ORIGINAL RESEARCH PAPER

Volume-7 | Issue-6 | June-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PREVALENCE AND ANTIBIOGRAM OF HOSPITAL ACQUIRED MRSA AND COMMUNITY ACQUIRED MRSA WITH SPECIAL REFERENCE TO INDUCIBLE CLINDAMYCIN RESISTANCE IN PATIENTS ATTENDING A TERTIARY CARE HOSPITAL: A CROSS SECTIONAL STUDY

Microbiology

Mr. Surendra Prashad Chauhan Tutor, Department of Microbiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai.

Dr. Khyati Jain* Assistant Professor, Department of Microbiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai. *Corresponding Author

Md. Mustafa Sofiur Rahman Tutor, Department of Microbiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai.

Dr. Smita Bawankar Associate Professor, Department of Microbiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai.

ABSTRACT

BACKGROUND: The multitudes of health ailments methicillin resistant Staphylococcus aureus (MRSA) inflict on human's remains a major issue worldwide. Knowing epidemiology of hospital acquired and community acquired MRSA along with rate of inducible Clindamycin resistance is important for deciding empirical treatment in case of MRSA infection.

AIM: To know prevalence and antibiogram of hospital acquired MRSA (HA-MRSA) and community acquired MRSA (CA-MRSA) and to determine rate of inducible Clindamycin resistance among MRSA isolates.

METHODS: A cross sectional study done in Department of Microbiology, Shri Shankaracharya Medical College, Bhilai; from 2017 to 2018. Processing of sample was done by standard protocol and antibiotic sensitivity test was done according to CSLI guidelines. MRSA was detected by using cefoxitin disc and inducible Clindamycin resistance was detected by using D-test. HA-MRSA and CA-MRSA were differentiated by asking history of patient.

RESULTS: Prevalence of MRSA in our study was 35.5% among S.aureus. Among MRSA prevalence of HA-MRSA was 64.7%. D-test positivity in MRSA was 22.53%. HA-MRSA isolates were more antibiotic resistant than CA-MRSA.

CONCLUSION: Formulation of treatment protocol should be done by periodic surveillance of MRSA in hospital because of their changing pattern of antimicrobial resistance. D-test should be routinely done for deciding treatment.

KEYWORDS

MRSA, HA-MRSA, CA-MRSA, D-test, antibiogram

INTRODUCTION:

Staphylococcal infections especially those caused by MRSA have significantly increased the morbidity and mortality in both the community and hospital settings.[1,2,3] MRSA, which was first isolated in UK in 1961, has now spread worldwide.[4] Once MRSA was considered to be prevalent in hospitals, has now implicated as established cause of morbidity in community as well.[5] In 1980 first case of a CA-MRSA infection in the United States was reported.[6] Advances in control of infections have not completely eradicated this problem because of development of drug resistance .[7] The spread of MRSA can occur by casual contact with fomites or carrier of MRSA making study of its epidemiology important.[8] It commonly spread from the hands of someone who has MRSA.[9] In India, various studies has reported high prevalence of MRSA ranging from 30-70% [10-11]. Recently the carrier state of CA-MRSA also found among the community.[12-13] High prevalence of community associated MRSA has increased the challenge for treating physician in selecting empirical antimicrobial on outpatient basis.

Emergence of CA-MRSA has led to resurgence in interest for Clindamycin [Macrolide- Lincosamide- Streptogramin B (MLS_B)], but possibility of emergence of Clindamycin resistance has discouraged some clinician from prescribing it. MLS resistance is of three phenotypes: resistant to both erythromycin and Clindamycin (constitutive), resistant to erythromycin but sensitive to Clindamycin (MS phenotype) and flattening of Clindamycin zone adjacent to erythromycin disk ($iMLS_B$).[14] Simple D-test can be used to detect inducible Clindamycin ($iMLS_B$) resistance.[15]

Periodic surveillance of *S aureus* is mandatory because of its changing pattern of resistance and formulation of protocol for treatment accordingly. This formed the basis of our study on prevalence and antibiogram of hospital acquired MRSA and community acquired MRSA along with inducible Clindamycin resistance at our hospital.

