



PREVALENCE AND ANTIBIOGRAM OF METHICILLIN RESISTANCE
STAPHYLOCOCCUS AUREUS AT A TERTIARY CARE HOSPITAL IN JAIPUR,
RAJASTHAN.



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Abstract

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Aim: The aim of this study is to report the prevalence and antibiotic susceptibility of methicillin resistance *Staphylococcus aureus* in a tertiary care hospital, Jaipur, Rajasthan. **Materials and methods:** The study was conducted during February 2011 to March 2012 and the bacterial isolates from various clinical samples were cultured as per standard protocol and all 195 isolates of *S. aureus* obtained were included in the study. The antibiotic susceptibility test was performed by Kirby Bauer disc diffusion method as recommended by CLSI. The isolates were tested for methicillin resistance by oxacillin (1µg) disc diffusion method. **Results:** During a period of one year study, the prevalence of MRSA was found to be 46 (23.59%). High resistance to penicillin, erythromycin, cephalexin, norfloxacin and ciprofloxacin was observed, however low resistance to antibiotics amikacin, clindamycin, azithromycin and, gentamycin had been observed. 38 (82.6%) MRSA strains were observed to multidrug resistant (MDR). All 46 MRSA and 149 MSSA strain were sensitive to Vancomycin and Linezolid. **Conclusion:** The most effective way to prevent MRSA infections is by doing continuous surveillance of antibiotic resistance profiles of local *S. aureus* isolates to formulate antibiotic policies. This may also help in preventing the spread of multidrug resistant strains.

INTRODUCTION

Staphylococcus aureus has emerged as one of the most important human pathogens and has over the past several decades, been a leading cause of hospital and community-acquired infections. It is associated with a variety of clinical infections including septicemia, pneumonia, wound sepsis, septic arthritis, osteomyelitis and post-surgical toxic shock syndrome with substantial rates of morbidity and mortality.¹

Methicillin-resistant *S. aureus* (MRSA) was first observed in 1961 after methicillin was introduced into clinical use in 1960. The mechanism of resistance to methicillin was uncovered in 1981. Methicillin resistance occurs due to the presence of the altered penicillin-binding protein PBP2a which is encoded by the *mecA* gene.

The determination of prevalence and antibiotic sensitivity pattern of MRSA will help the treating clinicians for first line treatment in referral hospitals.² MRSA is difficult to eradicate as they are multidrug resistant leaving glycopeptides as the drug of choice.³

The reported rate of MRSA prevalence is alarming. Given the ability of MRSA to spread from person to person, it is necessary to adhere to rational use of antibiotics and to raise awareness among the concerned communities.⁴

MATERIALS AND METHODS

A total number of 195 *S. aureus* strains were isolated from different clinical specimens such as pus, blood, sputum, throat swabs, body fluids, urine, stool, etc., and were identified as per conventional methods.⁵ The specimens were collected from different clinical specialties of a NIMS hospital, Jaipur from February 2011 to March 2012. Antibiotic sensitivity test was performed by Kirby Bauer disc diffusion method for following antibiotics: penicillin (10 units), oxacillin (1µg), erythromycin (15 µg), azithromycin (µg), cephalexin (30µg), ciprofloxacin (5µg), gentamycin (10µg), amikacin (30µg), clindamycin (µg), vacomycin (30µg), linezolid (30µg), norfloxacin (30µg), and nitrofurantoin (300µg) (Hi Media Mumbai). Norfloxacin was used only in urine and stool samples and nitrofurantoin was used only in urine samples, while erythromycin, azithromycin

and clindamycin were not put up in these samples.

Methicillin resistance was detected by oxacillin (1µg) disc diffusion test on separate Mueller Hinton Agar (MHA) (Hi Media, Mumbai) plate supplemented with 4% NaCl. The antibiotic susceptibility test was performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines.

RESULTS

The prevalence of MRSA was 46 (23.59%). Of 77 *S. aureus* strains isolated from pus and wound swabs and 36 *S. aureus* isolated from blood cultures, 21 (27.27%) & 6 (17%) were found to be MRSA respectively. Of 35 urine samples 8 (22.86%), of 24 *S. aureus* strains isolated from respiratory tract 4 (16.67%), of 7 *S. aureus* strains isolated from body fluid 3 (42.86%) and 16 strains isolated from stool 4 (25%) were MRSA. The distribution pattern of 195 *S. aureus* strains from various specimens is shown in Table 1. Antibiotic sensitivity pattern of all the isolates and comparison between MRSA and MSSA is shown in Table 2 and 3.

