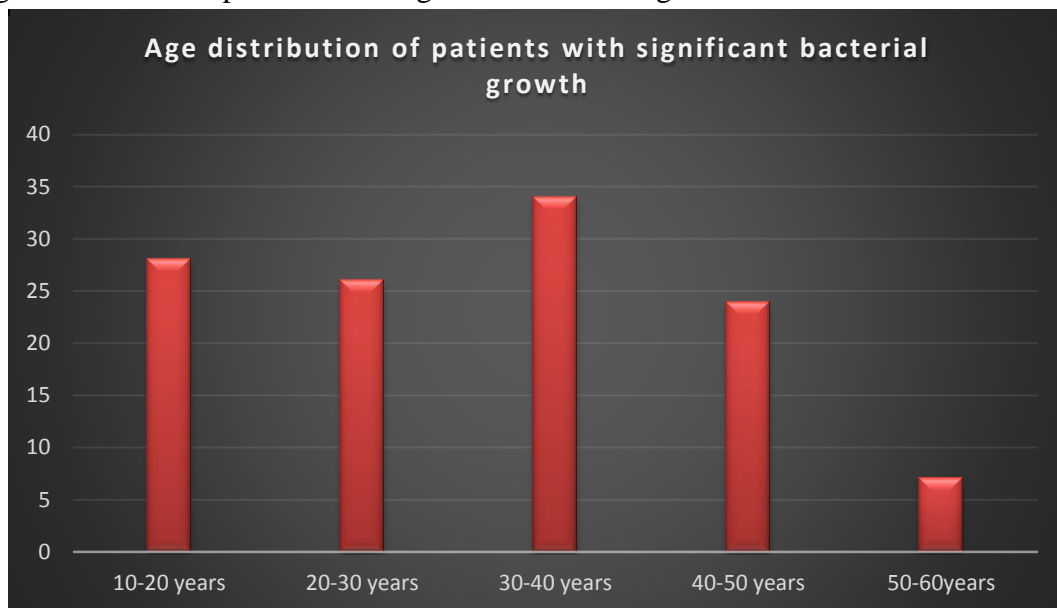
28 patients (23.52%) were in the age group of 10-20 years.

26 patients (21.84%) were in the age group of 20-30 years.

34 patients (28.57%) were in the age group of 30-40 years.

24 patients (20.16%) were in the age group of 40-50 years.

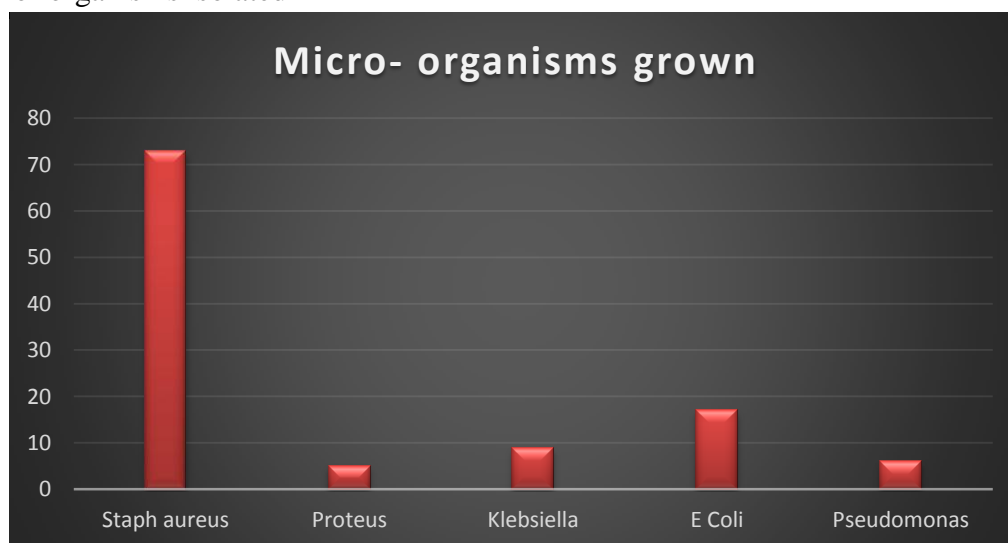
7 patients (5.88%) were in the age group of 50-60 years.

