Journal of College of Medical Sciences-Nepal, 2010, Vol. 6, No. 1, 1-6 **Original Article**

Prevalence and antimicrobial susceptibility pattern of methicillin-resistant *Staphylococcus aureus* (MRSA) in CMS-teaching hospital: a preliminary report

R. K. Sanjana [1], Rajesh Shah[2], Navin Chaudhary[2], Y.I. Singh [3]

[1]Assistant Professor, [2]Lecturer, [3]Prof & Head, Dept. of Microbiology, College of Medical Sciences-Teaching Hospital, Bharatpur, Chitwan District, Nepal.

Abstracts

Aims: *Nosocomial infection is a major problem in the world today. Methicillin- resistant Staphylococcus aureus (MRSA) strains, usually resistant to several antibiotics and also intrinsic resistance to ß- lactam antibiotics, shows a particular ability to spread in hospitals and now present in most of the countries. The present study was carried out to investigate the prevalence of MRSA and their rate of resistance to different antistaphylococcal antibiotics.*

Materials and methods*: Between April 2007 and December 2009, the clinical specimens submitted at the microbiology laboratory were processed and all Staphylococcus aureus (S. aureus) isolates were included in this study. All isolates were identified morphologically and biochemically by standard laboratory procedures and antibiotic susceptibility pattern including oxacillin was determined by modified Kirby Bauer disc diffusion method.*

Results: *Out of a total of 348 Staphylococcus aureus strains isolated from various clinical samples, 138 (39.6%) were found to be Methicillin- resistant. Among MRSA isolates, 86(62.3%) were from different inpatient departments, whereas, 52(37.7%) of the isolates were from outpatients. All MRSA were resistant to penicillin. More than 70% of the MRSA strains were resistant to cephalexin, ciprofloxacin and cloxacillin, while less than 10% of them were resistant to azithromycin, amikacin and tetracycline. Many MRSA strains were multidrug resistant. However, no strains were resistant to vancomycin.*

Conclusion: *This preliminary report showed a high prevalence of MRSA in our hospital. To reduce the prevalence of MRSA, regular surveillance of hospital acquired infection and isolation is the need of the hour.*

Key words: *Nosocomial infection, methicillin-resistant Staphylococcus aureus (MRSA), multidrug resistant.*

Correspondence: Dr. R. K. Sanjana

E-mail: Rajkumari_sanjana@yahoo.co.in

Introduction

Staphylococcus aureus is a leading cause of hospital acquired infection (HAI) and over the past 50 years it has acquired resistance to previously effective antimicrobials including the penicillinase resistant ones like methicillin.[1] Today, methicillin resistant *Staphylococcus aureus*(MRSA) has emerged as one of the most important nosocomial pathogens.[2] The percentage of hospitals isolating MRSA in the developed countries has increased from 2% in the 70's to 30% in the 90's.[3] Moreover, half of *S. aureus* in many centres are methicillin resistant(multidrug resistant) posing major therapeutic challenge.[4] MRSA causes more than 50% of HAI and are more virulent than the methicillin sensitive strains.[5,6] Prompt diagnosis of MRSA infection is, therefore, important for patients, health care givers and for epidemiological purposes. Hospital acquired infection (HAI) gives an enormous burden to the health care system significantly affecting the patient's morbidity and mortality. It results in prolongation of hospital stay and hence higher bed occupancy rate with an attendant increase in the cost of hospitalisation.[7,8] Surveillance of MRSA related infections especially in the hospital set up is required and has been doing in the developed countries. Not only that, the magnitude of the problem is yet to be quantified. This study is an attempt to assess the prevalence of methicillin resistant S. *aureus* (MRSA) infection and its antibiotic susceptibility pattern in this hospital.

