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Prevalence of Methicillin Resistance *Staphylococcus aureus* in Teaching Hospital, Karnataka, India

R. Sharlee[1] and B. Sumangala[2*]

[1]Department of Microbiology, Chamarajnagar Institute Medical Sciences, Chamarajanagar, Karnataka, India
[2]Department of Microbiology, Mandya Institute Medical Sciences, Mandya, Karnataka, India

**Corresponding author*

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A B S T R A C T

Methicillin-resistant *Staphylococcus aureus* (MRSA) is relatively ubiquitous and the cause of community acquired colonization and infections as well as endemic and epidemic nosocomial colonization and infections. Early detection of MRSA and formulation of an effective antibiotic policy, along with infection control in tertiary care hospitals is of paramount importance from an epidemiological viewpoint. Present study was carried out to know the prevalence MRSA infection in teaching hospital located in Karnataka One hundred fifty isolates from clinical samples were processed. Colonies suggestive of *Staphylococcus aureus* were identified as MRSA using Cefoxitin (30µg) discasper Clinical and Laboratory Standards Institute (CLSI) guidelines**.** In our study out of 150 isolates of *Staphylococcus aureus*, 65(43.3%) were MRSA and 85(56.7%) were MSSA. MRSA infections were noticed high in the age group <14 yrs (80%) and have high (67.7%) prevalence among male patients. Different studies show different rate of isolation of MRSA, this might be due to antibiotic policy & antibiotic pressure vary from hospital to hospital, different time period of studies and difference in their location. Difference in the socioeconomic status of study group between hospitals.

Introduction

Staphylococcus aureus is the most clinically significant species of *Staphylococci* has been recognized as an important cause of human disease for more than 100 years.[1] It is one of the pathogens of greatest concern because of its intrinsic virulence factors, its ability to cause diverse array of life threatening infections, it's competency to adapt to different environmental conditions and its nasal carriage, which accounts for possible

spread and re infection.[2] It is one among the top three major potential pathogens responsible for community and hospital acquired infections causing diseases ranging from relatively minor skin and soft tissue infections primarily to life-threatening systemic infections which can be either toxin/non-toxin mediated, leading to high morbidity and mortality throughout the world.[3,4]

Staphyloccus aureus is of increasing risk in the medical community due to the emergence of multiple antibiotic resistances. MRSA strains were first reported in 1961, soon after methicillin entered clinical use.[5]

Outbreaks of infections caused by MRSA were reported soon thereafter in Europe, and by the mid-1970s, MRSA had become a significant problem in the United States.[5]

MRSA strains are critical public health threats because they cause hospital-acquired infections that can be difficult and expensive to treat. Many MRSA strains are susceptible only to vancomycin, and this antibiotic is used extensively to treat patients infected with these organisms.

Hence, there is also concern that MRSA may serve as a reservoir of organisms that may give rise to vancomycin-resistant strains that could not be killed by available antibiotics.[5]

Methicillin-resistant *Staphylococcus aureus* (MRSA) is relatively ubiquitous and the cause of community acquired colonization and infections as well as endemic and epidemic nosocomial colonization and infections.[6]

Early detection of MRSA and formulation of an effective antibiotic policy, along with infection control in tertiary care hospitals is of paramount importance from an epidemiological viewpoint.

Present study was carried out to know the prevalence MRSA infection in teaching hospital located in Karnataka.

Materials and Methods

Study setting

The study was carried in Department of microbiology, Mandya Institute of medical Sciences, Mandya, Karnataka

Study design

Cross sectional study

Study period

January 2017 to December 2017

Sample size

150 Samples

Source of data

All isolates of *Staphylococcus aureus* from various clinical samples like urine, pus, sputum, blood and other body fluid received in microbiology laboratory, Mandya institute of medical science, Mandya.

Method of collection of data

The collected samples were inoculated onto MacConkey agar, Blood agar, Mannitol salt agar &incubated at 37°c for 24-48 hours. Yellow colonies from MSA were sub cultured on Nutrient agar. *Staphylococcus aureus* were identified and confirmed by Catalase test, Gram's staining and Coagulase test (Slide and tube) with respective controls using golden yellow colonies from Nutrient agar.A total of 150 isolates of *Staphylococcus aureus* thus obtained were screened for MRSA.

