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Characterization of Methicillin-Resistant *Staphylococcus aureus* in a Tertiary Care Teaching Hospital, South India

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Abstract

S. aureus causes superficial to deep seated infections in human beings. Methicillin-resistant *Staphylococcus arueus* (MRSA) evolved in the 1960s and since then has become a worldwide concern owing to increasing morbidity and mortality in health-care settings and even community. (MRSA) is a resistant variant of *S. aureus* which are resistant to beta-lactum antibiotics and other classes of antimicrobials. Early and accurate detection of MRSA and their antimicrobial susceptibility profile is therefore imperative for the selection of appropriate antimicrobial therapy. A total of 300 isolates of *S. aureus* collected from January 2010 to December 2012 were included in the study. *S. aureus* was characterized based on morphological and biochemical characters. To receive a pure culture, the isolates were grown on mannitol salt agar with supplement 5% v/v egg yolk emulsion. Antibiotic susceptibility testing was carried out on the strains by disc diffusion technique and the results interrupted according to Clinical laboratory standards International (CLSI) guidelines. A significant proportion of the *S. aureus* isolates were obtained from the exudates (226) specimens in all the three years followed by blood (48), urine (16) and respiratory (10). The average resistance seen in the 300 isolates tested was ampicillin (97.2%), cephelaxin (94%), cefotaxime (96.4%), cloxacillin (100%), erythromycin (82.6%), Gentamycin (76.3%), ciprofloxacin (54.4%), clindamycin (40.4%) and linezolid and vancomycin were susceptible for all the strains. In conclusion, the prevalence of MRSA in our health-care setting is 45% among the clinical isolates of *S. aureus*. Active screening and proper infection control procedures need to be adopted to control the MRSA infection.

Keywords: S. aureus; MRSA; Antibiotic susceptibility

Introduction

S. aureus causes a variety of infections ranging from skin and soft tissue infections to invasive diseases such as bacteremia, endocarditis, pneumonia, visceral abscesses, osteoarthritis and septicaemia [1]. Penicillin was the drug of choice for severe staphylococcal infections till the discovery of penicillin resistant strains in the hospital and community settings [2]. The development of beta-lactamase resistant penicillins such as methicillin, oxacillin and cloxacillin in the early 1960s revolutionized the treatment of Staphylococcal infections. But within a year of the introduction of methicillin, methicillin-resistant *Staphylococcus aureus* (MRSA) strains were reported worldwide and in the next few decades MRSA reached an epidemic proportion [3,4].

MRSA, a resistant variant of *S. aureus* is resistant to various classes of antibiotics such as penicillin, methicillin, cephalosporins and the fluroquinolones. It is often referred to as a super-bug. Vancomycin, a Glyocopeptide is the treatment of choice for MRSA infection. In recent times, there is development of vancomycin resistant Staphylococcus aureus (VRSA) strains around the world with highest being reported in USA. In India also, a few cases of VRSA have been reported in health-care settings in the northern and southern states. But most isolates are still susceptible to Oxazolidinones which includes linezolid and polycyclic compounds such as tetracycline and tigecycline [5,6].

Early and accurate detection of MRSA and their antimicrobial susceptibility profile is therefore imperative for the selection of appropriate antimicrobial therapy [7]. The present study was carried out to identify and characterize the MRSA strains and determine their prevalence in our health-care setting.

S. aureus strains were isolated from various specimens such as blood, exudates (pus, wound swabs, ear swabs and body fluids) respiratory and urine from January 2010 to December 2012. *Staphylococcus aureus* were characterized by their morphology on Gram staining, growth characteristics on blood agar and chocolate agar. Biochemical characterization was determined by catalase production, coagulase (slide and tube), mannitol fermentation and urease activity.

To receive a pure culture, the isolates were grown on mannitol salt agar with supplement 5% v/v egg yolk emulsion.

A total of 300 clinically significant isolates of S. aureus were included in the study. Antibiotic susceptibility testing was carried out on the strains by disc diffusion technique and the results interrupted according to Clinical laboratory standards International (CLSI) guidelines with quality controls ATCC 25923 (MSSA) and ATCC 43300 (MRSA). The antimicrobials tested included ampicillin (10 µg), cephalexin (30 µg), cefotaxime (30 µg), cloxacillin (5 µg), gentamycin (10 µg), erythromycin (30 µg), clindamycin (30 µg), ciprofloxacin (5 µg), vancomycin (30 µg) and linezolid (30µg).

