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Prevalence of MRSA in Clinical Samples and their Antibiotic Sensitivity Pattern

J.V. Sathish and Mita D. Wadekar*

Department of Microbiology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka, India
**Corresponding author*

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A B S T R A C T

Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important nosocomial and community pathogen. The objectives of this study were to estimate the prevalence of MRSA in clinical specimens and to detect the sensitivity pattern of these strains against various antibiotics used for treating hospitalized and out patients. Strains were identified using standard procedures, and their sensitivity pattern was done on Mueller Hinton agar by Kirby Bauer disc diffusion method. Among 103 isolates of *S. aureus*, 49 (47.5) were methicillin-resistant. Maximum sensitivity was seen with vancomycin 14(100%), linezolid 14(100%), amikacin 44(89.7%), chloramphenicol 44(89.7%) and tetracycline 41(83.6). Antibiotics other than vancomycin can be used as anti-MRSA agents after a sensitivity test so as to preclude the emergence of resistance to it and that prevailing problems in chemotherapy will escalate unless indiscriminate and irrational usage of antibiotics is checked.

Introduction

Staphylococci are the normal inhabitants of human skin and mucous membranes. *Staphylococci* play a role in bacteremia, endocarditis, urinary tract infections, surgical site infections, and so on (Trivedi *et al.*, 2015). Infections caused by *Staphylococcus aureus* have a poorer prognosis when the infecting strain is MRSA (Hare Krishna Tiwari *et al.*, 2008). First MRSA isolates were detected in the hospital settings in the early 1960 (Neetu Peedikayil John *et al.*, 2014). Methicillin-resistant *Staphylococcus aureus* (MRSA) strains are resistant to a large group of antibiotics called beta-lactams, including penicillins and cephalosporins (Seyed Mohsen Mahdiyoun *et al.*, 2016). They are also known as oxacillin-resistant *Staphylococcus aureus* (ORSA) and multiple-resistant *Staphylococcus aureus* (Islam *et al.*, 2008). Methicillin resistance is caused by the acquisition of a *mecA* gene. This produces an alternative penicillin-binding protein 2a (PBP2a), which has lower affinity for β-lactam antibiotics (Hamid *et al.*, 2017).

It was once thought to be primarily a hospital-associated pathogen; however, a clone of MRSA—predominantly, strain type USA300—has emerged in the community. Community-associated (CA) methicillin-

resistant (MRSA) infection is increasingly common in outpatient clinics and emergency departments (Popovich *et al.,* 2008). Community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) was first reported in Western Australia in the early 1990s from indigenous peoples living in remote areas (Geoffrey W. Coombs *et al.,* 2006). These have increased the disease burden in general population with or without exposure to the health care environment. Beside this, prolonged hospitalization, use of invasive medical devices, healthcare workers, suppressed immune system, prolonged use of antimicrobials, living in crowded or unsanitary conditions are some risk factors for MRSA infection (Ankur Goyal *et al.,* 2013). Nasal colonization with MRSA is a significant risk factor for hospital acquired infections (Sachin Sharma *et al.,* 2011). Although both CA-MRSA hospital-associated (HA) - MRSA are resistant to commonly used anti-staphylococcal beta-lactam antibiotics, the former is usually susceptible to a wider spectrum of antimicrobial agents such as sulphonamides, trimethoprim, tetracycline and clindamycin. However HA-MRSA is resistant to these drugs and susceptible only to vancomycin (Kunsang Bhutia *et al.,* 2012). MRSA are usually treated with vancomycin, a toxic and relatively expensive antibiotic (Tamer Essawi *et al.,* 1998). With wide spread use of vancomycin as a treatment option also increases the problem of vancomycin resistant *Staphylococcus aureus* (VRSA) (Wadekar *et al.,* 2015).

Control of MRSA hospital infection requires the facility to distinguish different strains. Typing methods currently used to differentiate MRSA strains include antibiogram and resistogram typing, phage typing, plasmid DNA analysis, total cellular DNA analysis (often followed by Southern hybridisation), electrophoretic protein typing and immunob1otting. Other methods used are multilocus enzyme electrophoresis, capsular serotyping and biotyping (Rossney *et al.,* 1994). Antibiogram typing has been successfully used for screening of epidemic strains (Nancy Younis Omar *et al.,* 2014). It appears that the widespread and indiscriminate use of antibiotics without prescriptions in the developing countries has rendered the commonly used antibiotics completely ineffective against treatment of *S. aureus*.

