

Original Research Article

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## Prevalence and Antibiogram of MRSA Isolated from Patient Samples and Health Care Workers in a Tertiary Care Hospital, Puducherry, India

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### ABSTRACT

#### Keywords

Methicillin resistant, Nasal swab, Prevalence, Multidrug resistant, Virulence.

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MRSA is of serious concern in health care settings as the organism is not only resistant to methicillin but also to many other antimicrobials used for treatment. This study has been carried to determine the prevalence and antibiotic susceptibility of MRSA isolated from patient samples and health care workers. A prospective analytical study carried out on 450 clinical samples from patients and 100 nasal swab from health care workers in tertiary care hospital, Puducherry. All *Staphylococcus aureus* isolates identified by conventional phenotypic methods were screened for methicillin resistance by Cefoxitin disc diffusion test. Out of 450 pus samples, 90(20%) were *Staphylococcus aureus*, of which, 30(33.3%) were methicillin resistant. Out of 100 nasal swab screened from health care workers, 18(18%) were *Staphylococcus aureus*, of which 5(27.8%) were methicillin resistant. All the MRSA isolates were found to be 100% sensitive to vancomycin, teicoplanin and linezolid. Treatment of multi drug resistant MRSA is still problematic because of limited choice of antibiotic and the option of drug for empirical therapy for staphylococcal infections depends on susceptibility data for the local geographic area.

### Introduction

Staphylococci spp are the major groups of bacteria inhabiting the skin, skin glands, and mucous membranes of humans. Among these, *Staphylococcus aureus* is the most common pathogen causing suppuration, abscess formation, pyogenic infections, and even fatal septicemia. *Staphylococcus aureus* has got the tendency to develop resistance to many antimicrobial agents and present with therapeutic difficulty.

Methicillin resistant *Staphylococcus aureus* (MRSA) was initially confined to the hospital setting. In present scenario, community

associated MRSA (CA-MRSA) has emerged, particularly in younger patients as cause of skin and soft tissue infections and necrotizing pneumonia. CA-MRSA isolates are considered more virulent, characterized by the presence of the Panton-Valentine leukocidin and Staphylococcal Cassette Chromosome *mec* type IV, which may explain the increased susceptibility to other antimicrobials as compared to hospital acquired MRSA strains.

The region wise incidence of MRSA shows, 25% in western part of India (Patel *et al.*, 2010) to 50% in South India (Gopalakrishnan

and Sureshkumar, 2010). Few expensive drugs like vancomycin, linezolid, daptomycin, teicoplanin, and streptogramins are the current drug of choice for MRSA.

This study has been carried to determine the prevalence and antibiotic susceptibility pattern of MRSA isolated from patient samples and health care workers.

## Materials and Methods

This prospective analytical study was carried out for a period of one year. Samples included in this study were 450 pus samples from patients and 100 nasal swab from health care workers in tertiary care hospital, Puducherry. Samples were inoculated into Blood agar and MacConkey agar.

Staphylococcal isolates were identified by conventional phenotypic methods such as colony morphology, Gram's stain, catalase test, slide and tube coagulase test, growth on Mannitol salt agar and DNase production. (Collee *et al.*, 1996)

## Antimicrobial susceptibility testing methods

Bacterial susceptibility to antimicrobial agents was determined by Kirby Bauer disc diffusion method on Mueller Hinton agar plates with commercially available discs (Hi-Media, Mumbai). Isolates were categorized as susceptible, intermediate and resistant, based upon interpretive criteria developed by the Clinical and Laboratory Standards Institute (CLSI). Antibiotic discs (Hi-Media) Penicillin (10µg), Erythromycin (10µg), Tetracycline (10µg), Gentamicin (10µg), Cotrimoxazole (1.25/23.75 µg), Ciprofloxacin (5µg), Erythromycin (15µg), Cefoxitin (30µg), Linezolid (30 µg), and Vancomycin (30 µg) were used for antimicrobial susceptibility tests.

## Detection of MRSA

All *Staphylococcus aureus* isolates were screened for MRSA by Cefoxitin disc diffusion testing. The results were interpreted according to CLSI guidelines 2013. An inhibition zone diameter of  $\leq 21$  mm was reported as methicillin resistant and  $\geq 22$  mm was reported as methicillin sensitive.

## Results and Discussion

In our study, out of 450 pus samples, 90(20%) *Staphylococcus aureus* isolated. Among 90 isolates of coagulase positive *Staphylococci*, 30(33.3%) were methicillin resistant (Table 1).

Study on antibiotic susceptibility pattern of methicillin resistant *Staphylococcus aureus* (n=30) from clinical samples is shown in Table 2. A high proportion of isolates were resistant to penicillin (100%) and ciprofloxacin (57.8%), while moderate resistance to gentamicin (22.2%) and erythromycin (28.9%) were seen. Sensitivity for Cotrimoxazole, Tetracycline, Gentamicin and Erythromycin were 81.1%, 85.6%, 77.8% and 71.1% respectively. Noresistance to vancomycin, linezolid and teicoplanin were observed.

Of 100 nasal swabs screened from health care workers, 18(18%) *Staphylococcus aureus* were isolated, of which, 5(27.8%) were methicillin resistant *Staphylococcus aureus* (Table 3).

