

Prevalence and Sensitivity Pattern of Methicillin Resistant *Staphylococcus aureus* in a Tertiary Care Hospital in Jaipur

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Abstract

Original Research Article

Antimicrobial resistance (AMR) is a growing global health problem. *Staphylococcus aureus* is a commonest bacterium associated with community acquired and nosocomial infections. Methicillin resistant strains are increasingly being reported worldwide. In this study, we determined the prevalence and antimicrobial susceptibility pattern of Methicillin resistant *Staphylococcus aureus* (MRSA), isolated from various clinical specimens from a tertiary care hospital. The study comprised of 545 strains of *Staphylococcus aureus* isolated from various clinical specimens using standard microbiological procedures. From these isolates, methicillin resistant strains were screened, and their antimicrobial susceptibility pattern was detected according to CLSI 2020 guidelines. Out of 545 strains a total of 358 Strains were found to be methicillin resistant. In this study all MRSA strains were Vancomycin sensitive and majority of the MRSA strains were linezolid susceptible. However, Vancomycin intermediate and Linezolid resistant strains has been reported in some studies, but not found in our study.

Keywords: MRSA, prevalence, antibiotic susceptibility, Cefoxitin disc, Hand hygiene.

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INTRODUCTION

Gram positive bacteraemia especially by *Staphylococcus aureus* is an important cause of morbidity and mortality among hospitalized patients. Due to increased frequency of invasive surgery, increased use of intravascular devices and increased number of immune-compromised patients, the incidence of *Staphylococcus* bacteraemia have been rising sharply [1]. MRSA has been implicated in serious skin infections, necrotizing fasciitis, deep tissue abscesses, and their hematogenous spread can result in bone and joint infections, sepsis and endocarditis [2].

MRSA has become a prime nosocomial pathogen for patients in hospitals and nursing homes now days. Moreover, community-acquired MRSA (CAMRSA) infections are on the rise; the transmission of MRSA from the community beyond acute care hospital environments is receiving more attention [3-5].

Methicillin resistance is due to harboring of *mec-A* gene, resulting in synthesis of an altered penicillin binding protein (PBP)- 2a by the organism having low affinity for β -lactam antibiotics. The

prevalence of MRSA strains has increased worldwide. Till late eighties, this organism was reported mostly from hospital settings but after that more and more reports started emerging from community settings. These strains were reclassified as community-associated MRSA (CA-MRSA) strains, spreading in general population with or without exposure to the health care environment [6-8].

The incriminating factors for emergence of MRSA include carriage of MRSA in nose, axilla, perineum and hands of patients and health care workers (HCWs), longer hospital stay, irrational use of antibiotics, presence of indwelling devices like catheter and cannulas, immunosuppression, elderly age, insulin-requiring diabetes and decubitus ulcers etc [9].

MRSA can be detected by Phenotypic and Genotypic methods. Phenotypic detection methods include Cefoxitin Disc Diffusion, Oxacillin Disc Diffusion (ODD), and Oxacillin Screen Agar (OSA) etc. Genotypic method is the polymerase chain reaction (PCR) based method for detecting *mec* gene which remains the gold standard for MRSA [10]. Phenotypic

methods in comparison to Genotypic methods are widely available, cost effective, easier to perform and interpret, but less discriminatory. Whereas genotypic methods are expensive, technically demanding, more precise.

Because of resistance to all the β lactam antibiotics, there are limited therapeutic options for MRSA infections, Glycopeptide (Vancomycin) being the drugs of choice, but recently resistance to these drugs has also emerged in various parts of the country [11, 12]. The knowledge of prevalence of MRSA and their antimicrobial susceptibility pattern is a must for appropriate treatment of these infections.

The present study was conducted to know the prevalence of MRSA which will further help in formulating antibiotic policy and implementation of antimicrobial stewardship programme.

MATERIAL AND METHODS

A study was conducted for a period of six months from February 2021 to July 2021.

Sample Collection and Processing

Staphylococcus aureus isolated from various clinical specimens like pus, urine, sputum, blood, vaginal swab, body fluids etc. were included in the study. All the specimens were collected aseptically in sterile containers and were inoculated on Blood agar,

MacConkey agar and Nutrient agar plates and incubated aerobically at 37 °C for 24 – 48 hours. The isolates were identified as *Staphylococcus aureus* by colony characteristics, gram stain and standard biochemical tests (catalase test, mannitol fermentation, slide coagulase and tube coagulase test).

