Original Article

Prevalence and antibiogram of hospital acquired-methicillin resistant *Staphylococcus aureus* and community acquired-methicillin resistant *Staphylococcus aureus* at a tertiary care hospital National Institute of Medical Sciences

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ABSTRACT

Background and Aims: Since 1959, treatment of infections caused by S. aureus included semi synthetic penicillin drugs such as Methicillin. Sooner a year later in 1960 Methicillin resistant S. aureus came into existence. Decade after decade the MRSA strains increased and these bacteria were marked as major cause of nosocomial infections in early 1980s. The invasion of MRSA into community is now day's matter of concern for microbiologist. This study was conducted to detect the prevalence of MRSA resistance and to prepare antibiogram of HA-MRSA and CA-MRSA isolates at our hospital. **Materials and Methods:** A total of 201 staphylococcus isolates were detected as MRSA. They were then separated into two categories i.e. community acquired MRSA (CA-MRSA) and hospital acquired MRSA (HA-MRSA) according prescribed criteria. Antibiogram was prepared by Kirby- Bauer disk diffusion method. **Results:** Out of 201 isolates, HA-MRSA prevalence was 143(28.6%) and CA-MRSA was 58(11.6%). The HA-MRSA isolates showed were 10- 30% more resistant when compared to CA-MRSA. All isolates were 100 % sensitive to Vancomycin and Linezolid. **Conclusion:** We strongly suggest that time to time monitoring of MRSA should be done and proper hand wash must be done to avoid spread of MRSA.

Key words: Community acquired-methicillin resistant *Staphylococcus aureus*, hospital acquired-methicillin resistant *Staphylococcus aureus*, methicillin resistant *Staphylococcus aureus*, *Staphylococcus aureus*

INTRODUCTION

Staphylococcus aureus is one of the most common human pathogens with ability to cause a wide range of infections. On an average 20-40% of the adults are carriers of S. *aureus* in the anterior nares.[1]

The emergence of community-acquired (CA) and hospital acquired (HA) methicillin resistant S. *aureus* (MRSA) has led to increasing in cases of invasive infections.[2,3]

In 1965 first case of MRSA infection recorded in Australia, (Sydney)[4,5] and in 1980 first case of a CA-MRSA infection in the United States was reported. Both HA-MRSA and

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CA-MRSA strains are transmitted by skin to skin contact although they have distinct clinical characteristics.

We determined the prevalence of MRSA resistance among *S. aureus* and reported antibiotic susceptibility pattern of HA-MRSA and CA-MRSA at our tertiary care hospital.

MATERIALS AND METHODS

The present study was carried out for a period of 1 year. Five hundred *S. aureus* were isolated from different clinical samples such as pus, ear swab, sputum, urine, blood, throat, nares, etc., by the standard laboratory procedures[6] in the Department of Microbiology, National Institute of Medical Sciences, Jaipur, Rajasthan, India.

Antibiotic susceptibility test

Antibiotic susceptibility test was performed by Kirby-Bauer disk diffusion method. Fourteen antibiotics were used including erythromycin (15 μg), clindamycin (2 μg), ciprofloxacin (5 μg), cefoxitin (30 μg), tetracycline (30 μg), amikacin (30 μg), gentamicin (10 μg), (co-trimoxazole 25 μg), norfloxacin (10 μg), chloramphenicol (30 μg), teicoplanin (30 μg), nitrofurontine (300 μg), vancomycin (30 μg) and linezolid (30 μg) (Hi-Media Pvt. Ltd., Mumbai, Maharashtra, India).

Detection of methicillin resistant *Staphylococcus aureus*

Methicillin resistant *Staphylococcus aureus* detection was done using cefoxitin 30 μg. Those isolates showed zone of inhibition <21 mm considered as MRSA.[7]

Categorization of methicillin resistant *Staphylococcus aureus* isolates into hospital acquired-methicillin resistant *Staphylococcus aureus* and community acquired-methicillin resistant *Staphylococcus aureus*

Based on the history of the patient, the MRSA isolates were categorized into CA or HA. Basically if an infection occurs among the out patients or inpatients with an MRSA isolate earlier than 48 h of hospitalization, is considered as CA-MRSA, and if MRSA strain isolated after 48 h of hospitalization or from a patient with a history of hospitalization for surgery or dialysis, or of a residence in a long-term care facility within 1 year of the MRSA culture date will come under HA-MRSA.

RESULTS

Prevalence of HA-MRSA and CA-MRSA is shown in Table 1. Antibiotic sensitivity pattern of HA-MRSA and CA-MRSA is depicted in Table 2.

