Original Research Article

Prevalence and anti-microbial susceptibility pattern of methicillin resistant *Staphylococcus aureus* at a tertiary care hospital

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ABSTRACT

Background: To study about the prevalence and anti-microbial susceptibility pattern of methicillin resistant *Staphylococcus aureus* (MRSA).
Methods: Totally 110 non-repetitive *Staphylococcus aureus* isolates were enrolled in this study. Isolates from different clinical specimens like pus and blood obtained from patients in tertiary care hospital and Staphylococcus aureus was identified by conventional phenotypic methods. Complete antibiotic susceptibility testing of all MRSA isolates was determined by Kirby-Bauer disc diffusion method.
Results: Out of 110 isolates of *S. aureus* 60 were found to be methicillin-resistant *Staphylococcus aureus* (MRSA). The prevalence of MRSA was 54%. Out of 60 isolates, male patients 37 (63%) and female patients are 22 (37%). Maximum numbers of isolates 25 (41.6%) were from the age group of 51 to 60 years. Among these 60 isolates, all of them were found to be resistant to penicillin and oxacillin. In contrast, 98% of the isolates were found to be sensitive to linezolid. The sensitivity to chloramphenicol 70%, co-trimoxazole 60%, amikacin 58%, clindamycin 43%, ciprofloxacin 38%, erythromycin 25%.
Conclusions: The observed prevalence rate was 54%. Linezolid showed the best therapeutic outcome against MRSA. Active screening plays an important role in control of MRSA.

Keywords: MRSA, Anti-microbial susceptibility, Kirby-Bauer method, Prevalence

INTRODUCTION

Staphylococcus aureus is a common pathogen that can cause various infections ranging from mild infections to life threatening sepsis in humans.[1] Methicillin resistance *Staphylococcus aureus* (MRSA) was first reported in United Kingdom in 1961.[2] MRSA infection is now most common in India. Of one the study shows the incidence of MRSA differences from 25% western India 50% in south India.[3] Presently more than 50% infections are caused by methicillin resistance strains of *S. aureus*.[4]

Before the introduction of penicillin *Staphylococcus septicemia* was extremely high in mortality rate.

Penicillin improved the prognosis of this infection.[5] Treatment of infection caused by *S. aureus* has become difficult since the development of anti-microbial resistance of *S. aureus*.[6] The development of resistant to beta lactam antibiotics like penicillin (methicillin, oxacillin) resulted in poor therapeutic outcome and therapeutic failure.[14] MRSA is recognized as a major cause of nosocomial infections which cause the high burden on health care worldwide. Rapid and accurate

identification of MRSA is necessary for to choose the appropriate therapy.[7]

After the emergence of MRSA as a nosocomial pathogen, there have been increase in number of life-threatening sepsis, endocarditis and osteomyelitis caused by MRSA have also been reported.[8] The present study is aimed to study about the sensitivity pattern of MRSA.

METHODS

Study duration

This study was conducted at Rajah Muthiah Medical College Hospital, Annamalai University, Annamalai Nagar, Tamil Nadu for 3 months period between December 2019 to February 2020.

Study population

Totally 110 subjects were enrolled in this study. A 110 non-repetitive clinical isolates of *S. aureus* were isolated from various clinical samples.

Method

Isolates from different clinical specimens like pus, blood obtained from patients in tertiary teaching hospital and staphylococcus aureus was identified by conventional phenotypic methods. Complete antibiotic susceptibility profile was also determined by Kirby-Bauer disc diffusion method.[12]

Identification of MRSA

All the isolates of staphylococcus aureus were subjected to cefoxitin diffusion testing. The results were interpreted according to CLSI guidelines 2013. An inhibition zone diameter <21 mm was reported as methicillin resistant and >22 mm was reported as methicillin sensitive.[10]

Kirby-Bauer disc diffusion method

It is widely used test antibiotic susceptibility test which helps to choose the antibiotic should be used in treating infection. Mueller-Hinton (15x150 mm) agar used in this method is very high in protein and thoroughly tested for its composition and pH level. It has three steps.[10]

Step-1: Preparation of bacterial suspension.

Step-1: Inoculation of Mueller Hinton agar.

Step-3: Reading and interpreting zone sizes.

Procedure

A sterile cotton swab was dipped into a suspension which was adjusted to 0.5 McFarland turbidity. After the swab

was streaked uniformly into MH agar and antibiotic sensitivity of the MRSA isolates against various antibiotics (Table 1) were determined by modified Kirby-Bauer method and incubated at 35º C for 18-24 h. All inoculum on MHA were suspension of pure isolates in physiological saline with density equivalent to a 0.5 McFarland turbidity standard. Antibiotic sensitivity testing and result interpretation will be according to CLSI standards.[11] Antibiotic vancomycin was not tested in this study (Table 1).

