Original Research Article

Study of Antimicrobial Susceptibility Pattern of Methicillin Resistant *Staphylococcus aureus* in a Tertiary Care Hospital

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A B S T R A C T

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Nosocomial infection is a major problem in the world today. Methicillin-resistant *Staphylococcus aureus* (MRSA) strains, usually resistant to several antibiotics, shows a particular ability to spread in hospitals and is now present in most of the countries. We reported the prevalence and antibiotic susceptibility pattern of MRSA. A total of 2200 samples were taken into the study. The various clinical samples included were pus, fluids, sputum, urine, blood and swab. Out of 2200 samples received 232 Staphylococcus aureus were isolated. 74 (31.89%) out of 232 were found to be MRSA. The maximum isolation of MRSA was from pus and swabs. Therefore, regular surveillance of hospital-associated infections including monitoring of antimicrobial (especially vancomycin and other newer glycopeptides) susceptibility pattern of MRSA and formulation of a definite antimicrobial policy may be helpful for reducing the incidence of these infections.

Introduction

Nosocomial infections accounts for five to ten percent of hospitalized patients (Greenwood *et al.,* 2002). The larger the referral hospital, the higher is the rate of these infections (Baron *et al.,* 1994). *Methicillin resistant Staphylococcus aureus* (MRSA) frequently causes nosocomial infections, is often resistant to most of the antibiotics and is one of the greatest challenges for modern antimicrobial therapy, particularly since the emergence of *Staphylococcus aureus* (*S. aureus*) with intermediate susceptibility to glycopeptides (Dominique *et al.,* 2002). The prolonged hospital stay, indiscriminate use of antibiotics, lack of awareness, receipt of

antibiotics before coming to the hospital etc. are the possible predisposing factors of MRSA emergence (Anupurba *et al.,* 2003). Serious endemic and epidemic MRSA infections occur globally as infected and colonized patients in hospitals mediate the dissemination of these isolates and hospital staff assists further transmission (McDonald, 1997). The development of resistance to multiple antibiotics and control of disease transmission by MRSA isolates in hospitals/ communities have been recognized as the major challenges as the bacterial population that expresses the resistance phenotype varies according to the environmental conditions (Qureshi *et al.,* 2004).

Therefore, the knowledge of prevalence of MRSA and their current antimicrobial profile becomes necessary in the selection of appropriate empirical treatment of these infections. We determine the prevalence of MRSA from different samples and their susceptibility pattern to various antimicrobial agents.

Materials and Methods

The study was carried out in the department of Microbiology of a teaching institute in the northern part of Karnataka. The study period is from January 2014 to June 2015. A total of 2200 samples were taken into the study. The various clinical samples included were pus, fluids, sputum, urine, blood and swab. All the samples were aseptically handled and processed. The morphotypes were done for all the samples based on the Gram staining method to determine the likely organism present. Subsequently, the clinical specimens were inoculated on to blood agar plates (aerobic with 5% CO_2), Mac Conkey agar and incubated at 37ºC for 24 hours. The colonies of Gram-positive cocci in clusters were further confirmed using biochemical reactions. All strains were further tested for the production of free coagulase enzyme using tube coagulase test based on standard methods (Betty *et al.,* 2002). *Staphylococcus aureus* ATTC-25923 of known coagulase production was included as control strain.

Testing for methicillin resistance was performed using the cefoxitin disc diffusion method recommended by the Clinical and Laboratory Standard Institute (CLSI, 2010). The isolates were considered methicillin resistant if zone of inhibition was 10 mm or less. Antibiogram was performed by modified Kirby Bauer Disc Diffusion method as per CLSI Standards against the following antibiotics- penicillin (10 units), amikacin (30μg), vancomycin (30μg),

gentamicin (10μg), ampicillin (10μg), cefuroxime (30μg), cefotaxime (3μg), chloramphenicol (30 μg), erythromycin (15μg), oxacillin (1.0μg), co-trimoxazole (1.25/23.75 μg), clindamycin (2μg) and ofloxacin (10μg).