**Figure 2:** Age distribution of patients with significant bacterial growth

A total of 110 samples (92.43%) revealed significant bacterial growth indicative of wound infection whereas 9 samples (7.56%) showed no growth. No sample grew more than one organism.

#### Micro organisms isolated

73 wound swabs (66.36%) grew Staph aureus, 5 (4.54%) grew Proteus, 9 (8.18%) grew Klebsiella, 17 (15.45%) grew E Coli and 6 (5.45%) grew Pseudomonas.

**Figure 3:** Micro- organisms isolated

#### Antibiotic resistance

The bacterial isolates exhibited a high degree of resistance to the antibiotics tested with most isolates showing resistance from 5.56 % as in Chloramphenicol to 90.90% as seen in Imipenem. High resistance levels were found with Imipenem, Ampicillin, Augmentin, Cloxacillin, Carbenicillin, Ceftriaxone, Ceftazidime. The study showed

moderate resistance to Ofloxacin, Ciprofloxacin, Azithromycin and Ticoplanin. Low antibiotic resistance were seen with Chloramphenicol, Gentamycin, Amikacin, Clindamycin, Erythromycin, Levofloxacin, Linezolid, Polymyxin B, Piperacillin, Tobramycin, Vancomycin, Tetracyclin and Netilmycin.

Figure 4

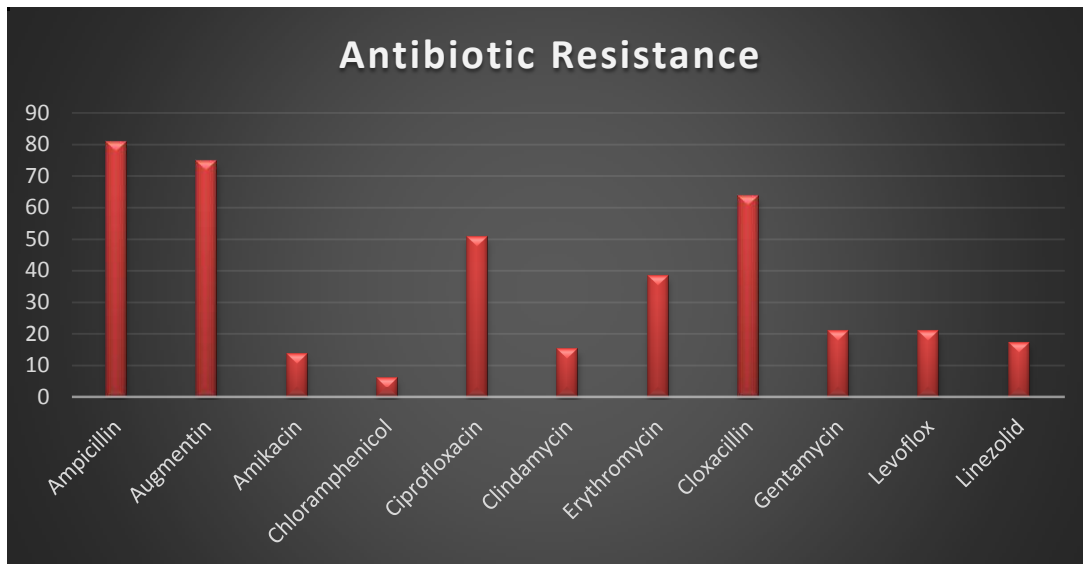
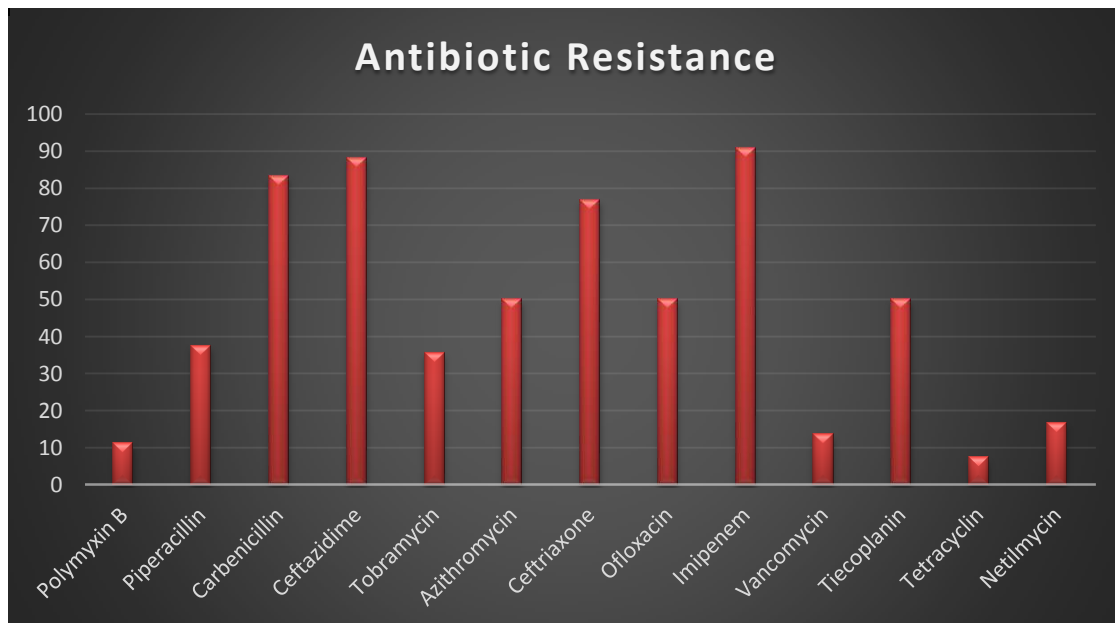