Materials and methods

This study was based on retrospective data of samples sent from different wards and OPDs of College of Medical Sciences-teaching hospital, Bharatpur. Total strains of 348 *S. aureus* were isolated from pus, urine, sputum, wound swab, aural swab, blood, throat swab and urethral swab during April 2007 and Dec 2009. *S. aureus* was identified by conventional method.[9] The antimicrobial susceptibility test was carried out using Kirby-Bauer's disc diffusion method modified and updated by Clinical and Laboratory Standards Institute guidelines (CLSI).[10] Each of the strain was screened for oxacillin resistance using American Type Culture Collection (ATCC) 43300 as the control. A standard inoculum was prepared by direct colony suspension in and comparing it with 0.5 Mc. Farland turbidity. Using a sterile cotton swab and after removing the excess of the inoculum by pressing against the side of the tube, the suspension was inoculated on a Mueller Hinton Agar medium by lawn culture method all over the surface of the medium. Oxacillin disc (1µg), (HI Media Laboratories, Pvt. Ltd. Mumbai) was applied along with other antimicrobials for testing sensitivity and the plates were examined after an over night incubation at 37 ° C. Zone of inhibition diameter (in mm) were measured and results were interpreted as sensitive, resistant as per recommendation of Clinical and Laboratory Standards Institute guidelines (CLSI). Other antimicrobials tested were chloramphenicol (30µg), tetracycline (30 µg), gentamicin (10µg), erythromycin (15µg), co-trimoxazole (25µg), cephalexin (30µg), ciprofloxacin (5µg), amikacin (30µg), cefotaxime (30µg) and vancomycin (10µg).

Results

Isolation of *Staphylococcus* was maximum in pus samples. Out of the 348 strains of *S. aureus* examined 138 (39.6%) were found to be Methicillin- resistant and of which 86 (62.3%) were from inpatient departments. Amongst them only 9 (10.4%) of the

isolates were from intensive care units (ICU). A total of 52 (37.7%) MRSA strains were from outpatients. Maximum isolation of MRSA was from pus (53.3%), followed by wound swabs (44.4%), sputum (37.5%), aural swabs (33.3%) etc. (Table- 1) shows detection of MRSA in different samples. All the strains of MRSA were found to be resistant to Penicillin. (Table -2) depicts the antibiotic susceptibility data for all the *S. aureus* isolates. Among MRSA, resistance to cephalexin was 81.8%, ciprofloxacin -71.0%, cloxacillin -70.6%, erythromycin -58.0%, gentamicin -38.0%, cefotaxim -31.6%, cotrimoxazole -20.4%, while amikacin, azithromycin and tetracycline were resistant to less than 10% of the MRSA strains. Many MRSA strains were multidrug resistant. No strain was resistant to vancomycin. However, 41.2% of Methicillin sensitive *S. aureus* (MSSA) were resistant to penicillin, 25.7% resistance to cephalexin, 25.4% resistance to ciprofloxacin, 16.6% resistance to cloxacillin, 14.5% resistance to erythromycin, 32.3 % resistance to gentamicin as compared with MRSA. MSSA isolates also revealed higher susceptibility to cefotaxime, cotrimoxazole with a resistance rate of 9.3% and 9.8% of the strains respectively. None of the MSSA was resistant to azithromycin.

Table- 1: Isolation of MRSA from Specimens of outdoor and indoor patients in CMS-teaching hospital, Bharatpur, Nepal

S.No	*Specimens*	*OPD*		*Ward & ICU*		*Total*	
		S. aureus	*MRSA (%)*	*S. aureus*	*MRSA (%)*	*S. aureus*	*MRSA (%)*
1	Pus	60	32 53.33	80	53 66.25	140	85 60.71
2	Urine	20	04 20.00	30	08 26.66	50	12 24.00
3	Wound swab	09	04 44.44	10	06 60.00	19	10 52.63
4	Sputum	08	03 37.50	15	06 20.00	23	09 39.13
5	Aural swab	09	03 33.33	20	06 30.00	29	09 31.03
6	Blood	18	02 11.11	34	03 08.82	52	05 09.61
7	Throat swab	08	02 25.00	12	03 25.00	20	05 25.00
8	CSF	00	00 00	01	00 00	01	00 00
9	Urethral swab	04	01 25.00	03	01 33.33	07	02 28.57
10	Bone cartilage	00	00 00	02	00 00	02	00 00
11	Semen	03	01 33.33	02	00 00	05	01 20.00
	Total	**139**	**52 37.68**	**209**	**86 41.14**	**348**	**138 39.65**

Table- 2: Resistance to individual antimicrobials in MRSA and MSSA isolated in CMS-teaching hospital, Bharatpur,Nepal