We isolated 87 (44.62%) *S. aureus* strains from out patient department (OPD), 93

(47.69%) from wards and 15 (7.6%) from intensive care unit (ICU). Of 46 MRSA, 24 (52.17%) MRSA strains were isolated from wards and 9 (19.57%) strains from ICU. 13 (28.26%) MRSA were isolated from OPD. Of 149 MSSA, 74 (49.66%) were isolated from OPD, 69 (46.31%) from wards and 6 (4.03%) from ICU.

All 46 MRSA strains were resistant to penicillin. Resistance to erythromycin, azithromycin, cephalixin, ciprofloxacin, gentamycin, amikacin and clindamycin was 26 (76.47%), 13 (38.24%), 29 (63.04%), 32 (69.57%), 19 (41.3%), 11 (23.91%), and 9 (26.47%), respectively. All 46 MRSA and 149 MSSA strain were sensitive to Vancomycin and Linezolid. All MRSA strains isolated from urine and stool samples were resistant to norfloxacin.

38 (82.6%) MRSA strains were observed to be resistant to ≥ 3 drug other than penicillin and were considered as multidrug resistant (MDR). 2 MRSA strains were resistant to 8 antibiotics, 2 to seven antibiotics, 6 to 6 antibiotics, 12 to 5 antibiotics, 9 to 4 antibiotics, 7 to three, 6 to two and 1 to one antibiotic (excluding penicillin). All MRSA

strains were found to be sensitive to vancomycin and linezolid.

DISCUSSION

The prevalence rate of MRSA was found to be 23.59% in the present study which is in accordance with other studies 23%, 23.6%, 26.14% and 29.1%.^{6,7,8,9} On the contrary other studies have reported alarmingly high incidence of MRSA prevalence in various parts of country ranging from 40.6% to 54.85% to 69.1%.^{10, 11, 12} The variation may be due to different detection methods, efficacy of infection control practices and antibiotic usage that vary from hospital to hospital.

MRSA strains were more resistant to all antibiotics than MSSA strains except for vancomycin and linezolid. MRSA strains are often multidrug resistance. In our study the prevalence of MDR strains among MRSA was found to be quite high (82.6%). In various other reports from other part of countries, such strains has ranged from 22% to 63.6%, TO 73%.^{13, 2, 14} In studies from

Nepal, MDR MRSA was reported to be 40.1%, to 72.1%.^{4, 15}

Our study shows high resistance to penicillin, erythromycin, cephalexin, norfloxacin, ciprofloxacin. Similar resistance has also been reported by other studies.^{4, 1, 14, 9} However, low resistance to antibiotics amikacin, clindamycin, azithromycin and, gentamycin had been observed which is in accordance with other studies.^{9,16} Thus, our study reports that antibiotics such as amikacin, clindamycin, azithromycin and gentamycin can be promising if susceptibility testing is done, reserving vancomycin for life threatening infection.

The marked difference between antibiogram of MRSA and MSSA isolates calls for routine testing of methicillin resistance. The most effective way to prevent MRSA infections is by doing continuous surveillance of antibiotic resistance profiles of local *S. aureus* isolates to formulate antibiotic policies and effective infection control practices.

Table 1

Distribution pattern of *S. aureus* and MRSA from different clinical samples

Site	Total No. of <i>S. aureus</i>	MRSA	
		No.	%age
Pus	77	21	27.27
Blood	36	6	16.67
Urine	35	8	22.86
Respiratory Tract	24	4	16.67
Stool	16	4	25
Body Fluid	7	3	42.86
Total No.	195	46	23.59

Table 2

Antibiogram of *Staphylococcus aureus* strains

Antibiotic	<i>S. aureus</i>		
	Total No.	Sensitive	%age
Penicillin G	195	35	17.95
Oxacillin	195	149	76.41
Erythromycin	144	62	43.06
Azithromycin	144	107	74.31
Cephalexin	195	117	60

Ciprofloxacin	195	114	58.46
Gentamycin	195	168	86.15
Amikacin	195	179	91.79
Clindamycin	144	130	90.28
Norfloxacin	51	13	25.49
Nitrofurantoin	35	33	94.29
Amoxyclav	195	134	68.72
Linezolid	195	195	100
Vancomycin	195	195	100

Table 3

Resistance of MRSA and MSSA strains to individual antimicrobial agents

Antibiotic	MRSA			MSSA		
	Total No.	Resistance	%age	Total No.	Resistance	%age
Penicillin G	46	46	100	149	114	76.51
Oxacillin	46	46	100	149	0	0
Erythromycin	34	26	76.47	110	56	50.9
Azithromycin	34	13	38.24	110	24	21.82
Cephalexin	46	29	63.04	149	59	39.6