MATERIALS AND METHODS:

Study place: The study was carried out in the department of Microbiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai.

Study design: cross sectional study

Study period: 01 July 2017 to 31 Dec 2018 (6 months)

Selection of patients and processing of sample: All the samples coming in microbiology lab were processed according to standard microbiological procedure.[16] 200 *S. aureus* were isolated from the various clinical samples such as sputum, urine, blood, exudate/pus, and cerebrospinal fluid (CSF) on culture in our microbiology laboratory during the study period were included in study. Duplicate isolates collected were excluded from the study.

Antibiotic sensitivity test: The *Staphylococcus aureus* isolates were subjected to an antibiotic sensitivity testing by the Kirby Bauer disk diffusion method and interpretated according to CSLI guidelines. Penicillin (10 µg), amoxicillin (10 µg), amoxicillin+clavulanic acid (10 µg), Cotrimoxazole (25 µg), Chloramphenicol (30µg), Clindamycin (2µg), erythromycin (15µg), vancomycin (30µg), ciprofloxacin (5 µg), ofloxacin (5µg), levofloxacin (5 µg), linezolid (30µg), Netilmicin (30 mcg), gentamicin (10 µg) and tetracycline (30µg) were used to study the susceptibility patterns of the isolates.[17]

Detection of MRSA: Detection of Methicillin resistant *Staphylococcus aureus* was done using cefoxitin 30 µg. Those isolates showed zone of inhibition ≤21 mm considered as MRSA.[17]

All 200 patients showing *Staphylococcus aureus* in culture report were reevaluated at time of dispensing of report to categorize them in HA-MRSA or CA-MRSA.

Case definition:[18]

Hospital acquired-MRSA: 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.

Community acquired-MRSA:

The Community acquired MRSA occurs in individuals in the community, who were not receiving healthcare in a hospital or on an

ongoing outpatient basis. If an infection occurs among the inpatients with an MRSA isolate earlier than 48 hours of hospitalization, are also considered as CA-MRSA.

Detection of Clindamycin resistance: The double-disk diffusion test (D-test) was done on all MRSA isolates whose antimicrobial susceptibility patterns were erythromycin resistant and Clindamycin susceptible. The test was used to estimate the proportion of iMLSB resistance.[19]

Statistics: Data was entered in excel sheet. And epi info version 7.2 was used for analysis.

RESULTS:

Within the 6-month study period, out of 200 *staphylococcus aureus* isolates, 71(35.5%) were MRSA. Among total 71 MRSA, 46 met the definition of HA-MRSA infections and the rest; 25patients were classified as CA-MRSA. Overall prevalence of HA-MRSA and CA-MRSA was 23% and 12.5% among *staphylococcus aureus* isolates. The basic demographics of the MRSA patients are shown in Table 1.

TABLE-1: Demographic profile of HA-MRSA and CA-MRSA:

Characteristics(N)	HA-MRSA	CA-MRSA	Total MRSA N=71 (%)
Gender (200) (total no. of S.aureus studied)			
Male (126)	29	16	45/126 (35.71)
Female (74)	17	09	26/71 (35.13)
Age group in years (total no. of S.aureus)			
0-20 (35)	4	2	6/35 (17.14)
11-40 (89)	23	16	39/89 (42.82)
21-60 (51)	16	4	20/51 (39.21)
>60 (25)	3	3	6/25 (24)

From the table 1, it can be inferred that prevalence in male and female was almost same and working age group was more affected than others.

TABLE-2: Prevalence of MRSA including HA-MRSA and CA-MRSA:

Number (n=200)	MRSA	MSSA	HA-MRSA	CA-MRSA
Total	71	129	46/200	25/200
Percentage	35.5	64.5	23	12.5

From the table 2, it can be seen that, HA-MRSA was more than CA-MRSA.

