RATIONAL USE AND PRESCRIBING TRENDS OF ANTIBIOTICS AGAINST STAPHYLOCOCCUS AUREUS POSITIVE INFECTIONS

Vijay Krishna Nidadavolu*1, V. Swaroop, Mohd. Amer Ahmed, Dr. Sanjeev S.M2, Dr. N.K.Rama and Dr. Syed Imam Rabbani1

1Department of Pharmacy Practice, Krupanidhi College of Pharmacy, Bangalore-560035, India.
2Department of Paediatrics, MVJ Medical College and Research Institute, Hoskote, Bangalore-562114, India.
3Department of Microbiology, MVJ Medical College and Research Institute, Hoskote, Bangalore-562114, India.

ABSTRACT

OBJECTIVE: Staphylococcus aureus is the pathogen of great concern, because of its pattern of resistance, primary in hospitals and then spreading to the community. To evaluate the use of antibiotics against Staphylococcus aureus infections in different departments of MVJ hospital. METHOD: A prospective observational study was conducted in different departments of MVJ Medical Hospital. To evaluate the rational use of antibiotics, a total of 100 strains were selected based on the inclusion and exclusion criteria in a period of 6 months. The antibiograms were collected from microbiology department on a daily basis and then the rationality in the selection of antibiotics was determined from the patient records. RESULTS: Out of 100 strains the results have shown that Staphylococcus aureus is the 4th leading cause for infectious diseases. The data indicated that 22% of the samples tested were methicillin resistant Staph aureus. Ampicillin and Linezolid were found to be more resistant and sensitive against Staphylococcus aureus respectively. The appropriateness in selection of antibiotics was found 73% and rational use of antibiotics was found 61%. CONCLUSION: The results suggest that majority of antibiotics in the Staphylococcus aureus infection was prescribed rationally. Linezolid was found to be more sensitive among all the tested...
antibiotics. The resistance against the antibiotics could be due to the wrong selection of antibiotics, self-medication, missed dose, etc.

**KEYWORDS:** *Staphylococcus aureus*, Antibiogram, Rationality in antibiotics.

**INTRODUCTION**

*Staphylococcus aureus* is gram positive spherical bacteria that occurs in microscopic clusters resembling grapes.[1] It colonizes mainly the nasal passages, but it may be found regularly in most other anatomical locales, including the skin, oral cavity and gastrointestinal tract.[2] Hence *staphylococcus aureus* should always be considered a potential pathogen.

The mortality of patients with *Staphylococcus aureus* bacteraemia in the pre–antibiotic era exceeded 80%, and over 70% developed metastatic infections. The introduction of penicillin in the early 1940s dramatically improved the prognosis of patients with staphylococcal infection. However, as early as 1942, penicillin-resistant staphylococci were recognized, first in hospitals and subsequently in the community.[3] By the late 1960s, more than 80% of both community-acquired and hospital-acquired staphylococcal isolates were resistant to penicillin. This pattern of resistance, first emerging in hospitals and then spreading to the community, is now a well-established pattern that recurs with each new wave of antimicrobial resistance.[4]

*Staphylococcus aureus* is perhaps the pathogen of greatest concern because of its intrinsic virulence, its ability to cause a diverse array of life-threatening infections, and its capacity to adapt to different environmental conditions.[5] The mortality of *Staphylococcus aureus* bacteraemia remains approximately 20–40% despite the availability of effective antimicrobials.[6] *Staphylococcus aureus* is now the leading overall cause of nosocomial infections and, as more patients are treated outside the hospital setting, is an increasing concern in the community.[7]

Culture sensitivity testing determines the sensitivity of the micro-organism to a specific antibiotic. This test is routinely done to decide the therapy for definite infection. However, injudicious use of antibiotics against infectious diseases have increased the chances of pathogens acquiring the resistance towards an antibiotic. Hence in this study we evaluated the rationale for selecting the antibiotics against
different types of infections caused by *staphylococcus aureus* in various departments of a tertiary care hospital.

**METHODOLOGY**

**Study site:** The study was conducted in MVJ Medical College Hospital & Research Centre, Bangalore. It is 900 bedded multi-specialty tertiary care teaching hospital. **Study design:** The study was a prospective observational study conducted in various departments like General Medicine, OBG, Paediatrics, Orthopaedics, Surgery, Psychiatry, ENT, Dermatology, and Microbiology. **Study duration:** The study was conducted for a period of six months from January 2014 to July 2014.

**Study criteria**

**Inclusion Criteria**
- Written Informed consent from the patient.
- Patients suffering from infection due to *staphylococcus aureus* strains.
- Inpatients of either sex or patients aged 18 years and above were included.

**Exclusion Criteria:**
- Out patients are excluded from our study
- Patients with worsened disease conditions and end organ damages,
- Pregnant and lactating women
- Patients having mental incapability.

**Source of data:** The patient demographical data, clinical data, therapeutic data and various other relevant and necessary data collected from:
- Medical records of inpatients.
- Personal interview of patients to determine the chief complaint, history of the present illness, past medical and medication history.
- Culture and sensitivity report.
- Patient’s prescriptions for analyzing prescription pattern.