Early detection of MRSA and formulation of effective antibiotic policy in tertiary care hospitals is very important from the epidemiological point. The antibiogram of MRSA is also important to select appropriate empirical antibiotic therapy in critically ill patients. Hence, this study was conducted to know the prevalence of MRSA in clinical samples and its antibiogram.

Materials and Methods

A retrospective analysis of *S. aureus* isolates isolated at Subbaiah institute of medical scinces, Shimoga was performed. The sex and age of patients, the organism isolated and the antimicrobial susceptibility patterns were collected from the registration records. The data was then analyzed by entering into Excel. As the study was based on secondary data there were no ethical issues.

A total of 103 strains of *S. aureus* were isolated from various samples. The samples were inoculated onto blood and MacConkey agar plates and incubated aerobically at 37^{o}C for 18-24 hrs. The isolates were identified by standard procedures (Collee *et al.,* 2007).

Antibiotic sensitivity was done on Mueller Hinton agar by Kirby Bauer disc diffusion method using Clinical and Laboratory Standard Institute guidelines (CLSI, 2017). Antibiotic discs used were: Ampicillin

(10µg), Gentamicin (10µg), Amikacin (30µg), Ciprofloxacin (5µg), Cotrimoxazole (1.25µg /23.75µg), Erythromycin (5µg), Clindamycin (2µg), Chloramphenicol (30µg), Tetracycline (30µg), Linezolid (30µg), Vancomycin (30µg).

Methicillin resistance was detected by Cefoxitin disk diffusion test. Lawn culture was done onto Mueller–Hinton agar plate. A 30 µg cefoxitin disc was placed and incubated at 37°C for 24 hrs. The zone of inhibition of *S. aureus*–□21mm was considered as methicillin resistant.

Results and Discussion

Total of 103 *S. aureus* isolates from clinical samples were studied. Of which 9 isolates were from blood sample, 20 from urine and 72 were from pus sample.

MRSA was detected in 49 (47.5) isolates of *S. aureus* (Table 1). Maximum sensitivity was seen with vancomycin 14(100%), linezolid 14(100%), amikacin 44(89.7%), chloramphenicol 44(89.7%) and tetracycline 41(83.6) and less sensitivity to ampicillin 2(4%), gentamicin 30(61.2%), ciprofloxacin 22(44.8%), cotrimoxazole 20(40.8%), erythromycin 18(36.7%) and clindamycin 29(59.1%). Methicillin-resistant *Staphylococcus aureus* (MRSA) has been an infection control problem ever since it was first discovered (Weller, 2000). Concerns over the emergence of this pathogen has caused many hospital laboratories to reassess their ability to identify antibiogram patterns and epidemiological shifts, determine appropriate laboratory testing, and review empiric therapy guidelines (Toni Beavers-May *et al.*, 2004). In this study, prevalence of MRSA was 47.5% which correlated with studies done by Kunsang Bhutia *et al.*, (2012) and Lakshmi *et al.*, (2015). 100% sensitivity was seen with vancomycin and linezolid which is similar to study done by Abbas *et al.*, (2015). Most isolates were resistant to ampicillin, gentamicin, ciprofloxacin, cotrimoxazole, erythromycin and clindamycin. Similar resistance was seen with study done by Oliveira *et al.*, (2001). The higher prevalence of resistance to antimicrobial agents could be due to widespread, indiscriminate use of antibiotics (Table 2). The formulation and implementation of drug policy are fundamental to ensure rational drug use. Proper use of drugs has to be promoted by providing objective information and training (Alsaimary, 2012).

Table.1 Number of MRSA producers

Organism	MRSA No. (%)
S.aureus n-103	49 (47.5)

Table.2 Antibiotic susceptibility pattern of MRSA producers

Antibiotics										
A No. (%)	G No. (%)	AK No. (%)	CIP No. (%)	COT No. (%)	E No. (%)	CD No. (%)	C No. (%)	TE No. (%)	LZ No. (%)	VA No. (%)
2(4)	30(61.2)	44(89.7)	22(44.8)	20(40.8)	18(36.7)	29(59.1)	44(89.7)	41(83.6)	49(100)	49(100)

A – Ampicillin, G – Gentamicin, AK – Amikacin, CIP – Ciprofloxacin, COT – Cotrimoxozole, E – Erythromycin, CD - Clindamycin, C – Chloramphenicol, TE – Tetracycline, LZ – Linezolid, VA - Vancomycin

