

## Prevalence and Antibiotic Susceptibility Patterns of Methicillin Resistant Staphylococcus Aureus- A study in a tertiary care centre of Chhattisgarh of India

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### Abstract

**Background:** Serious endemic and epidemic Methicillin Resistant Staphylococcus Aureus (MRSA) infections occur globally. Many strains of MRSA exhibit resistance to  $\beta$ - lactams and amino glycosides. Therefore, the knowledge of prevalence of MRSA and their current antimicrobial profile become necessary in the selection of appropriate empirical treatment of these infections.

**Material and Methods:** A total of one hundred and fifty samples from surgery, orthopedics, pediatrics, gynecology and obstetrics, medicine, ENT departments, were collected. **Results:** 84.78% resistance was noticed for penicillin-G followed by Co-Trimoxazole (80 %). Majority were multidrug resistant. The resistance to Erythromycin, Clindamycin, Gentamycin and Ciprofloxacin was 65.21%, 65.21%, 52.17% and 56.09% respectively. All the MRSA strains were highly resistant to Nalidixic Acid (85.71%) and Norfloxacin (78.57%) and least resistance was observed for the Nitrofurantoin (7.69%). The MRSA were seen to be highly sensitive to Vancomycin and Rifampicin which showed 100% sensitivity and also for Amoxicillin (82.92%), Amikacin (67.44%).

**Conclusion:** Fluoroquinolones have resistance but still drugs like Amoxicillin and Amikacin have sensitivity.

**Key words:** Infections, Staphylococcus aureus, Methicillin Resistant

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### Introduction

The emergence of a community pathogen depends on its ability to survive in different environments and to interact successfully with the host. Staphylococcus aureus is one of the successful and adaptable human pathogens<sup>1</sup>. Staphylococcus aureus has a broad pathogenic potential causing a wide range of community acquired as well as nosocomial infections<sup>2</sup>. The organism has been found to be the most common bacterial agent recovered from blood stream infections, skin and soft tissue infections, pneumonia and hospital – acquired post-operative wound infections<sup>3</sup>. Also it can cause a variety of infections ranging from relatively minor skin infections, to life-threatening systemic illnesses such as meningitis, endocarditis, septic arthritis, osteomyelitis,

subcutaneous or visceral abscesses, toxic shock syndrome (TSS), Staphylococcal scalded skin syndrome (SSSS) and septicemia. Staphylococcus aureus infections are associated with morbidity in hospitals and community<sup>4</sup>. Serious endemic and epidemic Methicillin Resistant Staphylococcus Aureus (MRSA) infections occur globally. Methicillin resistant Staphylococcus aureus infection was initially reported in 1961, the same year in which methicillin (a penicillinase – resistant semi synthetic penicillin) was introduced. In 1982, a “community – acquired outbreak” of MRSA, outside of a hospital, was first reported in intravenous drug users in Detroit, Michigan. During the 1990s, numerous outbreak of community acquired MRSA (CAMRSA). Indeed, the initial publication in the medical literature describing CAMRSA skin infections

as “an emerging epidemic”<sup>6</sup>. Many strains of MRSA exhibit resistance to  $\beta$ - lactams and amino glycosides. Therefore, the knowledge of prevalence of MRSA and their current antimicrobial profile become necessary in the selection of appropriate empirical treatment of these infections. Hence the present study was conducted at Chhattisgarh region of India.

## Material and methods

A total of one hundred and fifty different samples from different clinical specialties like surgery, orthopedics, pediatrics, gynecology and obstetrics, medicine were collected and processed for culture and sensitivity. This study was carried out between the period September 2013 to April 2014 out in the Department of Microbiology, CM Medical College and Hospital, Durg. All clinical specimens such as urine, pus, sputum/throat swab, blood, pleural fluid, catheter tip, tracheal and nasal swabs and vaginal swabs were collected for *Staphylococcus aureus* screening. All the

samples were aseptically handled and processed<sup>7</sup>. Epidemiological parameters were recorded. An emphasis was made to record down whether the patient was on antimicrobial therapy, if yes, the duration of course and name of antibiotics.

## Results

A total of 150 isolates from different clinical specimens were studied in which males were 76 (50.66%) and females 74 (49.33%). Majority were from surgical wards 33.33% (50), in that MRSA was 30% (15) and MSSA was 70% (35) followed by medicine wards 23.33% (35), in that MRSA and MSSA were 28.57% (10). Least number of cases was seen in ophthalmology department as total number of cases was 2 in which 1 was MRSA and 1 MSSA (Table- 1). MRSA was seen in 27 out of 76 males comprising 35.52% whereas in case of females it was 25.67% i.e. 19 out of 74 cases.

**Table- 1: Prevalence of cases**

Department	No. of cases	%	MRSA*	%	MSSA#	%
Surgery	50	33.33	15	30	35	70
Medicine	35	23.33	10	28.57	25	71.42
Obstetric/Gynecology	22	14.66	04	18.18	18	81.81
Pediatrics	06	04	03	50	03	50
Ear Nose and Throat	03	02	01	33.33	02	66.66
Orthopedics	20	13.33	06	30	14	70
Intensive Care Unit	02	1.33	02	100	00	00
Urology	05	3.33	02	40	03	60
Ophthalmology	01	0.66	00	00	01	100
Gynecology	04	2.66	02	50	02	50
Dermatology	02	1.33	01	50	01	50
Total	150	100	46	30.33	104	69.67

\*Methicillin Resistant *Staphylococcus Aureus*, #Methicillin Sensitive *Staphylococcus Aureus*

76.66% (115/150) resistance was noticed for penicillin followed by for Co-Trimoxazole 74% (111/150). In case of Erythromycin, Clindamycin and Gentamycin, the resistance percentage was 32.66% (49/150), 32.21% (48/149) and 38.66% (58/150) respectively. Resistance for Oxacillin was 30.66% (46/150). Least resistance was observed for Amikacin

17.60% (25/142). Of the 45 urine isolates, 77.77% resistance was for Nalidixic Acid and 71.11 for Norfloxacin. Good sensitivity was noticed for Nitrofurantoin, which was 95.45%. It was further seen that all the isolates were susceptible to Rifampicin and Vancomycin.