Figure 5

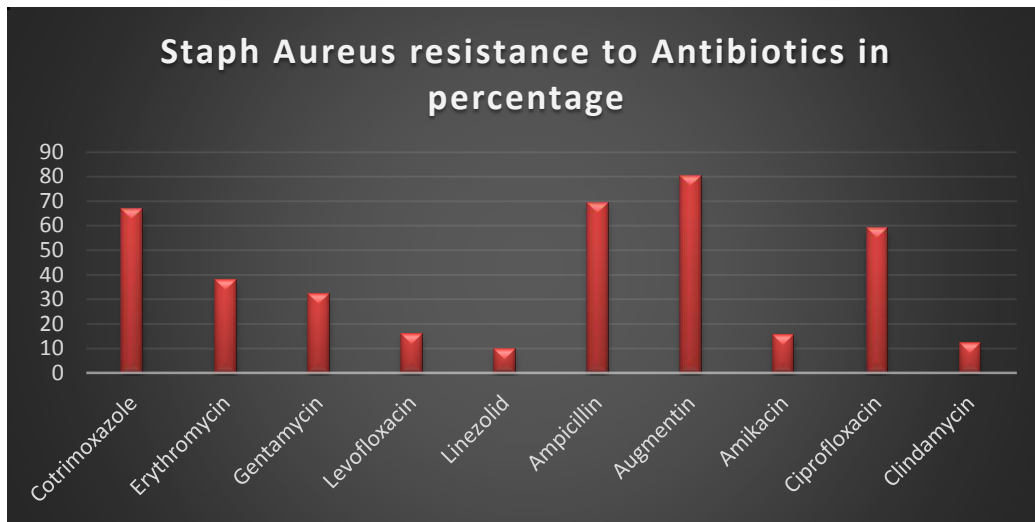


Degree of susceptibility of micro-organisms isolated to antibiotics expressed in percentage resistance:  
Staph Aureus:

Table 1:

Antibiotic	Sensitivity	Resistance
Cotrimoxazole	33.33%	66.66%
Erythromycin	62.26%	37.73%
Gentamycin	72.72%	32.14%
Levofloxacin	84.21%	15.78%
Linezolid	90.74%	9.25%
Ampicillin	30.76%	69.23%
Augmentin	19.60%	80.39%
Amikacin	84.61%	15.38%
Ciprofloxacin	41.17%	58.82%
Clindamycin	87.93%	12.06%