Recent studies indicate that disc diffusion test using cefoxitin is far superior to most of the currently recommended phenotypic methods like oxacillin disc diffusion. It has been reported as surrogate marker of *mecA* gene, gives clearer end points, easier to read and is more reproducible than tests with Oxacillin disk diffusion. Thus cefoxitin is now an accepted method for detecting MRSA with high efficiency and has been used as an alternative to PCR in resource constrained areas (Blessing Ike *et al.,* 2016). The resistance capability of MRSA isolates to various antimicrobials may be located either on chromosomes, plasmids or transposons (Chibuike Ibe *et al.,* 2014). Approximately 20-30% of healthy persons are persistent carriers of *S. aureus* and 60% are intermittent carriers with high colonization rates among risk groups including hospital patients, children's and jail inmates (Tekalign Kejela *et al.,* 2013). Surveillance for MRSA and eradication of the carrier state reduces the rate of MRSA (Sarika Gupta *et al.,* 2015).

In conclusion, Antibiogram pattern of MRSA varies in different geographical areas. Therefore, the choice of antibiotic for the treatment of infections caused by MRSA should be guided by the antibiotic susceptibility test of the isolate and or current antibiotic policy. The data on the antibiotic susceptible pattern of common bacterial pathogens should be made available to the clinicians. Also antibiotics other than vancomycin like amikacin can be used as anti-MRSA agents after a sensitivity test.

References

Abbas A, Nirwan PS, Srivastava P. 2015. 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. Community Acquir Infect, 2:13-5.

Ankur Goyal, Manish Kumar Diwakar, Suneel Bhooshan, Sapna Goyal, Arti Agrawal. 2013. Prevalence and Antimicrobial Susceptibility Pattern of Methicillin-resistant *Staphylococcus aureus* [MRSA] isolates at a Tertiary Care Hospital in Agra, North India – A systemic annual review. Journal of Dental and Medical Sciences, 11(6): 80-84.

A. S. Rossney, D. C. Coleman and C. T. Keane. 1994. Antibiogram-resistogram typing scheme for methicillin resistant *Staphylococcus aureus.* J. Med. Microbiol., 41: 430-440.

Blessing Ike *et al.,* 2016. Prevalence, Antibiogram and Molecular Characterization of Comunity-Acquired Methicillin-Resistant *Staphylococcus aureus* in AWKA, Anambra Nigeria. *The Open Microbiology Journal,* 10: 211-221.

Chibuike Ibe, Reginald Azu Onyeagba. 2014. Antibiotic Resistance Patterns and Plasmid Profiles of Methicillin Resistant *Staphylococcus aureus* Isolates from Human Samples. *British Microbiology Research Journal,* 4(2): 185-194.

Clinical Laboratory Standards Institutes (CLSI). 2017. Performance Standards for antimicrobial susceptibility testing, XXI International Supplement (M100-S27). Wayne, Pennsylvania, USA: National Committee for Clinical Laboratory Standards.

Geoffrey W. Coombs *et al.,* 2006. Methicillin-resistant *Staphylococcus aureus* Clones, Western Australia. Emerging Infectious Diseases, 12(2): 241-247.

Geraldo A. Oliveira, Juarez B. Faria, Carlos E. Levy and Elsa M. Mamizuka. 2001.

Characterization of the Brazilian Endemic Clone of Methicillin-Resistant *Staphylococcus aureus* (MRSA) from Hospitals throughout Brazil. The Brazilian Journal of Infectious Diseases, 5(4):163-170.

Hamid S, Bhat MA, Mir IA, Taku A, Badroo GA, Nazki S, Malik A. 2017. Phenotypic and genotypic characterization of methicillin-resistant *Staphylococcus aureus* from bovine mastitis, *Veterinary World*, 10(3): 363-367.

Hare Krishna Tiwari, Darshan Sapkota, Malaya Ranjan Sen. 2008. High prevalence of multidrug-resistant MRSA in a tertiary care hospital of northern India. Infection and Drug Resistance, 1: 57–61.

Ihsan E.A. Alsaimary. 2012. Antibiogram and multidrug resistance patterns of *Staphylococcus aureus* (MDRSA) associated with post-operative wound infections in Basrah – Iraq. Medical Journal of Islamic World Academy of Sciences, 20(2): 57-66.

