



## Prevalence of Methicillin Resistant *Staphylococcus aureus* in Clinical Samples of Teerthankar Mahaveer Medical College Hospital and Research Centre (TMMCH & RC), Moradabad (UP), India

Bina Pani Gupta<sup>1\*</sup>, and Shruti Sinha<sup>2</sup>

<sup>1</sup> Department of Microbiology, Teerthankar Mahaveer University (TMU), Moradabad, Uttar Pradesh, India

<sup>2</sup> Teerthankar Mahaveer University (TMU), Moradabad, Uttar Pradesh, India

\*Corresponding e-mail: [binapani.gupta@gmail.com](mailto:binapani.gupta@gmail.com)

### ABSTRACT

*Staphylococcus aureus* is the emerging and prevalent pathogen causing serious infections in community and hospital associated diseases. *S. aureus* resistant to methicillin is nowadays a big and expanding problem of concern in India. Amongst the different pathogens, *S. aureus* is being studied for prevalence of infections and drug resistance behavior. The present study describes the dominance of *Staphylococcus aureus* prevalence in the clinical samples of TMU, Moradabad, India. The study showed the isolation of 450 cultures of *S. aureus* from different samples. Amongst which, 234 isolates of *S. aureus* were from pus, 164 isolates were from blood, 15 isolates were from respiratory fluid samples, 33 isolates were from urine samples and 04 isolates were from ear swabs and nasal swabs. These strains of *S. aureus* were screened for characteristic coagulase assay. The strains were found to be coagulase positive and coagulase negative both. It was observed that, amongst, 450 isolates of Staphylococci, 185 (41.11%) strains were coagulase positive and 265 (58.88%) were coagulase negative. A total of 142 (76.75%) of the coagulase positive staphylococci strains shows resistance to methicillin and 202 (76.22%) coagulase negative strains showed methicillin resistance. Methicillin resistance was consistent when tested with other antibiotics in coagulase positive strains but when studied about coagulase negative strains, about 12.5% strains showed sensitivity with other antibiotics although they were found resistant when checked with methicillin. It was determined that, on an average, 85 (18.88%) Staphylococci strains were resistant.

**Keywords:** *S. aureus*, coagulase positive, coagulase negative, hospital mediated infections, methicillin resistance, microbial resistance

### INTRODUCTION

*Staphylococcus aureus* continues to be a dangerous pathogen for both community-acquired as well as hospital-associated infections. After introduction in 1960, *S. aureus* was found to be methicillin resistant [1]. Methicillin resistant *Staphylococcus aureus* causes sepsis, endocarditis, and osteomyelitis [2]. MRSA is the most prevalent nosocomial pathogen causing diseases [3]. The [4] MRSA emergence occurs due to prolonged hospital stay, indiscriminate use of antibiotics, lack of awareness, receipt of antibiotics before coming to the hospital etc. are predisposing factors [5]. Hospital acquired infections are mostly due to MRSA [6]. MSSA isolates showed higher susceptibility to gentamicin, co-trimoxazole, erythromycin and clindamycin in comparison to MRSA isolates [7]. Different strains of MRSA exhibit resistance to both-lactams and amino glycosides [8].

### MATERIALS AND METHODS

#### Media and antibiotics

The media was procured from Hi-Media, Mumbai, India and the antibiotics viz. Penicillin (PG/10 mcg), Amoxicillin (AX/10 mcg), Amoxicillin + Clavulanic acid (AC/10 mcg), Co-trimoxazole (CT/25 mcg), Cephalexin (CP/25 mcg), Cefazolin (CF/30 mcg), Cefuroxime (CR/30 mcg), Erythromycin (ER/15 mcg), Chloramphenicol (CK/30 mcg), Iprofloxacin (CI/5 mcg), Ofloxacin (OF/5 mcg), Piperacillin (PC/100 mcg), Azithromycin (AZ/15 mcg), Tetracycline

(TE/30 mcg), Methicillin (ME/1 mcg), Methicillin (ME/5 mcg) were procured from Sigma-Aldrich, Bangalore. The glassware used were from Borosil, India.

### Study design

The present study was carried for ten months (October 2015 to July 2016). Different clinical specimens who were interpreted for *S. aureus* positive were collected from Microbiology laboratory of Teerthanker Mahaveer Medical College Hospital and Research Centre (TMMCH&RC), Moradabad, Uttar Pradesh, India. The samples were screened for *S. aureus* on phenol red mannitol salt agar in sterilized petri plates by streaking. The culture plates were incubated at 37°C for 24-48 hours in incubator.