The isolates were subjected to Antibiotic Susceptibility testing using Kirby Bauer disc diffusion method and for Vancomycin, Vancomycin screening agar method as per CLSI 2020 guidelines. The various antibiotics tested were: Ampicillin, Cefoxitin, Gentamicin, Ciprofloxacin, Cotrimoxazole, Teicoplanin, Linezolid, and Vancomycin. Zone diameters were measured using CLSI criteria. *Staphylococcus aureus* ATCC 25923 was used as a standard control strain. Methicillin Resistance of isolates were tested by using Cefoxitin (30 μ g) Disk Diffusion method.

RESULT AND DISCUSSION

A total of 545 *Staphylococcus aureus* were isolated from different clinical samples. Blood accounted for the maximum number of the isolates, followed by pus, urine, respiratory samples. Overall prevalence of MRSA in the present study was (65.8%). In our study all MRSA were sensitive to Vancomycin. Maximum resistance was observed against Ciprofloxacin (68.2%), Ampicillin (46.6%), Gentamicin (35.7%) and Co-trimoxazole (27.6%).

Table-1: Resistance of MRSA to individual antimicrobial agents

Antibiotic	Sensitive (number)	Sensitive (percentage)	Resistant (number)	Resistant (percentage)
Ampicillin	191	53.3	167	46.6
Cefoxitin	0	0	358	100
Ciprofloxacin	114	31.8	244	68.2
Cotrimoxazole	259	72.3	99	27.6
Gentamicin	244	68.1	128	35.7
Linezolid	354	98.8	4	1.1
Teicoplanin	343	95.8	15	4.1
Vancomycin	358	100	0	0

The present study showed an alarmingly high prevalence (65.8%) of MRSA infections. Such high prevalence rates have also been reported in various studies conducted by Tiwari *et al.* [12] (59.3%), Hussian *et al.* [13] (66.25%) and Venkata *et al.* [14] (75.27%). Lower prevalence has been reported by Vijayamohan *et al.* [15] (22.2%), Pai *et al.* [16] (29.1%) and Rajadurai pandi *et al.* [17] (31.1%). This variation in prevalence of MRSA might be because of various factors like infection control practices, health care facilities and variation in usage of antibiotics in different hospitals.

Vancomycin is a drug of choice for infections caused by MRSA. In present study, all MRSA strains were susceptible to Vancomycin. Similar result was

obtained by Abbas *et al.* [18]. In the present study, isolated MRSA strains sensitivity to Linezolid was found to be (98.8%) this is in accordance with study Abbas *et al.* [18] and Arora *et al.* [19].

In our study maximum resistance was observed against Ciprofloxacin (68.2%), Ampicillin (46.6%) Gentamicin (35.7%) and Co-trimoxazole (27.6%). These results are in accordance with study conducted by Rajkumar *et al.* [20] Abbas *et al.* [18] reported about (52.73%) of MRSA isolates were resistant to Ciprofloxacin, (37.81%) to Gentamicin, (29.35%) to Cotrimoxazole.

CONCLUSION

Multidrug resistant strains of MRSA are increasing day by day. This is a subject of concern in the present therapeutic scenario especially in the developing countries. Phenotypic methods of detection of MRSA are preferred for identification; genotypic methods are used as gold standards to confirm the infection. Hence, continuous surveillance of prevalence of MRSA infections and their antibiotic susceptibility pattern is important to further prevention of this spread. To control the spread of such strains among the patient, basic hygiene measures like hand washing and hand sanitization must be followed strictly. Currently, re-evaluation of existing infection control practices, implementation of more effective practices (screening of MRSA carriers, isolation of patients, colonised healthcare workers, and environmental decontamination, among others) should suffice.

In lieu of the upcoming rise of multi drug resistance *Staphylococcus aureus*, emerging vancomycin intermediate and resistant and Linezolid resistant strains, there should be close monitoring of antimicrobial susceptibility pattern of MRSA strains with special reference to vancomycin and linezolid and these drugs should be used judiciously.

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