J.G. Collee, Barrie P. Marmion, AG Fraser, A. Simmons. 2007. Mackie and McCartney Practical Medical Microbiology, 14thed. Edinburgh: Churchill Livingstone.

Kyle J. Popovich, Robert A. Weinstein, and Bala Hota. 2008. Are Community-Associated Methicillin-Resistant *Staphylococcus aureus* (MRSA) Strains Replacing Traditional Nosocomial MRSA Strains? Clinical Infectious Diseases, 46:787–94.

M. A. Islam, M. M. Alam, M. E. Choudhury, N. Kobayashi and M. U. Ahmed. 2008. Determination of minimum inhibitory concentration (MIC) of cloxacillin for selected isolates of methicillin-resistant *Staphylococcus aureus* (MRSA) with their antibiogram. *Bangl. J. Vet. Med.* 6 (1): 121–126.

Mita D. Wadekar, Mallikarjun Naganath and D. Venkatesha. 2015. Detection of ESBL, MBL and MRSA among Isolates of Chronic Osteomyelitis and their Antibiogram. *Int.J.Curr.Microbiol.App.Sci*, 4(10): 289-295.

Nancy Younis Omar, Hala Abdel Salam Ali, Reem Abdel Hameed Harfoush, and Engy Hamdy El Khayat. 2014. Molecular Typing of Methicillin Resistant *Staphylococcus aureus* Clinical isolates on the Basis of Protein A and Coagulase Gene Polymorphisms. International Journal of Microbiology, 1-11.

Neetu Peedikayil John and Sevanan Murugan. 2014. Biofilm formation by methicillin resistant *Staphylococcus aureus* and their antibiotic susceptibility pattern: An in vitro study. Current research in bacteriology, 7(1): 1-11.

N. Lakshmi, Ramalakshmi Koripella, Jayalaxmi Manem, Perala Balamurali Krishna. 2015. Bacteriological profile and Antibiogram of Burn wound infections in a tertiary care hospital. Journal of Dental and Medical Sciences, 14(10):01-04.

O. Kunsang Bhutia, T.S.K. Singh. 2012. Occurrence and Antimicrobial Susceptibility Pattern of Community and Hospital associated Methicillin resistant *Staphylococcus aureus* strains in Sikkim. JIMSA, 25(4): 235-237.

Sachin Sharma and Anju Mall. 2011. The prevalence, antibiogram and characterization of methicillin resistant *Staphylococcus aureus* among the patients from the Doon Valley hospitals. African Journal of Microbiology Research, 5(21): 3446-3451.

Sarika Gupta, Aman Dongre, Anshuja Charvi Pandey, Rajesh Biswas and Saksham Gupta. 2015. Antibiogram of methicillin resistant *Staphylococcus aureus* (MRSA) in healthcare settings. Journal

of Chemical and Pharmaceutical Research, 7(8):61-66.

Seyed Mohsen Mahdiyoun, Hossein Kazemian, Mohammad Ahanjan, Hamidreza Houri, and Mehdi Goudarzi. 2016. Frequency of Aminoglycoside-Resistance Genes in Methicillin-Resistant *Staphylococcus aureus* (MRSA) Isolates from Hospitalized Patients. Jundishapur J Microbiol., 9(8):e35052.

Tamer Essawi *et al.*, 1998. Molecular, antibiogram and serological typing of *Staphylococcus aureus* isolates recovered from Al-Makased hospital in East Jerusalem. Tropical Medicine and International Health, 3(7): 576-583.

Tekalign Kejela and Ketema Bacha. 2013. Prevalence and antibiotic susceptibility pattern of methicillin-resistant *Staphylococcus aureus* (MRSA) among primary school children and prisoners in Jimma Town, Southwest Ethiopia. Annals of Clinical Microbiology and Antimicrobials, 12:11.

Toni Beavers-May and Richard F. Jacobs. 2004. Clinical and Laboratory Issues in Community-acquired MRSA. J Pediatr Pharmacol Ther, 9(2): 82-88.

Trivedi MB, Vegad M, Soni S. 2015. Prevalence of methicillin-resistant *Staphylococcus aureus* in various clinical samples in a tertiary-care hospital. Int J Med Sci Public Health, 4:1735-1738.

T. M. A. Weller. 2000. Methicillin-resistant *Staphylococcus aureus* typing methods: which should be the international standard? Journal of Hospital Infection, 44: 160–172.

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