Results and Discussion

Out of 2200 samples received 232 *Staphylococcus aureus* were isolated. 74 (31.89%) out of 232 were found to be MRSA. The maximum isolation of MRSA was from pus and swabs. The number and percentage of isolation of MRSA from different clinical specimens are given in (Table 1).

The drug resistance patterns of MRSA isolated from clinical specimens and carrier screening samples were found to be highly variable. Almost all the 74 MRSA strains (98.9%) screened from clinical specimens were resistant to penicillin, 94.8% to ampicillin, 68.4% to co-trimoxazole, 58.8% to gentamicin, 61.2% to cephalexin and 67.8% to erythromycin. However, all (100%) MRSA strains recorded sensitivity to vancomycin, which was followed by 96.2% to linezolid. In general, 68.2% of MRSA strains were proved to be multidrug resistant. Higher percentage of intermediate resistance was noted against antibiotics such as erythromycin, ofloxacin, amikacin, cephotaxime and ciprofloxacin (Table 2).

The important reservoirs of MRSA in hospitals/institutions are infected or colonized patients and transient hand carriage on the hands of health care workers is the predominant mode for patient-to-patient transmission. *S. aureus* continues to cause skin and soft tissue infections (SSTI) in the community as well as invasive infections in the hospitalized patients. In a recent Europe-wide survey, the most

common organisms in SSTIs were *S. aureus* (71% cases) with 22.5 per cent being MRSA. The proportion of MRSA varied among countries ranging from 0.4 per cent in Sweden to 48.4 per cent in Belgium (Sader *et al.,* 2010). In the present study prevalence was seen highest in pus (35.2%)

& swabs (33.8%) samples. Similar observation was made by Mehta, who in his study on control of MRSA in a tertiary care center, had reported an isolation rate of 33% from pus and wound swabs (Mehta *et al.,* 1998).

Table.1 Number of MRSA isolated from different samples

Sample	No of Staph aureus	No of MRSA	Percentage
Pus	88	31	35.2%
Swab	71	24	33.8%
Blood	36	9	25%
Sputum	24	7	29.1%
Urine	8	2	25%
Body fluids	5	1	20%

Table.2 Percentage of drug resistance to various antibacterial agents

Drug	Percentage of resistance
Penicillin	98.9%
Ampicillin	94.8%
Co-trimoxazole	68.4%
Gentamicin	58.8%
Cephalexin	61.2%
Erythromicin	67.8%
Vancomycin	0%
Linezolid	3.8%
Ofloxacin	49.2%
Amikacin	38.8%
Cephotaxime	52.6%
Ciprofloxacin	54.8%

In the present study all the strains showed susceptibility to vancomycin and most of them were susceptible to linezolid. All the strains were resistant to penicillin and most of them were resistant to ampicillin. The resistance for cephotaxime was 52.6%. Resistance to quinolones like Ciprofloxacin and ofloxacin were 54.8% and 49.2% respectively. This is probably due to the indiscriminate and empirical use of these drugs. The resistance in our study is relatively less than those of Udaya *et al.*

(1997) (95.8%) and Mehta *et al.* (1998) (68%). Vancomycin is considered inferior to β-lactams for the treatment of MSSA bacteraemia and endocarditis (Liu *et al.,* 2011).

Therefore, the first-generation cephalosporins are the drugs of choice for the treatment of MSSA infections in patients who are unable to tolerate antistaphylococcal penicillins. De-escalation of vancomycin to β-lactams should be

encouraged in all cases of MSSA. Vancomycin which showed 100% sensitivity and so may be used as the reserved drug of choice for treating multidrug-resistant MRSA infections. Vancomycin is not a commonly prescribed drug, which is almost certainly due to the higher price of the antibiotic and its unavailability in many parts of the country.

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