Figure 6

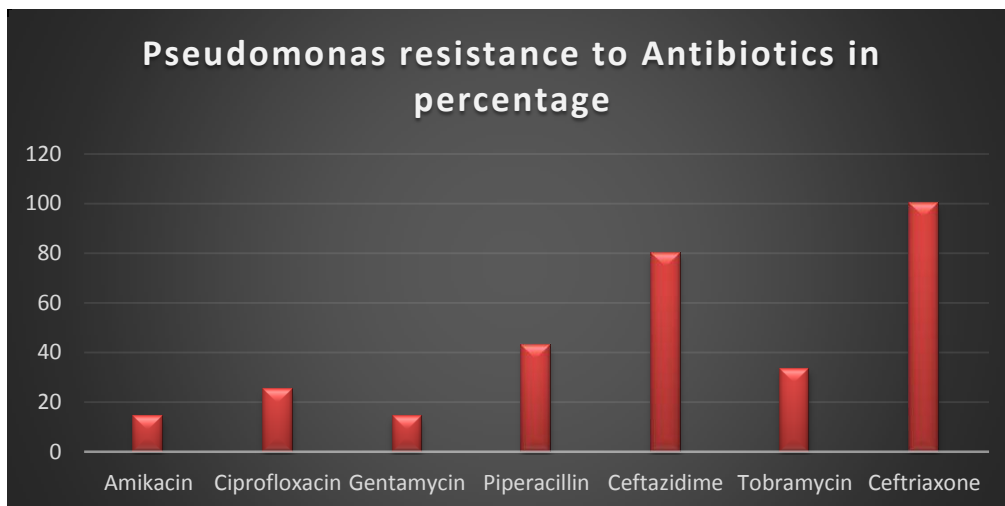


**Pseudomonas**

Table 2

Antibiotic	Sensitivity	Resistance
Amikacin	85.71%	14.28%
Ciprofloxacin	75%	25%
Gentamycin	85.71%	14.28%
Piperacillin	57.14%	42.85%
Ceftazidime	20%	80%
Tobramycin	66.66%	33.33%
Ceftriaxone	0%	100%

Figure 7

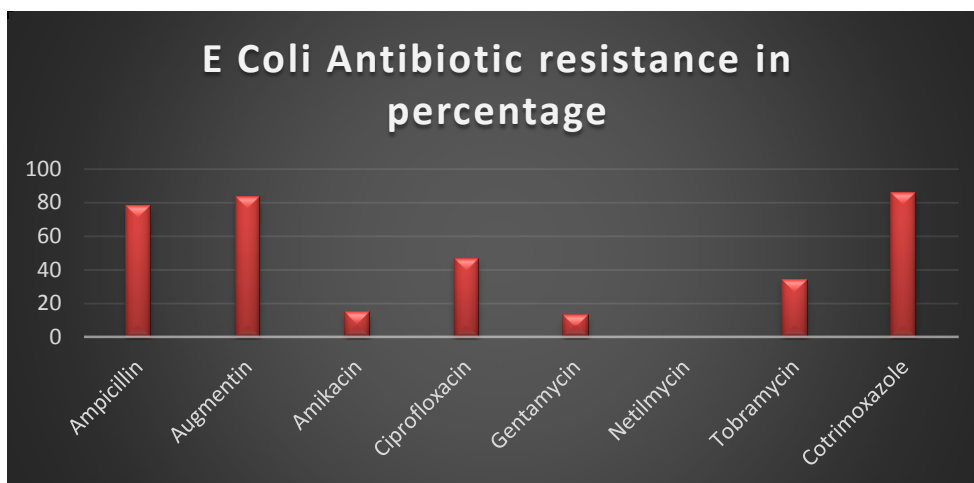


**E Coli**

Table 3

Antibiotic	Sensitivity	Resistance
Ampicillin	22.22%	77.77%
Augmentin	16.66%	83.33%
Amikacin	85.71%	14.28%
Ciprofloxacin	53.84%	46.15%
Gentamycin	87.5%	12.5%
Netilmycin	100%	0%
Tobramycin	66.66%	33.33%
Cotrimoxazole	14.28%	85.71%

