



ANTIBIOTIC SUSCEPTIBILITY PATTERN OF STAPHYLOCOCCUS AUREUS ISOLATED FROM VARIOUS CLINICAL SPECIMENS OF TERTIARY CARE HOSPITAL IN TIRUPATI.

Microbiology

Dr. Indira

**Ananthapadmanab
asamy***

Post graduate, Department of Microbiology, Sri Venkateswara Medical College, Tirupati.

*Corresponding Author

**Dr. V. Pavani Sai
Mounika**

Post graduate, Department of Microbiology, Sri Venkateswara Medical College, Tirupati.

**Dr. K.
Vijayakumar**

Post graduate, Department of Microbiology, Sri Venkateswara Medical College, Tirupati.

**Dr. C.H. Srinivasa
Rao**

Professor and Head, Department of Microbiology, Sri Venkateswara Medical College, Tirupati.

ABSTRACT

INTRODUCTION: *Staphylococcus aureus* causes a wide range of infections including skin and soft tissue infections to life-threatening systemic infections like sepsis, endocarditis. This study aims to evaluate the antimicrobial susceptibility pattern of *S. aureus* among various clinical specimens. **METHODS:** The study included 326 *S. aureus*, isolated from various clinical specimens which were subjected to antimicrobial susceptibility testing as per CLSI guidelines.

RESULTS: Among the 326 isolates, the highest were from pus specimens (47.85%), and was from Orthopaedics department (28.53%). Among the isolates, 219 (67.17%) were Methicillin resistant. All isolates were sensitive to Vancomycin, and all urine isolates were sensitive to Nitrofurantoin. The highest resistance was towards Penicillin (87.42%), Erythromycin (85.28), and Ciprofloxacin (83.13%).

CONCLUSION: The most effective way to prevent MRSA infection in every hospital is by performing continuous surveillance of antibiotic resistance and by following an effective antibiotic policy.

KEYWORDS

Staphylococcus aureus, MRSA, MSSA, Nosocomial infections

INTRODUCTION

Staphylococcus aureus is a Gram positive bacterium which is commensal of the skin, mouth, and upper respiratory tract, and this makes it a risk factor for nosocomial and opportunistic infections⁽¹⁾. *S. aureus* causes a wide range of infections including skin and soft tissue infections like furuncle, carbuncle to life-threatening systemic infections like sepsis, septic arthritis, endocarditis, osteomyelitis⁽²⁻⁴⁾.

Multidrug resistant strains including MRSA strains are common causes of health care associated infections which are also associated with high morbidity and mortality⁽⁵⁾. A report from the National Nosocomial Infections Surveillance System of the Centres for Disease Control and Prevention (2013-2015) showed that MRSA in India and USA accounts for > 60% of *S. aureus* isolates causing nosocomial infections in ICUs⁽⁶⁾. The incidence of MRSA is 50% in South India⁽⁷⁾.

The prolonged duration of stay in the hospital, indiscriminate use of antibiotics over-the counter issue of antibiotics, and the presence of indwelling medical devices are the predisposing factors of MRSA emergence⁽⁸⁾. Horizontal gene transfer is responsible for disseminating antibiotic resistant determinants among the bacteria in the hospital environment⁽⁹⁾.

This study aims to evaluate the prevalence and antibiotic susceptibility pattern of *S. aureus* among various clinical specimens.

METHODOLOGY

The study included 326 *S. aureus*, isolated from a total of 9885 clinical specimens including urine, pus, sputum, body fluids, blood, and erival swabs of patients admitted in SVRRGG hospital, Tirupati. The study was conducted between November 2019 and October 2020, with the approval of Institutional Ethical Committee.

The specimens were screened by direct Grams staining and then inoculated on 5% sheep blood agar and MacConkey agar. *S. aureus* was identified by conventional techniques like catalase test, coagulase test, Mannitol fermentation tests⁽¹⁰⁾ antimicrobial susceptibility test of the isolates was performed by Kirby Bauer disk diffusion method as per CLSI guidelines⁽¹¹⁾.

Antibiotics tested were Oxacillin, Cefoxitin, Erythromycin,

Ciprofloxacin, Gentamicin, Nitrofurantoin, Trimethoprim-Sulfamethoxazole, Ceftriaxone, Ceftazidime-Clavulanic acid, Clindamycin. Nitrofurantoin was used only for urine specimens and erythromycin was not used for urine specimens.

The plates were incubated at 37°C overnight aerobically and the zone of inhibition was measured as per CLSI guidelines.

All isolates were tested for methicillin resistance by Cefoxitin disc test. Inducible Clindamycin resistance was detected by D-test in isolates with Erythromycin disc [Fig 1]. Susceptibility test to Vancomycin was performed to determine the MIC by Epsilometer E test [Fig 2]⁽¹²⁾.

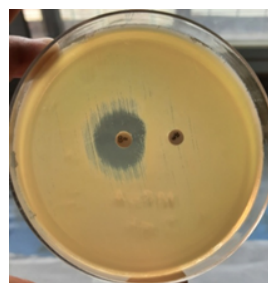


Fig 1: D TEST



Fig 2: E TEST

RESULTS

A total of 326 *S. aureus* isolated from various clinical specimens during the study period. Specimen-wise distribution were urine (61, 18.71%), pus (156, 47.85%), sputum (52, 15.95%), body fluids (10, 3.06%), blood (42, 12.88%), and cervical swabs (5, 1.5%) [Table 1]

Among the 326 isolates, 119 (36.50%) and 207 (63.50%) were collected from out-patients and admitted patients, respectively. 177 (54.29%) and 149 (45.71%) isolates belong to males and females, respectively.