TABLE-3: HA-MRSA and CA-MRSA, by infection type:

Infection type	HA-MRSA(%)	CA-MRSA(%)
Skin/ soft tissue	18 (39.13)	19 (76)
Otitis media/ externa	01 (2.17)	3 (12)
Blood stream	04 (8.69)	1 (4)
Urinary tract	03 (6.52)	1 (4)
Respiratory tract	11 (23.91)	1 (4)
Others	9 (19.56)	-
Total	46	25

From the Table 3, it can be seen that, both HA-MRSA and CA-MRSA were common in skin and soft tissue infections. HA-MRSA was more common than CA-MRSA in respiratory infection and CA-MRSA was more common than HA-MRSA in ear infections.

TABLE-4: Antimicrobial resistance pattern of HA-MRSA and CA-MRSA isolates:

Antimicrobial	HA-MRSA (N=46)(%)	CA-MRSA (N=25)(%)
Penicillin (10 mcg)	46 (100)	25 (100)
Amoxicillin (10 mcg)	46 (100)	25 (100)
Amoxicillin-clavulanic acid (10 mcg)	46 (100)	25 (100)
Erythromycin (15 mcg)	29 (63.04)	13 (52)
Clindamycin (2 mcg)	24 (52.17)	8 (32)
Cotrimoxazole (25 mcg)	27 (58.69)	11 (44)
Chloramphenicol (30 mcg)	11 (23.91)	2 (8)
Tetracycline (30 mcg)	6 (13.04)	1 (4)
Ciprofloxacin (5 mcg)	28 (60.86)	13 (52)
Ofloxacin (5 mcg)	13 (28.26)	6 (24)
Levofloxacin (5 mcg)	16 (34.78)	3 (12)
Netilmicin (30 mcg)	5 (10.86)	1 (4)
Vancomycin (30 mcg)	00	00
Gentamicin (10 mcg)	21 (45.65)	4 (16)
Linezolid (30 mcg)	00	00

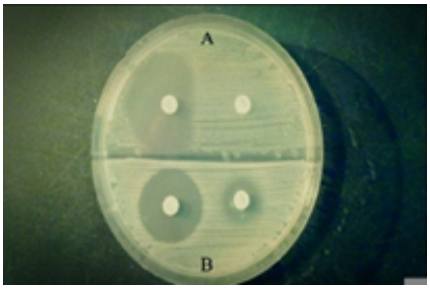
From table 4 , it can be inferred that both HA-MRSA and CA-MRSA were 100% sensitive to vancomycin and linezolid; and are 100% resistant to penicillin, amoxicillin and amoxicillin –clavulanic acid. CA-MRSA isolates were more sensitive than HA-MRSA isolates.

TABLE-5: D-test to detect inducible Clindamycin resistance in HA-MRSA and CA-MRSA:

	D-test positive(%)	D-test negative(%)
HA-MRSA	14 (63.63)	8 (36.36)
CA-MRSA	2 (15.38)	11 (84.61)
Total	16(22.53)	19

From table 5, it can be concluded that, the overall D test positivity in MRSA isolates was 22.53% (16/71).Among the HA-MRSA strains, 52.17% (24/46) showed constitutive resistance (resistant to both erythromycin and clindamycin), 47.82% (22/46) showed MS phenotype (resistant to erythromycin and sensitive to clindamycin), and 30.43% (14/46) showed iMLSB resistance (blunting of clindamycin zone adjacent to erythromycin disk). Among the CA-MRSA isolates, 8% (2/25) exhibited iMLSB resistance and32% (8/25),52%(13/25) of the strains showed constitutive resistance and MS phenotype respectively. Therefore inducible Clindamycin resistance is more common in HA-MRSA than CA-MRSA (30.43% VS 8%). Even constitutive and MS phenotypes were more common in HA-MRSA than CA-MRSA.

IMAGE 1: Image showing D-test A. D-test positive; B. D-test negative



DISCUSSION:

Alarming prevalence of MRSA in our study(35.5%) , is comparable with two different studies done by Dixit et al.(2017) and Wankhade AB et al(2017)in durg.[20,21]Other studies done in different regions of India shows different prevalence rate ranging from 30 to 70%.[10,11] This difference in resistance pattern in various studies is may due to the differential clonal expansion of drug pressure in the community.[3] In our study, HA-MRSA (64.78%) were more common than CA-MRSA(35.21%), which is similar to study done by Naimi et al. who showed prevalence of HA-MRSA and CA-MRSA to be 85% and 12% respectively.[13] High CA-MRSA increased the challenge of selecting treatment in outpatient settings which can be overcome by making antibiotic policy according to local epidemiological and antibiogram data.