S. No	Antimicrobials	MRSA		MSSA		Total	
		Tested	Resistance (%)	Tested	Resistance (%)	Tested	Resistance (%)
1	Penicillin G	126	126 100	189	78 41.25	315	204 64.76
2	Cephalexin	22	18 81.81	69	25 36.23	91	43 47.25
3	Ciprofloxacin	83	59 71.08	138	35 25.36	221	94 42.53
4	Cloxacillin	136	96 70.58	187	80 42.78	323	127 39.31
5	Erythromycin	62	36 58.06	124	18 14.51	186	54 29.03
6	Gentamicin	21	08 38.09	65	21 32.30	86	29 33.72
7	Cefotaxim	57	18 31.57	118	11 09.32	175	29 16.57
8	Co-trimoxazole	44	09 20.45	132	13 09.84	176	22 12.50
9	Ofloxacin	68	12 17.64	154	18 11.68	222	30 13.51
10	Amoxyclav	28	04 14.28	84	07 08.33	112	11 09.82
11	Azithromycin	52	05 09.61	158	00 00	210	08 03.80
12	Amikacin	65	06 09.23	112	07 06.25	177	13 07.34
13	Tetrcyclin	50	04 08.00	59	06 10.16	109	10 09.17
14	Vancomycin	128	00 00	186	00 00	324	00 00

Discussion

MRSA is a global phenomenon with a prevalence rate ranging from 2% in Netherland and Switzerland, to 70% in Japan and Hong Kong.[11, 12] In this study, the prevalence of MRSA was found to be 39.6%. Prevalence of MRSA was higher among inpatients (41.1%) than outpatients (37.4%). This difference could be due to prolonged hospital stay, instrumentation and other invasive procedures. A comparable prevalence rate of 34.7%, 31.0% and 38.5% were also reported from Assam, Tamil Nadu and Delhi[13, 14, 15] whereas, in some studies the rate is comparatively low. In a study in Eastern part of Nepal in Dharan, the rate of MRSA was (26.4%),[16] which was low as compared to this study. In another study in Nagpur the rate of MRSA (19.5%) [17] was also low compared to our study. However, in another study it was very high (80.8%).[18] Analysis from previous studies revealed a relationship between methicillin resistance and

resistance to other antibiotics.[19,20] This study showed that all MRSA isolates were significantly less sensitive to antibiotics as compared with MSSA isolates. Many of the isolates were resistant to commonly used antistaphylococcal agents except vancomycin. Anupurba et al. also observed that 32% of MRSA isolates are resistant to all commonly used antibiotics for *S. aureus* except vancomycin.[21] Because of the resistance of MRSA to all commonly used antibiotics, it is necessary to test newer group of antibiotics such as vancomycin and teicoplanin routinely. Resistance to (cephalexin) was much higher (81.8%) in this study. This is comparable to the study done by Namrata et al. in the eastern part of Nepal who reported the resistant rate to be above (65%).[16] Resistance to quinolones (ciprofloxacin) was also high (71%) in this study . In the study reported by Lahari Sakia et al., the resistant rate was also high (87.5%) in Assam.[13] However, in the same institute, a previous study, in 2001, reported the resistant rate of ciprofloxacin to be only (22.8%).[16] The rapid emergence of ciprofloxacin is probably due to the indiscriminate and empirical use of these drugs. MSSA isolates shows higher susceptibility to penicillin and cloxacillin (100% vs. 41.3%) and (70.6% vs.43.0%) respectively than MRSA strains. The epidemiology of MRSA is gradually changing since its emergence was reported. Initially there were occasional reports but now it has become one of the established hospital acquired pathogen. Moreover, the association of multidrug resistance with MRSA had added to the problem. ß – lactam antibiotics like penicillin and cephalexin resistance were 100% and 81% respectively. Resistance to amino glycosides was more in gentamicin (38%) than amikacin (9.2%) in this study, however, it cannot be recommended for empirical treatment of MRSA associated infections.

Vancomycin seems to be the only antimicrobial agent which showed 100% sensitivity and may be used as the drug of choice for treating multidrug resistant MRSA infections. However, regular monitoring of vancomycin sensitivity and routine testing of other newer glycopeptides like teicoplanin should be carried out. Further, the regular surveillance of hospital associated infections including monitoring antibiotic sensitivity pattern of MRSA and formulation of definite antibiotic policy may be helpful for reducing the incidence of MRSA infection.

Conclusion

This preliminary report showed a high prevalence of MRSA in our hospital. There is a need for surveillance of MRSA and its antimicrobial profile. The hospital infection control policy and guidelines that already exists should be strictly implemented and followed so as to enable the clinicians to deliver better and proper health care to the patients.

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