Antibiotic	2010 (n=100)			2011(n=100)			2012(n=100)			Average	
	R %	%	S	R %	%	S	R %	%	S	Resistant	%
Ampicillin	87(95) 8.4	91.6	8(95)	98(98)	100 0	0(98)	100(100) 0	100	0(100)	95(97.7)	97.2
Cephelaxin	81(93) 13	87.1	12(93)	95(98) 3.1	97	3(98)	87(89) 2.2	97.7	2(89)	87.7 (93.3)	94
Cefotaxime	88(96) 8.3	91.7	8(96)	68(68)	100 0	0(68)	64(64) 0	100	0(64)	73.3 (76)	96.4
Cloxacillin	100(100)	100	0(100)	100(100)	100 0	0(100)	100(100) 0	100	0(100)	100(100)	100
Erythromycin	76(93) 18.3	81.7	17(93)	78(96) 18.7	81.2	18(96)	82(97) 15.5	84.5	15(97)	78.7(95.3)	82.6
Gentamycin	62(90) 31.1	68.9	28(90)	71(100) 29	71	29(100)	87(98) 11.2	88.8	11(98)	73.3(96)	76.3
Ciprofloxacillin	52(91) 42.8	57.1	39(91)	39(97) 59.8	40.2	58(97)	64(97) 34.0	66	33(97)	51.7(95)	54.4
Clindamycin	-	- -	-	24(67) 64.2	35.8	43(67)	41(94) 56.4	43.6	53(94)	32.5(80.5)	40.4
Linezolid	0(100) 100	0	100(100)	0(100)	0 0	100(100)	0(100) 100	0	100(100)	0(100)	0
Vancomycin	0(100) 100	0	100(100)	0(100)	0 0	100(100)	0(100) 100	0	100(100)	0(100)	0

Table 1: Susceptibility to various antibiotics in the three years of sample collection (n=300)

As *S. aureus* can be a colonizer, clinical significance of the isolates were emphasised by correlating the laboratory results with the patient history. A strain was identified as MRSA based on its resistance to cloxacillin in the Muller-Hinton agar plates. Oxacillin (1 μg) is generally used for the detection of MRSA. As oxacillin potency reduces with time, cloxacillin was used for the identification of MRSA. A significant proportion of the S. aureus isolates were obtained from the exudates (226) specimens in all the three years followed by blood (48), urine (16) and respiratory (10). The average resistance seen in the 300 isolates tested was ampicillin (97.2%), cephelaxin (94%), cefotaxime (96.4%), cloxacillin (100%), erythromycin (82.6%), Gentamycin (76.3%), ciprofloxacin (54.4%), clindamycin (40.4%) and linezolid and vancomycin were susceptible for the entire strains (Table 1). In conclusion, the prevalence of MRSA in our health-care setting is 45% among the clinical isolates of S. aureus. Active screening and proper infection control procedures need to be adopted to control the MRSA infection.

References

1. Lowy FD (1998) Staphylococcus aureus infections. N Engl J Med 339: 520-532.
2. Gardam MA (2000) Is methicillin-resistant Staphylococcus aureus an emerging community pathogen? A review of the literature. Can J Infect Dis 11: 202-211.
3. Felton A, Grandry B, Lagrange PH, Casin I (2002) Evaluation of three techniques for detection of low-level resistant Staphylococcus aureus (MRSA): a disk diffusion method with cefoxitin and moxalacatam, the Vitek 2 syatem, and the MRSA Screen latex aggulination test. J Clin Microbiol 40: 2766-2771.
4. Madani TA (2002) Epidemiology and clinical features of methicillin-resistant Staphylococcus aureus in the University Hospital, Jeddah, Saudi Arabia. Can J Infect Dis 13: 245-250.
5. Moreillon P, Que YA, Glauser MP (2005) Staphylococcus aureus (including staphylococcal toxic shock) in Mandell, Doughlas and Bennett's. Principles and practice of infectious disease 6th ed. Churchill Livingstone 2321-2351.
6. Deresinski S (2005) Methicillin-resistant Staphylococcus aureus: an evolutionary, epidemiologic, and therapeutic odyssey. Clin Infect Dis 40: 562-573.
7. Mohanasoundaram KM, Lalitha MK (2008) Comparison of phenotypic versus genotypic methods in the detection of methicillin resistance in Staphylococcus aureus. Indian J Med Res 127: 78-84.