**Table- 2: Antibiotic susceptibility patterns**

Antimicrobials	Total samples	Resistant	%	Sensitive	%
Penicillin –G (P)	150	115	76.66	35	23.33
Amoxicillin (Ac)	136	17	12.5	119	87.5
Co-Trimoxazole (Co)	150	111	74	39	26
Erythromycin (E)	150	49	32.66	101	67.33
Clindamycin (Cd)	149	48	32.21	101	67.78
Gentamycin (G)	150	58	38.66	92	61.33
Ciprofloxacin (Cf)	140	61	43.57	79	56.42
Amikacin (Ak)	142	25	17.60	117	82.39
Nitrofurantoin (Nf)	44	02	4.54	42	95.45
Nalidixic acid (Na)	45	35	77.77	10	22.22
Rifampicin (R)	150	00	00	150	100
Vancomycin (Va)	150	00	00	150	100
Oxacillin (Ox)	150	46	30.66	104	69.33
Teicoplanin (Te)	40	23	57.5	17	42.5
Norfloxacin (Nx)	45	32	71.11	13	28.88

## Discussion

The prevalence rate of MRSA in the present study is 30.66%. Pulimood et al found it 24% in 1996 [Pulimood TB., et al.1996]<sup>6</sup> while 51.6% in 2001 by Vidhani S et al<sup>7</sup>. Similar observation was made by Mehta, who in his study on control of MRSA in a tertiary care centre, had reported an isolation rate of 33% from pus and wound swabs [Mehta AP., et al.,1998]<sup>8</sup>. However, Qureshi from Pakistan reported a high isolation rate of up to 83% MRSA from pus [Qureshi AH, et al, 2004]<sup>9</sup>. This implies that the incidence of infection by MRSA isolates keeps changing every year and it is on a rise compared to last few years<sup>10</sup>.

Risk factors that have been associated with MRSA acquisition include older age, prolonged hospitalization, prior antibiotic therapy, more severe underlying disease and degree of disability, surgical procedures, presence in an intensive care or burn unit, having a surgical wound infection, intravascular devices, mechanical ventilation, tracheostomy, pressure ulcers, or exposure to other infected or colonized individuals. Not only does antibiotic therapy predispose patients to colonization with MRSA, but it also increases the risk of invasive disease and infection. Other host factors associated with progression from colonization to infection include recent hospitalization,

preceding surgical or wound debridement, and the number of invasive procedure<sup>4</sup>.

In the present study, the antibiotic sensitivity results showed that all MRSA isolates were significantly more resistant to various antibiotics. The resistance of MRSA to  $\beta$ -lactams like Penicillin was 84.78% while co-trimoxazole resistance was seen in 80% of the isolates, which was much higher than the resistance obtained in another study in 1999 to 2004 (13.3%) and in 1997 to 1998 (45.4%) from the different institution<sup>3</sup>. In our study the spectrum of antimicrobial resistance among MRSA, quinolones (Ciprofloxacin) was also found to be high i.e 56.09%. This co-relates with an earlier finding where it has been shown that the resistance to ciprofloxacin is steadily increasing from 39% in 1992 to 68% in 1996<sup>5</sup>. In 1997 also a high incidence of ciprofloxacin resistance (95.8%) was reported<sup>11</sup>. Again the resistance to ciprofloxacin is decreasing from 59.1% in 1999 - 2004<sup>3</sup>. However, Pulimood had observed only 8% resistance of MRSA to gentamycin, as against 52.17% in our study. Gentamycin resistance is on rise since 1996. An increase of gentamycin 0% before 1996 to 80% after 1996 has been reported. Qureshi had reported a gentamycin resistance of 97.8%, which is higher compared to our study<sup>10</sup>. But in the present study 65.21% of the strains were resistant to clindamycin, which is the same for erythromycin. All the MRSA isolates were found to be

susceptible to vancomycin (100%) and rifampicin (100%), MRSA also showed high level of resistance to amoxicillin. The resistant rate to amikacin and nalidixic acid were 32.55% and 85.71%. An important feature of MRSA is their propensity to spread and colonize debilitated patients. Since these strains tend to be multiple antibiotic-resistant, they pose a major difficulty in treating systemic infections. MRSA are more pathogenic than methicillin-sensitive *Staphylococcus aureus*, especially in the seriously ill and immunosuppressed patients. Both can cause a spectrum of illnesses ranging from minor skin infections to life-threatening complication like bacteremia and pneumonia.

## Conclusion

The choice of appropriate antimicrobial agents for suspected *Staphylococcus aureus* infections should be judicious. Although many antimicrobials are ineffective but at least vancomycin seems to be the only antimicrobial agent which showed 100% sensitivity and may be used as the drug of choice for treating multidrug resistant MRSA infections. Further, the regular surveillance of hospital associated infections including monitoring antibiotic sensitivity pattern of MRSA and formulation of definite antibiotic policy may be helpful for reducing the incidence of MRSA infection.

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