### Isolation and identification of *Staphylococcus aureus*

Yellow colored colony was selected as positive isolate and further screened for gram staining. The isolates which showed gram positive cocci colonies were further screened for catalase and coagulase tests.

### Screen test for MRSA

The swab of culture (0.5 Mac Farland) was streaked on Mueller-Hinton agar supplemented with 4% NaCl and 6 mcg/ml Methicillin were further subjected for incubation overnight at 37°C.

### Sensitivity to other antibiotics

The sensitivity to other conventional antibiotics was studied by Kirby Bauer Disc diffusion techniques as per CLSI (Clinical Laboratory Standards) guidelines. Different antibiotics were tested for antimicrobial activity viz. Penicillin (PG/10 mcg), Amoxicillin (AX/10 mcg), Amoxicillin + Clavulanic acid (AC/10 mcg), Co-trimoxazole (CT/25 mcg), Cephalexin (CP/25 mcg), Cefazolin (CF/30 mcg), Cefuroxime (CR/30mcg), Erythromycin (ER/15 mcg), Chloramphenicol (CK/30 mcg), Iprofloxacin (CI/5 mcg), Ofloxacin (OF/5 mcg), Piperacillin (PC/100 mcg), Azithromycin (AZ/15 mcg), Tetracycline (TE/30 mcg) and Methicillin (ME/5 mcg).

### Statistical analysis

The statistical analysis was performed by Chi-square test to compare antimicrobial susceptibility data.

## RESULTS AND DISCUSSION

The results showed the isolation of 450 cultures of *S. aureus* from different samples. Amongst which, 234 isolates of *S. aureus* were from pus, 164 isolates were from blood, 15 isolates were from respiratory fluid samples, 33 isolates were from urine samples and 04 isolates were from ear swabs and nasal swabs. The results are shown in Table 1. Out of 450 isolates of *Staphylococci* 185 (41.11%) strains were coagulase positive and 265 (58.88%) were coagulase negative. A total of 142 (76.75%) of the coagulase positive *Staphylococci* strains shows resistance to methicillin and 202 (76.22%) coagulase negative strains showed methicillin resistance. Methicillin resistance was consistent when tested with other antibiotics in coagulase positive strains but 12.5% of coagulase negative strains showed sensitivity with other antibiotics discs though they were labelled as resistant with methicillin discs. 85 (18.88%) *Staphylococci* strains were resistant to all the antibiotics tested and 21 (4.66%) were resistant to all other antibiotics except methicillin. The results are shown in Table 2 and Figure 1. The level of significance was found to be higher in methicillin resistant strains in comparison to methicillin sensitive strains (p values).

Table 1 Isolation of *Staphylococcus aureus* in different clinical samples

S. No.	Clinical samples	No. of <i>S. aureus</i> isolates
1	Pus	234
2	Blood	164
3	Respiratory samples	15
4	Urine	33
5	Others (ear swabs, nasal swabs etc.)	4
	Total samples	450

Table 2 Antibiotic sensitivity pattern of isolated *S. aureus* against different antibiotics

S. No.	Types of <i>S. aureus</i>	Resistant	p-value
(A)	Coagulase positive <i>S. aureus</i>	142	<0.005

(B)	Coagulase negative <i>S. aureus</i>	202	<0.005
S. No.	Antibiotics	Resistant	p-value
1	Penicillin	26	-
2	Amoxicillin	28	<0.005
3	Amoxicillin + Clavulanic acid	45	<0.005
4	Co-trimoxazole	32	<0.005
5	Cephalexin	25	<0.005
6	Cefazolin	22	<0.005
7	Cefuroxime	45	<0.005
8	Erythromycin	43	<0.005
9	Chloramphenicol	24	<0.005
10	Iprofloxacin	25	<0.005
11	Ofloxacin	27	<0.005
12	Piperacillin	24	<0.005
13	Azithromycin	29	<0.005
14	Tetracycline	34	<0.005
15	Methicillin	21	<0.0001

Nowadays, different cases of MRSA are widespread throughout the world [9,10]. Different cases of MRSA in Eastern U.P. and AIIMS in New Delhi are 54.85% and 44% prevalent respectively [11,12]. The results in context with the present study showed the prevalence rate of MRSA viz. 16.27% in Moradabad district (U.P). It is found that, 30% of healthy people are affected with the mild symptoms of drug resistant TB [13,14].