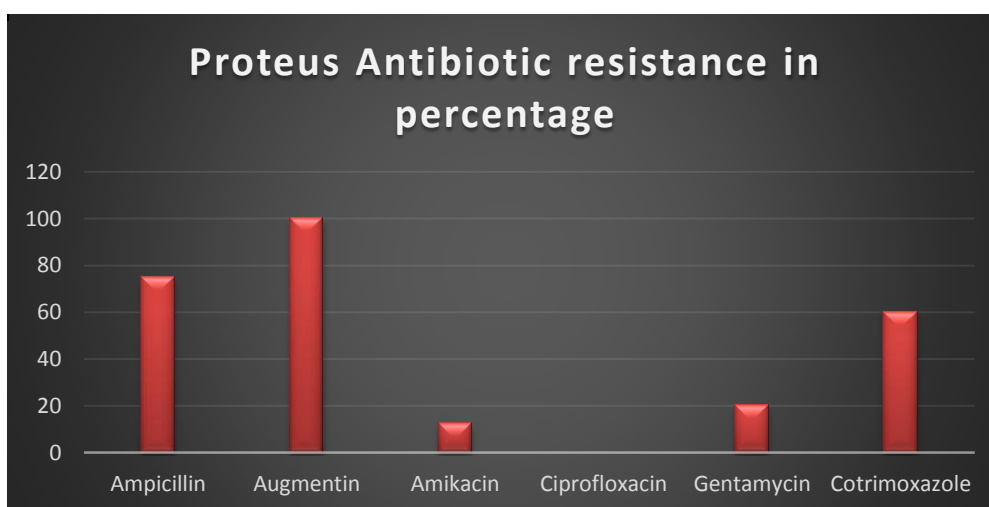
Figure 8



Proteus  
Table 4

Antibiotic	Sensitivity	Resistance
Ampicillin	25%	75%
Augmentin	0%	100%
Amikacin	87.5%	12.5%
Ciprofloxacin	100%	0%
Gentamycin	80%	20%
Cotrimoxazole	40%	60%

Figure 9



**Results**

A total of 110 samples (92.43%) revealed significant bacterial growth indicative of wound infection whereas 9 samples (7.56%) showed no growth.

99 patients (83.19%) were males and 20 patients (16.80%) were females from whom wound swabs were taken.

Most patients were in the age group of 30-40 years i.e.34 patients (28.57%) whereas the least

number of patients i.e.7 patients (5.88%) were in the age group of 50-60 years.

No sample grew more than one organism.

73 wound swabs (66.36%) grew Staph aureus, 5 (4.54%) grew Proteus, 9 ((8.18%) grew Klebsiella, 17 (15.45%) grew E Coli and 6 (5.45%) grew Pseudomonas. So to infer Staph aureus grew the most and Proteus grew the least.

The bacterial isolates exhibited a high degree of resistance to the antibiotics tested with most

isolates showing resistance from 5.56 % as in Chloramphenicol to 90.90% as seen in Imipenem. High resistance levels were found with Imipenem, Ampicillin, Augmentin, Cloxacillin, Carbenicillin, Ceftriaxone, Ceftazidime.

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Low antibiotic resistance were seen with Chloramphenicol, Gentamycin, Amikacin, Clindamycin, Erythromycin, Levofloxacin, Linezolid, Polymyxin B, Piperacillin, Tobramycin, Vancomycin, Tetracyclin and Netilmycin.

Staph aureus was found to be most sensitive to Linezolid (90.74%) and most resistant to Augmentin (80.39%).

Pseudomonas was found to be most sensitive to Amikacin (85.71%) and most resistant to Ceftriaxone (100%).

E Coli was found to be most sensitive to Netilmycin (100%) and most resistant to Cotrimoxazole (85.71%).

Proteus was found to be most sensitive to Ciprofloxacin (100%) and most resistant to Augmentin (100%).

## Discussion

Bacterial contamination of wounds is a serious problem in hospitals, specially in surgical practice where the site of a sterile operation can become contaminated and subsequently infected<sup>1</sup>.