Table 1: Antibiotics tested against MRSA isolates by Kirby-Bauer disc diffusion method.

Antibiotic	Concentration
Erythromycin	15 µg
Clindamycin	2 µg
Co-trimoxazole	1.25/23.7 µg
Ciprofloxacin	5 µg
Chloramphenicol	30 µg
Amikacin	30 µg
Gentamycin	10 µg
Linezolid	30 µg
Penicillin	10 units

RESULTS

Out of 110 isolates of *S. aureus* 60 were found to be methicillin-resistant *Staphylococcus aureus* (MRSA). The prevalence of MRSA was 54%. Out of 60 patients from whom MRSA were isolated, male patients 37 (63%) and female patients are 22 (37%) (Table 2).

Table 2: Gender wise distribution.

Gender	No. of isolates	%
Male	37	63
Female	22	37

Table 3: Age wise distribution.

Age (in years)	No. of isolates	%
18-30	12	20
31-41	10	16.6
40-50	13	21.6
51-60	25	41.6

The age of the patients from whom MRSA were obtained ranged from 18 years to 70 years of age. It was noticed that amongst the 60 patients, maximum numbers of isolates were from the age group of 51 to 60 years comprising 25 (41.6%) of the total followed by the age group 41-50 years 21.6%. Table 2 shows the age wise distribution of the various isolates of MRSA (Table 3). The various clinical samples which from MRSA were isolated are pus 81% and blood 19%. The most common clinical sample is pus.

Among these 60 isolates, all of them were found to be resistant to penicillin and oxacillin. In contrast, most of them were found to be sensitive to linezolid 98%. The sensitivity to chloramphenicol 70%, co-trimoxazole 60%, amikacin 58%, clindamycin 43%, ciprofloxacin 38%, and erythromycin 25% (Table 4).

Table 4: Antibiotic sensitivity profile of MRSA isolates.

Antibiotic	No. of isolates	%
Linezolid	58	98
Chloramphenicol	42	70
Co-trimoxazole	36	60
Amikacin	35	58
Clindamycin	26	43
Ciprofloxacin	23	38
Erythromycin	15	25
Penicillin	00	00
Oxacillin	00	00

DISCUSSION

MRSA is the most common cause for nosocomial infection worldwide. The prevalence of the MRSA infections as reported by National Nosocomial Infection Surveillance System (NNIS) in the US has been steadily increasing from 2.4% in 1974, 5% in 1981, 29% 1991 to 43% in 1997.[5] This study shows, out of 110 isolates of *S. aureus* 60 were found to be methicillin-resistant *Staphylococcus aureus* (MRSA). The prevalence of MRSA was 54%.

Out of 60 patients from whom MRSA were isolated, male patients 37 (63%) and female patients are 22 (37%). The higher incidence of MRSA infections among male has been reported in this study. This result is similar to the study by Bhatt et al.[9]

In the present study, it was found that maximum number of isolates came from the age group of the patients from whom MRSA were obtained ranged from 18 years to 70 years of age. It was noticed that amongst the 60 patients, maximum numbers of isolates were from the age group of 51 to 60 years comprising 25 (41.6%) of the total followed by the age group 41-50 years 21.6%. Then age group of 18 to 30 years 20% and then the age group of 31 to 40 years 16%. This shows the controversial result to the study by Kalyani et al.[11]

The various clinical samples which from MRSA were isolated are pus 81% and blood 19%. The most common clinical sample is pus.[13]

Linezolid showed excellent therapeutic activity against MRSA. All MRSA strains were resistant to penicillin and oxacillin which is similar to the by Ahmad et al similar results have been obtained in some major area of India. High degree sensitivity has been reported for chloramphenicol 70% similar to the study by Kalyani et al.[11] Aminoglycosides such as gentamycin and amikacin show good sensitivity to MRSA strains showing 60% and 58% respectively. About 65% were found to be resistant to co-trimoxazole and clindamycin sensitivity in this study was 43%. Sensitivity to ciprofloxacin and erythromycin ranged from 25-38% which shows most the of isolates were resistant to them. Similar results were also observed in the INSAR group study.[3]

CONCLUSION

The observed prevalence rate was 54%. Linezolid showed the best therapeutic outcome against MRSA. Active screening plays an important role in control of MRSA.

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