In our study, distribution of MRSA was almost same in males and female. In our study, working age group have higher MRSA which is comparable to study done by abbas et al.[6] This may be due to higher contact of males with surrounding and individuals with MRSA carriage owing to their outdoor activity. In our study, MRSA were

more common in skin and soft tissue infections which is same as reported in some studies done world over.[2,22]

Antibiogram of HA-MRSA and CA-MRSA in our study showed that HA-MRSA isolates were more resistant than CA-MRSA which is similar to some studies done world over.[23,24] All HA and CA-MRSA isolates were resistant to penicillin, amoxicillin and amoxicillin-clavulanic acid and sensitive to Vancomycin and linezolid. Abbas et al. also reported similar results.[6] HA-MRSA strains were more resistant to erythromycin, Clindamycin, Cotrimoxazole, Chloramphenicol, tetracycline, ciprofloxacin,ofloxacin, levofloxacin, netlimicin and gentamicin than CA-MRSA. HA-MRSA and CA-MRSA were considerably sensitive to chloramphinicol, tetracycline, which are oral and inexpensive drugs. According to our findings, CA-MRSA were sensitive to several non-beta lactam drugs but were resistant to macrolides, which indicates that vancomycin and linezolid can be reserved and used as alternative when empirical treatment with other antibiotics fails.

In our study, HA-MRSA showed more $iMLS_B$ than CA-MRSA, which is consistent with study done by Saikia et al.[25] our study showed higher $iMLS_B$ resistance in MRSA strains. This may be because of selection pressure due to overuse of antibiotic. The results indicate that the D-test to identify $iMLS_B$ strains should be routinely done to prevent therapeutic failure.

Higher prevalence of resistance in *Staphylococcus aureus* isolates in our study leads to conclusion that a working knowledge of the most likely causative organism and the prevailing antibiotic sensitivity resistance pattern is necessary to decide antibiotic to be used.[26] Our findings strongly prompt future study on epidemiological mapping of MRSA in this area.

CONCLUSION:

Expanding rate of CA-MRSA along with HA-MRSA indicates importance of regular monitoring of prevalence and antibiogram of MRSA in our area and making antibiotic policy accordingly. Proper awareness of public about hand washing and proper use of antibiotics is mandatory.

LIMITATION OF STUDY:

Due to limited resources, our study does not involve genotyping which is required for comprehensive understanding of epidemiology and evolution of MRSA in hospital and community.

REFERENCES:

1. Tiwari HK, Das AK, Sapkota D, Kunjukunju S, Pahwa VK. Methicillin resistant *Staphylococcus aureus*: Prevalence and antibiogram in a tertiary care hospital in Western Nepal. J Infect Dev Ctries 2009;3:681 4.
2. Tiwari HK, Sapkota D, Sen MR. High prevalence of multidrug resistant MRSA in a tertiary care hospital of northern India. J Infect Drug Resist 2008;1:57-61.
3. Khyati Jain, Nilesh Shyam Chavan, S.M. Jain. Bacteriological profile of post-surgicalwound infection alongwith special reference to MRSA in central india, indore*Int J IntgMed Sci 2014;1(1):9-13.*
4. Jevons, M. 1961. "Celbenin"-resistant staphylococci. Br. Med. J. 1:124–125.
5. von Eiff, C., et al., *New England Journal of Medicine, 2001.* 344(1): p. 11-16.
6. Abbas A, Nirwan PS, Srivastava P. 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 2015;2:13-5.
7. Anguzu JR, Olila D. Drug sensitivity patterns of bacterial isolates from septic post-operative wounds in a regional referral hospital in Uganda. Afr Health Sci. 2007; 7(3):148-154.
8. Jain K, Chavan NS, and Jain SM. Blood Pressure Cuff - As a Fomite for cross infection. *Int.J.Curr.Microbiol.App.Sci* (2014) 3(6) 755-758
9. Craven D E, Reed C, Kollisch N, DeMaria A, Lichtenberg D, Shen K. et al., 1981. A large outbreak of infections caused by a strain of Staphylococcus aureus resistant to oxacillin and aminoglycosides. Am J Med. 71(1): 53-58.
10. Verma S, Joshi S, Chitnis V, Hemwani N, Chitnis D. 2000. Growing problem of methicillin resistant staphylococcus- Indian scenario. Indian J Med Sci. 54: 535-540.
11. Rajaduraipandi K, Mani K R, Panneerselvam K, Mani M, Bhasker M, Manikandan P. 2006. Prevalence and antimicrobial susceptibility pattern of methicillin resistant Staphylococcus aureus: A multicenter study. Indian J Med Microbiol. 24(1): 34-38.
12. Centers for Disease Control and Prevention. Four pediatric deaths from community-acquired methicillin- resistant Staphylococcus aureus- Minnesota and North Dakota, 1997-1999. Morbidity and Mortality Weekly Report. 1999;48:707-710.
13. Naimi TS, LeDell KH, Como-Sabetti K, et al. Comparison of community and health care- associated methicillin- resistant Staphylococcus aureus infections. The Journal of the American Medical Association. 2003;290(22):2976-2984.
14. Yilmaz G, Aydin K, Iskender S, Caylan R, Koksal I. Detection and prevalence of inducible clindamycin resistance in Staphylococci. J Med Microbiol 2007;56:342-5.
15. Clinical and laboratory standards institute. Performance standards for antimicrobial susceptibility testing; Seventeenth informational supplement. Vol. 27. N. 1. Clinical Laboratory Standards Institute; 2007.
16. Baird D. *Staphylococcus*. Cluster forming gram-positive cocci. Mackie and McCartney Practical Medical Microbiology. 14th ed. 1996. p. 245-58.
17. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Disk Susceptibility Tests. Approved Standard M2-A7. Clinical and Laboratory Standards Institute (CLSI); 2005. p. 768-800.
18. ASM microlibrary (http://www.microbelibrary.org/library/laboratory-test/3656-polymerase-chain-reaction)
19. Siberry, G. K., T. Tekle, K. Carroll, and J. Dick. 2003. Failure of clindamycin treatment of methicillin-resistant Staphylococcus aureus expressing inducible clindamycin resistance in vitro. Clin. Infect. Dis. 37:1257–1260.
20. Dixit NS, Kothari D, Chandrakar KS. Prevalence of Methicillin Resistant Staphylococcus Aurous In Surgical Units of a Tertiary Care Hospital. IJIRMS.2017 02(07):1076-1079.
21. Wankhade AB, Panda S, Hathiwala R. Study of antibiotic resistance profiling of *staphylococcus aureus* isolated from clinical specimens of the patients attending a tertiary teaching hospital from Chhattisgarh. Int J Res Med Sci 2017;5:4808-11.
22. Kumari N, Mohapatra TM, Singh YI. Prevalence of Methicillin Resistant *Staphylococcus aureus* in a tertiary care hospital in Eastern Nepal. J Nepal Med Assoc 2008;47:53-6.
23. Huang H, Flynn NM, King JH, Monchaud C, Morita M, Cohen SH. Comparisons of community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) and hospital-associated MSRA infections in Sacramento, California. J Clin Microbiol 2006;44:2423-7.
24. Vysakh PR, Jeya M. A comparative analysis of community acquired and hospital acquired methicillin resistant *Staphylococcus aureus*. J Clin Diagn Res 2013;7:1339-42.
25. Saikia L, Nath R, Choudhury B, Sarkar M. Prevalence and antimicrobial susceptibility pattern of methicillin resistant *Staphylococcus aureus* in Assam. Indian J Crit Care Med 2009;13:156-8.
26. Siguan SS, Ang BS, Pala IMand ReynaldoM, Baclig. Aerobic surgical infection: A surveillance on microbiological etiology and Antimicrobial sensitivity pattern of commonly used Antibiotics. Phil J Microbiol Infect Dis 1990; 19(1):27-33.