Table 1: Prevalence of HA-MRSA and CA-MRSA

Number (n = 500)	MRSA	MSSA	HA-MRSA	CA-MRSA
Total	201	299	143	58
Percentage	40.2	59.8	71.1	28.8

MRSA: Methicillin resistant *Staphylococcus aureus*; MSSA: Methicillin sensitive *Staphylococcus aureus*; HA-MRSA: Hospital acquired methicillin resistant *Staphylococcus aureus*; CA-MRSA: Community acquired methicillin resistant *Staphylococcus aureus*

Table 2: Antibiotic resistance pattern of HA-MRSA and CA-MRSA

Antibiotics	HA-MRSA (%)	CA-MRSA %(%)
Norfloxacin	88.88	84.21
Erythromycin	62.93	56.89
Ciprofloxacin	54.54	48.27
Clindamycin	46.15	22.41
Gentamicin	46.15	20.68
Co-trimoxazole	32.16	17.24
Tetracycline	21.67	15.51
Teicoplanin	16.08	13.79
Amikacin	13.98	6.89
Chloramphenicol	9.79	5.17
Nitrofurontine	5.55	0
Vancomycin	0	0
Linezolid	0	0

HA-MRSA: Hospital acquired methicillin resistant *Staphylococcus aureus*; CA-MRSA: Community acquired methicillin resistant *Staphylococcus aureus*

DISCUSSION

We observed no significant difference observed between males and females patients. Male were 277 (56%) and females were 223 (44%). The age groups that were seen to be highly infected with *S. aureus* were 0-20 and 21-40 at a percentage of 38.40% each.

A total of 201 (40.20%) MRSA were detected from various clinical samples using cefoxitin disc diffusion technique. These results are in accordance with Mittal *et al*. (India)[8] 40.38%, Seifi *et al*. (Iran)[9] 41.7%, and Mohanasoundaram (India)[10] 39.16%, although high prevalence of MRSA have been reported by Venkata *et al*. (India)[11] 75.27%. Unfavorable point is there is a tremendous increase in the methicillin-resistant isolates in our hospital, when compared with the study by Sharma *et al*. conducted during February 2011-March 2012,[12] this observation might be because Sharma *et al*. used oxacillin disc diffusion method for detection of MRSA on the other hand we used cefoxitin disc diffusion for the detection of MRSA isolates which far superior method as compared to oxacillin disc diffusion method.

The isolation rate of MRSA among different clinical samples were as follows, high prevalence was seen among pus sample, that is, 43.80% followed by swabs from different sites 41.59%, blood 39.47%, urine 38.73% and sputum 33.33%. High prevalence of MRSA among pus samples was also reported by Tiwari *et al*. 71.20% of MRSA were from pus samples.[13] Deepak *et al*. also reported high percentage of MRSA among pus samples 43.10%.[14]

This study revealed that all MRSA isolates were 100% sensitive to vancomycin and linezolid. About 61.19% of MRSA isolates were resistant to erythromycin, 52.73% to

ciprofloxacin, 38.80% to clindamycin, 37.81% to gentamicin, 29.35% to co-trimoxazole and 19.40% to tetracycline. Contrary to the reports by Qureshi *et al*.[15] who reported 98.9% resistance to ciprofloxacin and 97.8% to gentamicin, Sharma *et al*.[16] reported 87.3% of MRSA strains were resistant to co-trimoxazole and 58.3% to tetracycline that is much higher when compared to our study.

In our study among 144 HA-MRSA isolates majority of resistance was shown to norfloxacin (88.88%) followed by erythromycin (62.93%), ciprofloxacin (54.54%), clindamycin (46.15%), gentamicin (46.15%), co-trimoxazole (32.16%), tetracycline (21.67%) and teicoplanin (16.08%). Amikacin (13.98%), chloramphenicol (9.79%), nitrofurontine (5.55%) were least resistant drug among hospital-associated MRSA isolates.

Of the 58 CA-MRSA isolates, 16 (84.21%) were resistant to norfloxacin, 33 (56.89%) to erythromycin, 28 (48.27%) to ciprofloxacin. Good sign was CA-MRSA isolates did not show higher resistant to drugs of choice like co-trimoxazole (22.41%), clindamycin (20.68%), gentamicin (17.24%), teicoplanin (15.51%) and tetracycline (13.79%) chloramphenicol (6.89%) and amikacin (5.17%) were least resistant drugs. All CA-MRSA isolates was 100% sensitive to nitrofurontine, vancomycin and linezolid.

The resistance patterns of the HA-MRSA were higher when compared to those of the CA-MRSA. This correlated with the results of Huang *et al*. and Vysakh and Jeya.[17,18] Both HA-MRSA and CA-MRSA possess different gene like mecA gene and PVL gene respectively, which enhance resistance to antibiotics and inappropriate use of antibiotics also promotes resistance that could be a possible reason for the difference in resistance pattern of HA-MRSA and CA-MRSA.

Antibiotics such as clindamycin, amikacin, chloramphenicol and teicoplanin can be alternative for reserved drugs such as vancomycin and linezolid which can be used for life-threatening infections. Clindamycin is still a reliable drug among CA infections.

CONCLUSION

Methicillin resistant *Staphylococcus aureus* is one of most common cause of therapeutic problems in many hospitals. Misuse of antibiotics can be a main reason for the spread of MRSA. HA-MRSA is always a worry for health care workers. Further spread of MRSA among community, that is, CA-MRSA is a current challenging problem. Rational use of antibiotics, institutional antibiotic policy, proper hand hygiene and washing are the answer of it.

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