**Study procedure:** All the patients who are admitted to the various department were reviewed daily to identify the patients suffering from infection due to *staphylococcus aureus* strains. The patients who met the study criteria were enrolled in the study. Ethical clearance from Institutional Ethical Committee, by MVJ medical College and Research institute, Bangalore were obtained prior to the study. A suitable data collection form designed to collect all the
relevant and necessary data. The demographic details of the patient such as name, age, sex, IP number; clinical data such as diagnosis, clinical condition; therapeutic data such as name of the drug, duration of therapy and Culture and sensitivity report were collected by reviewing the case notes, treatment charts and lab data reports from microbiology.

**Data analysis:** All statistical analyses were performed using excel spread sheet. Statistical significance was defined as p value less than 0.05 (p <0.05)

**RESULTS**

Out of 100 staphylococcus aureus infected patients, males were 57% and females were 43%. Male were found more when compared to females. More number of infected age distribution patients were found at the age of less than 10 years (21%) followed 11 - 20 years (7%), 21 - 30 years (12%), 31 - 40 years (11%), 41 - 50 years (10%), 51 - 60 years (19%) and 60 yrs (20%) respectively.

Department wise staphylococcus aureus infected patients were found as general medicine: male (26%) and female (16%), Paediatric: male (17%) and female (8%), Dermatology: male (10%) and female (5%), Orthopaedics: male (5%) and female (4%), OBG: male (0%) and female (5%), others: male (3%) and female (1%) respectively showed in **Table 1**.

Comparing staphylococcus aureus to other organisms were found 13% showed in **Fig 1.** Number of MSSA were found 78% and MRSA found 22%.

**Staphylococcus aureus sensitivity and resistant to various antibiotics**

In total 100 strains, number of drugs found resistant and sensitive to *staphylococcus aureus* are Ampicillin – 69 and 17, Erythromycin – 36 and 32, Cotrimoxazole – 26 and 45, Cefoxitin – 22 and 57, Vancomycin – 19 and 53, Teicoplanin – 17 and 49, Linezolid – 5 and 74, Clindamycin – 4 and 59, Nitrofurantoin 4 and 3, Ceftriaxone – 3 and 6, Ciprofloxacin 3 and 5, Amikacin – 2 and 3, Cefotaxime – 1 and 6, Gentamycin – 1 and 5, Ofloxacin – 1 and 5, Nalidixic acid – 1 and 3, Chloramphenicol – 1 and 4, Piperacillin + Tazobactum – 1 and 2, Cefazidine – 1 and 3, Cloxacillin – 1 and 0, Norfloxacin – 1 and 0, Cefipime 0 and 2, Cefuroxime – 0 and 1, Cefodoxime – 0 and 1, Imipenim 0 and 1, Meropenem – 0 and 1, Tetracycline – 0 and 1, Cefephalxin – 0 and 1.

Prescription pattern of antibiotics were showed in **Table 2.** Number of antibiotics prescribed to the individuals with *staphylococcus aureus* infections are as follows – No antibiotics
were prescribed to 14 patients, 42 patients were treated with single antibiotic, 24 patients were treated with two antibiotics, 16 patients were treated with three antibiotics, 4 patients were treated with 4 antibiotics.

The total percentage of appropriateness and inappropriateness in selection of antibiotics was found 73% and 27% respectively. Rational and irrational use of antibiotics were found 61% and 39% respectively.

The possible cause for irrational use of antibiotics in 39 patients with MRSA and MSSA were found with OTC drugs: 11 and 10, missed dose: 7 and 2, wrong drug: 4 and 2, wrong dose: 0 and 0, others: 0 and 3.

The possible cause for development of resistance in MRSA patients were found OTC drugs – 50%, missed dose – 31.8%, wrong drug – 18.2%, wrong dose – 0%, others - 0%.

(Just to remind you that previously it was 13 reference and now 12 as one article was repeated u can see in your old manuscript ie. Mylotee in ref 5 and 7 now corrected)

Table 1: Percentage of patient distribution based on different departments in hospital

<table>
<thead>
<tr>
<th>Total Number of Patients n=100</th>
<th>Male%</th>
<th>Female%</th>
<th>Total%</th>
</tr>
</thead>
<tbody>
<tr>
<td>General medicine</td>
<td>26%</td>
<td>16%</td>
<td>42%</td>
</tr>
<tr>
<td>Paediatrics</td>
<td>17%</td>
<td>8%</td>
<td>25%</td>
</tr>
<tr>
<td>Dermatology</td>
<td>10%</td>
<td>5%</td>
<td>15%</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>5%</td>
<td>4%</td>
<td>9%</td>
</tr>
<tr>
<td>OBG</td>
<td>-</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Others</td>
<td>3%</td>
<td>1%</td>
<td>4%</td>
</tr>
</tbody>
</table>

![Number of organisms](image)

Figure 1: Comparison of staphylococcus aureus with other organisms
Table 2: Prescription pattern of antibiotics