Table 1: Specimen-wise distribution of isolates (n=326)

Type of specimen	No. of isolates	Percentage (%)
Pus	156	47.85
Urine	61	18.71

Sputum	52	15.95
Blood	42	12.88
Body fluids	10	3.06%
Cervical swabs	5	1.5%
Total	326	100

The specimens for the study was collected from various departments, namely, Orthopaedics: 93 (28.53%), Surgery: 73 (22.39%), Obstetrics & Gynaecology: 45 (13.80%), Paediatrics: 47 (14.42%), ICU: 32 (9.81%), Medicine: 18 (5.52%) and DVL: 18 (5.52%) [Table 2]

Table 2: Department-wise distribution of isolates (n=326)

Department	No. of isolates	Percentage (%)
Orthopaedics	93	28.53
Surgery	73	22.39
OBG	45	13.80
Paediatrics	47	14.42
ICU	32	9.81
DVL	18	5.52
Medicine	18	5.52
Total	326	100

MRSA were most frequently isolated from pus specimens (103/219, 47.03%), followed by sputum specimens (41/219, 18.72%) [Table 3]

Table 3: Specimen-wise distribution of *S. aureus* isolates (n=326)

Specimen	No. of MSSA isolates	No. of MRSA isolates
Pus	53	103
Sputum	11	41
Urine	26	35
Blood	10	32
Body fluid	3	7
Cervical swab	4	1
Total	107	219

Among the 326 isolates, Methicillin sensitive *S. aureus* (MSSA) strains were 107 (32.82%) while Methicillin Resistant *S. aureus* (MRSA) strains were 219 (67.18%) detected by Cefoxitin disc test. High susceptibility was seen with Vancomycin (100%), and high resistance was seen with Penicillin (87.42%).

Among the 219 MRSA strains, 147 (67.12%) were observed to be resistant to ≥ 3 drugs other than penicillin, which were considered as Multidrug Resistant – Erythromycin, Co-trimoxazole, Ciprofloxacin. [Table 4]

Table 4: Antimicrobial susceptibility pattern of the isolates (n=326)

Antibiotic	Sensitive (%)	Resistance (%)
Cefoxitin	107 (32.82)	219 (67.18)
Co-trimoxazole	93 (28.53)	233 (71.47)
Nitrofurantoin	61 (100)	0 (0)
Erythromycin	48 (14.72)	278 (85.28)
Ciprofloxacin	55 (16.87)	271 (83.13)
Ceftriaxone	102 (31.29)	224 (68.71)
Ceftazidime-clavulanate	124 (38.04)	202 (61.96)
Gentamicin	288 (88.34)	38 (11.66)
Doxycycline	280 (85.89)	46 (14.11)
Vancomycin	326 (100)	0 (0)
Penicillin	41 (12.58)	285 (87.42)

DISCUSSION

The study includes a comprehensive data of MRSA and MSSA in a tertiary care hospital, Tirupati.

The study isolates were isolated from pus samples (47.5%), followed by urine specimens (18.71%), and respiratory specimens (15.95%) which correlates with Mohanty et al. ⁽²⁾ which reported 61.6%, and Joshi et al. ⁽¹³⁾ (60%).

The present study revealed a prevalence of 67.18% (219 out of 326) MRSA strains among the *S. aureus* isolates which correlates with Tiwari et al. ⁽¹⁴⁾ (59.3%).

Among the 219 MRSA strains, 67.12% were observed to be MDR which correlates to Mohanty et al. ⁽²⁾ (71.6%), and Tiwari et al. ⁽¹⁴⁾ (72.1%). The MRSA strains isolated from this study were significantly

resistant to various antibiotics such as Penicillin, Trimethoprim-sulfamethoxazole, Erythromycin, Ciprofloxacin similar to the other studies.

In the present study, all MRSA isolates were sensitive to Vancomycin similar to Anupurba et al. ⁽⁸⁾ (100%) and Arora et al. ⁽¹⁵⁾ (100%).

In the present study, 126 (57.53%) MRSA strains were isolated from Orthopaedic and Surgical units, which is similar to Arora et al. ⁽¹⁵⁾ (54.8%), Srinivasan et al. ⁽⁷⁾ (80%).

In the present study, the highest MRSA strains were isolated from pus specimens (47.03%), followed by sputum specimens (18.72%), which correlates with a study by Rupali et al. ⁽¹⁶⁾ in which they are 67.85%, and 19.64% respectively.

LIMITATION

The limitation of the present study is that a genotypic study was not conducted to demonstrate the *mecA* gene among the MRSA strains and CA-MRSA and HA-MRSA could not be differentiated.

CONCLUSION

Glycopeptides stand as the only drug of choice to treat multidrug resistant MRSA infections. The high prevalence of glycopeptide use in all *S. aureus* infections may result in a high risk of development of VRSA strains. Therefore, glycopeptides should be reserved for life-threatening conditions caused by multidrug resistant MRSA.

The most effective way to prevent MRSA infection in every hospital is to perform continuous surveillance of the antibiotic resistance profile of local *S. aureus* isolates to form antibiotic policies and effective infection control practices.

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