Risk factors for increased risk of wound infection<sup>2</sup>:

- Malnutrition
- Metabolic diseases: Diabetes, Uraemia, Jaundice
- Immunosuppression: Cancer, AIDS, steroids, chemotherapy, radiotherapy
- Colonisation and translocation in GIT
- Poor perfusion ( Systemic shock, Local ischemia)
- Foreign body/ material
- Poor surgical technique (dead space, haematoma)

A wound is a breakdown in protective function of skin, the loss of continuity of epithelium with or without loss of underlying connective tissue<sup>3</sup>. Infection is believed to occur when virulence factors expressed by one or more micro-organisms in a wound out- compete the host natural immune system<sup>4</sup>. Wound infection is important because it can delay healing and can cause wound breakdown<sup>5</sup>.

If cultures are negative, empirical antibiotic therapy should usually be stopped after no more than 48-72 hours<sup>6</sup>. Unnecessary antibiotic therapy increases risk of multi drug resistance infection, so prolonged therapy with negative cultures is usually unjustifiable. The high degree of resistance may be attributed to the widespread abuse of antibiotics, practicing self medication, indiscriminate use of antibiotics as oral prophylaxis, lack of lab services and guidelines/ protocols regarding the selection of antibiotics<sup>7</sup>. Neu said "Bacteria are cleverer than men" as they have capacity to adapt in every environmental niche on the planet and now adjusting to a world laced with antibiotics<sup>11</sup>. The morbidity of antibiotic therapy includes allergic reactions, development of nosocomial super infections (fungal, enterococcal and C difficile related infections), organ toxicity, reduced yield from subsequent cultures and Vitamin K deficiency with coagulopathy or accentuation of warfarin effects<sup>6</sup>.

The high proportion of *S. aureus* as evident in this study might be because of endogenous source of infection or contamination from the environment such as contamination of surgical instruments with the disruption of natural skin barrier as these bacteria are a common bacterium on surfaces, easily finds their way into wounds<sup>8</sup>. The common bacterial pathogens responsible for wound infections are *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and bacteria belonging to family Enterobacteriaceae<sup>9</sup>. Since the emergence of methicillin-resistant *Staphylococcus aureus* (MRSA) in 1960, there have been reports of increasing rate of infection by MRSA and this



superbug has established itself as the common cause of nosocomial as well as community acquired infections<sup>10</sup>.

The increased prevalence of drug resistance mainly methicillin resistance among the strains of *S. aureus* has impelled the usage of macrolide–lincosamide–streptogramin B (MLS<sub>B</sub>) antibiotics mainly clindamycin for the treatment of the infections caused by *Staph aureus*<sup>12</sup>. Clindamycin is considered as one of the drugs of choice for treatment of the infection caused by MRSA<sup>13</sup>.

Antibacterial agents for empirical use<sup>6</sup>:

- Antipseudomonal: Piperacillin – Tazobactam, Cefipime, Ceftazidime, Imipenem-cilastatin
- Gram positive: Vancomycin, Linezolid
- Gram negative: Third generation Cephalosporin, Polymyxin B
- Anti- anaerobic: Metronidazole, Carbapenems
- Broad spectrum : Piperacillin- Tazobactam, Carbapenems, Fluoroquinolones, Tigecycline
- Anti MRSA: Linezolid, Vancomycin, Tigecycline, Minocycline

Treatment guidelines must be continuously revised as susceptibility to antibiotic drugs is constantly threatened due to an empirical approach to treatment and high self-medication of humans and animals without a medical prescription<sup>14</sup>. Enforcing a strict adherence policy in the healthcare sector to reduce the development and spread of drug-resistant bacterial strains goes hand in hand with nationwide antimicrobial surveillance. Routine clinical diagnostic laboratories can contribute to the national surveillance network by sharing routine antibiograms from clinical samples<sup>15</sup>.

### Conclusion

Severe antimicrobial resistance in wound infections was observed among patients treated for wound infections by department of Surgery in a peripheral hospital in Nasik. There is a need for serious and urgent intervention to stem the spread and further evolution of this antibiotic resistance. A rigorous infection control policy along with

rational use of antibiotics will go a long way in fighting against antibiotic resistance. Since a high proportion of samples had positive cultures, infection control is recommended as a strategy to minimise spread of resistant organisms. It is recommended that Linezolid, Amikacin, Ciprofloxacin and Netilmycin be used in preference to Ampicillin, Amoxycillin and Ceftriaxone for treatment of septic wounds. Finally, there is need to develop national surveillance of antibiotic- resistant organisms.

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