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEFTRIAXONE</td>
<td>18%</td>
</tr>
<tr>
<td>CEFOTAXIME</td>
<td>11%</td>
</tr>
<tr>
<td>AMOXICILLIN + CLAVULUNIC ACID</td>
<td>10%</td>
</tr>
<tr>
<td>PIPERACILLIN + TAZOBACTUM</td>
<td>8%</td>
</tr>
<tr>
<td>CIPROFLOXACIN</td>
<td>7%</td>
</tr>
<tr>
<td>AMPICILLIN + CLOxacillin</td>
<td>6%</td>
</tr>
<tr>
<td>AMIKACIN</td>
<td>6%</td>
</tr>
<tr>
<td>LINEZOLID</td>
<td>6%</td>
</tr>
<tr>
<td>LEVOFLOXACIN</td>
<td>5%</td>
</tr>
<tr>
<td>GENTAMICIN</td>
<td>4%</td>
</tr>
<tr>
<td>VANCOMYCIN</td>
<td>3%</td>
</tr>
<tr>
<td>COTRIMOXAZOLE</td>
<td>3%</td>
</tr>
<tr>
<td>TETRACYCLINE</td>
<td>3%</td>
</tr>
<tr>
<td>CEFEXIME</td>
<td>3%</td>
</tr>
<tr>
<td>ERYTHROMYCIN</td>
<td>2%</td>
</tr>
<tr>
<td>AZITHROMYCIN</td>
<td>2%</td>
</tr>
<tr>
<td>NITROFURANTOIN</td>
<td>2%</td>
</tr>
<tr>
<td>CEFOPERAZONE</td>
<td>1%</td>
</tr>
</tbody>
</table>

DISCUSSION

*Staphylococcus aureus* causes a variety of supportive (pus forming) infections and toxinoses in humans.[8] It causes superficial skin lesions such as boils, styes and furuncules[9]; more serious infections such as pneumonia, mastitis, phlebitis, meningitis and urinary tract infections; and deep seated infections, such as osteomyelitis and endocarditis. *Staphylococcus aureus* is a major cause of hospital acquired (nosocomial) infection of surgical wounds and infections associated with indwelling medical devices. *Staphylococcus aureus* causes food poisoning by releasing enterotoxins into food, and toxic shock syndrome[8] by release of super antigens into the blood stream.

*Staphylococcus aureus* is the 4th leading cause for bacterial infections and Prescription pattern of antibiotics is rational against *staphylococcus aureus* infection but there are also instances where selection of antibiotic was inappropriate. Clinical pharmacist can play an important role in monitoring the rational use of antibiotics and gives their input in the preparation of guidelines for appropriate use of antibiotics.

Staphylococcus aureus infected patients, males were 57% and females were 43%. Male patients are more susceptible to *staphylococcus aureus* organism when compared to females. The age distribution shows that children and elderly are more at risk than
adults indicating that these group of patients needs careful monitoring since the chances of neglecting medical adherence is more in them. Krziwanek K et al showed similar results that males are more susceptible compared to females.40

Patients in General medicine are more susceptible when compared to other departments. This is because the general medicine have the greater number of patients with various infectious disease when compared to other departments. The pattern of resistance shown by *staphylococcus aureus* suggests that the organism is more resistant to ampicillin compared to other antibiotics. The results suggests that if antibiotic is improperly and inadequately used then the chances of resistance enhances as ampicillin.9 Further, *staphylococcus aureus* has shown greater sensitivity to linezolid followed by clindamycin, cefoxitin, vancomycin, teicoplanin, erythromycin respectively. These agents are extensively used worldwide in the treatment of different infections.10 The prescribing pattern of antibiotics based on the culture-sensitive test shows highest selection with ceftriaxone, selection depends on the sensitivity of that particular antibiotic and the right choice of drug to the right patient.

The patient treated with number of antibiotics shows that 42 patients were treated with single antibiotic, 24 patients were treated with two antibiotics, 16 patients were treated with three antibiotics and 4 patients were treated with 4 antibiotics. Tomasz A, et al reported that the antibiotics exhibiting multiple mechanisms are selected for combination therapy. This is done to increase the lethality of the antimicrobial therapy as more number of pathogenic strains are showing resistance towards single antibiotic.11

The appropriateness of drug selection was done comparing the resistant and sensitivity report with choice of drug administered to the patient. Whereas, the total percentage of rational and irrational use of antibiotics was found 61% and 39% respectively. The possible cause for irrational use of antibiotics in patients with MRSA and MSSA were found more with OTC drugs and the percentage of development of resistance in MRSA patients was found greater with OTC drugs followed by missed dose and wrong drug.12, 13
CONCLUSION

*Staphylococcus aureus* was found to be the fourth leading cause for infections. The most commonly prescribed antibiotic in the *staphylococcus aureus* infections was found to be ceftriaxone and in multiple-drug combination amoxicillin + clavulunic acid were frequently selected, although the bacteria have shown more sensitivity towards linezolide. The 39% irrationality and 27% inappropriateness in the selection of antibiotics could become one of the reasons for the development of resistance. Hence the prescription of antibiotics should be carefully selected as per the guidelines so as to preserve its lethality against the disease causing pathogens.

REFERENCES