Study on antibiotic susceptibility pattern of methicillin resistant *Staphylococcus aureus* (n=5) isolated from nasal swab from health care workers is shown in Table 4. The resistant rate of isolates to penicillin, tetracycline and erythromycin were 100%, 38.9%, 27.8% respectively. Least resistance of 11.1% was shown for ciprofloxacin and

gentamicin, and 5.6% to co-trimoxazole. All were sensitive to vancomycin, linezolid and teicoplanin

*Staphylococcus aureus*, the most virulent of many staphylococcal species, still remains a major cause of morbidity and mortality worldwide despite the availability of numerous antistaphylococcal antibiotics. This organism is responsible for both nosocomial and community-based infections ranging from minor skin and soft tissue infections to life-threatening systemic infections. Contact spread of infection plays an important role in the hospitals, where a large proportion of the

staff and patients carry antibiotic-resistant *Staphylococci* in the nose or on the skin.

MRSA case was reported within one year of the introduction of methicillin. Since then, the prevalence of MRSA has been steadily increasing. In many hospital settings, about 40–50% of *S. aureus* isolates are resistant to methicillin. The mechanism of methicillin resistance is due to the production of novel penicillin-binding protein (PBP2a). This protein is synthesized by the *mecA* gene, which is part of a large mobile genetic element—a pathogenicity or genomic island—called SCCmec.

**Table.1** Isolation rate of *Staphylococcus aureus* from clinical samples

Total no of samples	Total No of <i>Staphylococcus aureus</i> isolated from clinical samples	Percentage of Methicillin resistant <i>Staphylococcus aureus</i>
450	90(20%)	30(33.3%)

**Table.2** Study of antibiotic susceptibility (%) pattern of MRSA isolated from clinical samples (n=30)

Antibiotic	S (%)	R (%)
Penicillin	0%	100%
Cotrimoxazole	81.1%	18.9%
Erythromycin	71.1%	28.9%
Tetracycline	85.6%	14.4%
Cefoxitin	0	100%
Ciprofloxacin	31.1%	57.8%
Gentamicin	77.8%	22.2%
Vancomycin	100%	0
Linezolid	100%	0
Teicoplanin	100%	0

S= Sensitive R= Resistant

**Table.3** Percentage of *Staphylococcus aureus* isolated from nasal swab from health care workers

Total No of cases	Isolates of <i>Staphylococcus aureus</i>	Percentage of Methicillin resistant <i>Staphylococcus aureus</i>
100	18(18%)	5(27.8%)

**Table.4** Study of antibiotic susceptibility (%) pattern of MSSA & MRSA isolated from nasal swab (n=18)

Antibiotic	S (%)	R (%)
Penicillin	0%	100%
Cotrimoxazole	94.4%	5.6%
Erythromycin	72.2%	27.8%
Tetracycline	61.1%	38.9%
Cefoxitin	72.2%	27.8%
Ciprofloxacin	88.9%	11.1%
Gentamicin	88.9%	11.1%
Vancomycin	100%	0
Linezolid	100%	0
Teicoplanin	100%	0

S= Sensitive R= Resistant

In the current study, of 450 pus samples, 90(20%) were *Staphylococcus aureus* and among these isolates 30(33.3%) were methicillin resistant. The prevalence obtained in this study was slight than lower the prevalence of 41% reported in earlier studies in India by Joshi *et al.*, (2013). Our prevalence was well comparably equal to other studies, which showed 32.22%, 32.12% and 30% (Bilal Ahmad Mir *et al.*, 2013; Suryadevara *et al.*, 2017; Debnath and Chikkaswamy, 2015).

In our study on antibiotic profile of methicillin resistant *Staphylococcus aureus* isolated from clinical samples showed, high proportion of isolates were resistant to penicillin (100%) and ciprofloxacin (57.8%), moderate resistance rates to gentamicin (22.2%) and erythromycin (28.9%). Similar resistance and sensitivity pattern has been demonstrated by many other studies also where almost 80-90% of isolates were resistant to Penicillin and ciprofloxacin and almost 100% showed sensitivity to vancomycin, linezolid and teicoplanin (Bhatt *et al.*, 2015; Debanath and Chikkaswamy, 2015; Tiwari *et al.*, 2009).

In the current study, of 100 nasal swab

screened from health care workers, 18(18%) *Staphylococcus aureus* were isolated. The present study on prevalence of MRSA from nasal sample screened from health care workers, showed isolation of 27.8%. This percentage is comparable to similar study where they have reported 23.6% MRSA isolated from surveillance cultures. Wakatake *et al.*, (2015) and another study which reported 23.71% from nasal samples (Sharma and Mall, 2011). Study by Sharon *et al.*, 2013, showed that 22.22% of the HCWs carried *S.aureus* in their anterior nares of which 11.43% were MRSA, lower percentage recorded than our study.

Our study on the sensitivity pattern of MRSA isolated showed, 94.4% were sensitive to trimethoprim/sulfamethoxazole and 88.9% were sensitive to ciprofloxacin and gentamicin. The sensitive pattern to trimethoprim/sulfamethoxazole was similar to study by Wakatake *et al.*, (2015) (95.4%) and resistant pattern to Ciprofloxacin and Gentamicin were comparable to study by Mohite (2015).

To conclude, the prevalence of MRSA infection in patient and health care workers, in the present study was found to be 33.3%

and 27.8%. Increasingly, vancomycin, linezolid and teicoplanin are still the drugs of choice for both community- and hospital-acquired infections. Oral agents that effective against these isolates include clindamycin, trimethoprim- sulfamethoxazole, doxycycline, linezolid, and tedizolid (Kasper and Dennis, 2015).

Treatment of multi drug resistant MRSA is still problematic because of limited choice of antibiotic and the option of drug for empirical therapy for staphylococcal infections depends on susceptibility data for the local geographic area. In addition to it measures like cleanliness, hygiene, and aseptic management of lesions can control the spread of staphylococci from lesions as well dissemination of *Staphylococci* from carriers.

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