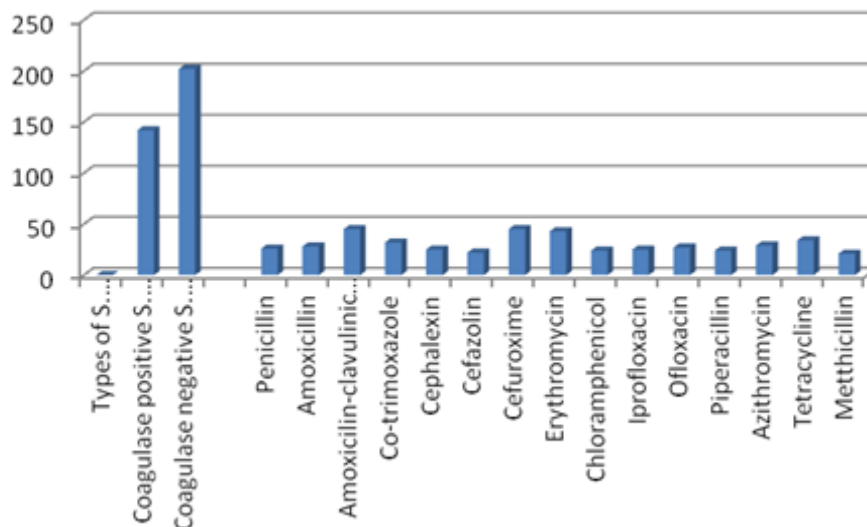


Figure 1 Antibiotic sensitivity pattern of isolated *S. aureus* against different antibiotics

### CONCLUSION

It was found that the antibiotic resistance of *S. aureus* in today's times is an emerging problem. The present study shows the resistance variability of *S. aureus* against different antibiotics.

### REFERENCES

- [1] Jevons, M. Patricia. "Celbenin-resistant staphylococci." *British medical journal* 1.5219 (1961): 124.
- [2] Ray, Pallab, et al. "Methicillin resistant *Staphylococcus aureus* (MRSA) in India: Prevalence and susceptibility pattern." *The Indian journal of medical research* 137.2 (2013): 363.
- [3] Gopalakrishnan, Ram, and Dorairajan Suresh Kumar. "Changing trends in antimicrobial susceptibility and hospital acquired infections over an 8-year period in a tertiary care hospital in relation to introduction of an infection control programme." *J Assoc Physicians India* 58.Suppl (2010): 25-31.
- [4] Wattal, Chand, et al. "Surveillance of multidrug resistant organisms in tertiary care hospital in Delhi, India." *J Assoc Physicians India* 58.Suppl (2010): 32-36.

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- [5] Varghese, George K., et al. "Bacterial organisms and antimicrobial resistance patterns." *J Assoc Physicians India* 58.Suppl (2010): 23-24.
- [6] Arora, Shilpa, et al. "Prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) in a tertiary care hospital in Northern India." *Journal of laboratory physicians* 2.2 (2010): 78.
- [7] Liu, Catherine, et al. "Clinical practice guidelines by the infectious diseases society of America for the treatment of methicillin-resistant *Staphylococcus aureus* infections in adults and children." *Clinical infectious diseases* (2011): ciq146.
- [8] Maple, P. A. C., Hamilton-Miller, J. M. T., and Brumfitt, W. "World-wide antibiotic resistance in methicillin-resistant *Staphylococcus aureus*." *The Lancet* 333.8637 (1989): 537-540.
- [9] Doebbeling, B. N. "The epidemiology of methicillin-resistant *Staphylococcus aureus* colonization and infection." *Journal of chemotherapy (Florence, Italy)* 7 (1995): 99-103.
- [10] Thorasberry, Clyde. "The development of antimicrobial resistance in staphylococci." *Journal of Antimicrobial Chemotherapy* 21. suppl C (1988): 9-16.
- [11] Anupurba, S., et al. "Prevalence of methicillin resistant *Staphylococcus aureus* in a tertiary referral hospital in eastern Uttar Pradesh." *Indian journal of medical microbiology* 21.1 (2003): 49.
- [12] Udaya Shankar, C., et al. "Prevalence of methicillin resistant *Staphylococcus aureus* in JIPMER hospital-a preliminary report." *Indian Journal of Medical Microbiology* 15 (1997): 137-138.
- [13] Mehta, A. P., et al. "Control of methicillin resistant *Staphylococcus aureus* in a tertiary care centre: A five-year study." *Indian Journal of Medical Microbiology* 16.1 (1998): 31.
- [14] Vidhani, S., Mehndiratta, P. L., and Mathur, M. D. "Study of methicillin resistant *S. aureus* (MRSA) isolates from high risk patients." *Indian journal of medical microbiology* 19.2 (2001): 13.