Ciprofloxacin	46	32	69.57	149	49	32.89
Gentamycin	46	19	41.3	149	8	5.37
Amikacin	46	11	23.91	149	5	3.35
Clindamycin	34	9	26.47	110	5	4.55
Norfloxacin	12	12	100	39	26	66.67
Nitrofurantoin	8	0	0	27	2	7.41
Amoxyclav	46	25	45.65	149	36	24.16
Linezolid	46	0	0	149	0	0
Vancomycin	46	0	0	149	0	0

REFERENCES

1. Akindele A.A., Adewuyi I.K., Adefioye O.A., Adedokun S.A. and Olaolu AO: Antibiogram and Beta-Lactamase Production of Staphylococcus aureus Isolates from Different Human Clinical Specimens in a Tertiary Health Institution in Ile-Ife, Nigeria : American-Eurasian Journal of Scientific Research 2010; 5 (4): 230-233.
2. Rajadurai pandi K, Mani KR, Panneerselvam K, Mani M, Bhaskar M and Manikandan P: Prevalence and antimicrobial susceptibility pattern of methicillin resistant staphylococcus aureus: A multicentre study: Indian Journal of Medical Microbiology, 2006; 24 (1): 34-8.
3. Paterson DL and Bonomo RA: Extended-spectrum b-lactamases: a clinical update. Clin Microbiol Rev 2005; 18: 657-86.
4. Tiwari HK, Das AK, Sapkota D, Sivarajan K and Pahwa: Methicillin resistant Staphylococcus aureus: prevalence and antibiogram in a tertiary care hospital in western Nepal: 2009; 3(9 J Infect Dev Ctries):681-684.

5. Washington CWJr, Stephen DA, William MJ, Gram positive cocci. In: *Koneman's Color Atlas and Textbook of Diagnostic Microbiology*. 6th edn. Philadelphia: Lippincott Williams & Williams, 2006; 623–71.
6. Sachin Sharma and Anju Mall: The prevalence, antibiogram and characterization of methicillin resistant *Staphylococcus aureus* among the patients from the Doon Valley hospitals. *African Journal of Microbiology Research* Vol. 5(21), pp. 3446-3451, 9 October, 2011 ISSN 1996-0808 ©2011 Academic Journals.
7. Mazumdar D, Bordoloi JS, Phukan AC and Mahanta J: Antimicrobial susceptibility pattern among methicillin resistance *staphylococcus* isolates in Assam. *Indian Journal Medical Microbiolo* 2001; 19: 138-40.
8. Kumari N, Mohapatra TM and Singh Y: Prevalence of Methicillin-Resistant *Staphylococcus aureus* (MRSA) in a Tertiary-Care Hospital in Eastern Nepal: *JNMA*. 2008; 47(2).
9. Pai V, Rao VI and Rao SP: Prevalence and antimicrobial susceptibility pattern of methicillin-resistant *Staphylococcus aureus* [MRSA] isolates at a tertiary care hospital in Mangalore, South India. *J Lab Physicians* 2010; 2: 82-4.
10. Muralidharan S: Special article on methicillin resistance *staphylococcus aureus*. *J Acad Clin Microbiol* 2009; 11: 15-6.
- 5.
11. Anuprabha S, Sen MR, Nath G, Sharma BM, Gulati AK and Mahopatra TM: Prevalence of methicillin resistance *staphylococcus aureus* in a tertiary referral hospital in eastern Uttar Pradesh. *Indian Journal Medical Microbiol* 2003; 21: 49-51.
12. . Hare Krishna Tiwari and Malay Ranjan Sen: Emergence of vancomycin resistant *Staphylococcus aureus* (VRSA) from a tertiary care hospital from northern part of India. *BMC Infectious Diseases* 2006, 6:156doi:10.1186/1471-2334-6-156.
13. Mallick SK and Basak S: MRSA – too many hurdles to overcome: a study from Central India: *Trop Doct* 2010; 40: 108-110.
14. Arora S, Devi P, Arora U and Devi V: Prevalence of methicillin resistance *staphylococcus aureus* in a tertiary care

hospital in Northern India. *Journal of Lab Physicians* 2010; 2 (2): 78-81.

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

16. S. Kumar, N. M. Joseph, J.M. Easow, R. Singh, S. Umadevi, S. Pramodhini, S. Srirangaraj and G.K.Kumari: Prevalence and Current Antibiogram of Staphylococci isolated from various clinical specimens in a tertiary care hospital in Pondicherry. *The Internet Journal of Microbiology*. 2012; 10 (1).