Antimicrobial susceptibility test

Antibiotic susceptibility testing was performed by Kirby-Bauer disk diffusion method as per CLSI Guidelines. Antimicrobial discs used were Penicillin (10 units), Co-trimoxazole (25µg), Linezolid (30µg),Vancomycin (30µg), Chloramphenicol (30µg), Cefoxitin (30µg), Clindamycin (2µg), Erythromycin (15µg),Tetracycline (30µg), Ciprofloxacin (5µg), Gentamicin (10µg) (Hi media Pvt.Ltd., Mumbai, India).[7]

All the isolates whose Zone diameter less than 21mm for Cefoxitin (30 µg)disc were considered as MRSA and zone diameters greater than 21mm were considered as MSSA as per CLSI guidelines.[7] Linezolid resistance on MRSA was carried out using Kirby-Bauer disk diffusion method, Epsilomer test and Broth micro dilution method as per CLSI guidelines. Zone diameter less than 21mm for linezolid were considered resistant by Kirby-Bauer disk diffusion method.

Statistical analysis

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

Results and Discussion

Table.1 Age wise Distribution of MRSA and MSSA

Age groups	MRSA (%)	MSSA (%)	Total
≤14yrs	8 (80.0)	2 (20.0)	10
15-30yrs	14 (33.3)	28 (66.7)	42
31-60yrs	30 (41.1)	43 (58.9)	73
≥ 60yrs	13 (52.0))	12 (48.0)	25
Total	**65**	**85**	**150**

Above table shows that majority of MRSA isolated were in the age group < 14 yrs showing 80%, followed by age group >60 yrs showing 52%,age group between 31-60yrs showing 41.1 % and least 33.3% between 15-30 yrs.

Table.2 Gender wise distribution of MRSA & MSSA

Gender	MRSA (%)	MSSA (%)	Total
Male	44 (53.0)	39 (47.0)	83
Female	21 (31.3)	46 (68.7)	67
Total	**65**	**85**	**150**

In the present study, 150 *Staphylococcus aureus* were screened for MRSA. Out of 150 isolates, 65 (43.3%) were MRSA and 85 (56.7%) were MSSA. Out of 65 MRSA isolates, males have higher prevalence of 67.7% compared to females showing 32.3%.Out of 85 MSSA isolates, females have higher prevalence of 45.9% compared to males showing 54.1%.

Table.3 Distribution of MRSA and MSSA among the clinical samples

Samples	MRSA (%)	MSSA (%)	Total
Urine	6 (40.0)	9 (60.0)	15
Pus	48 (41.4)	68 (58.6)	116
Sputum	11 (61.1)	7 (38.9)	18
Throat swab	0	1 (100)	01
Total	**65**	**85**	**150**

Out of 150 isolates, 116 (77.3%) were isolated from pus, 18 (12%) from sputum, 15(10%) from urine and 1(0.7%) from throat swab. Out of 65 MRSA, 48 (73.8%) were isolated from pus,11(16.9%) from sputum, 6(9.3%)from urine. Out of 85 MSSA, 68(80%) were isolated from pus, 9(10.6%) from urine, 7(8.2%) from sputum and 1(1.2%) from throat swab.

Table.4 Antibiogram of MRSA isolates

Antibiotics	MRSA(n=65)	
	Sensitive (%)	Resistant (%)
Penicillin-G	-	65(100)
Vancomycin	65(100)	-
Cotrimoxazole	37(56.9)	28(43.1)
Linezolid	65(100)	-
Rifampicin	49(75.4)	16(24.6)
Clindamycin	38(58.5)	27(41.5)
Teicoplanin	65(100)	-
Chloramphenicol	34(52.3)	31(47.7)
Erythromycin	46(70.8)	19(29.2)
Gentamycin	37(57.0)	28(43.0)
Ciprofloaxacin	40(61.5)	25(38.5)
Ofloxacin	30(46.2)	35(53.8)
Nitrofurtion (for urine samples only)	3(50.0)	3(50.0)

Out of 65 MRSA, Penicillin-G shows 100% resistance followed by Ofloxacin 53.8% and Chloramphenicol 47.7%. Vancomycin, Teicoplanin and Linezolid showed 100% sensitivity followed by Rifampicin 75.4%, Erythromycin70.8% and Ciprofloxacin 61.5%.

In our study out of 150 clinical isolates 65(43.3%) were MRSA and 85(56.7%) were MSSA in comparison with the study conducted by Sanjana *et al.*, [8] showing 39.6% MRSA and by kshetry *et al.*, [9] with 37.6%.

Out of 65 MRSA, majority of isolates were isolated from age group less than 14 years

with 80% followed by age group more than 60 years with 52% in comparison with Shakya *et al.,* [10] showing 79% below 14yrs and 48% above 60 yrs.

Similar findings were observed in a study conducted by Rachel J Gorwiz *et al.,* [11]showing72% below 14yrs and 47% above 60 yrs.

This result indicates that the extreme of the ages were more prone to get MRSA infection due to weak immune system. Sharma *et al.,* [12]also noted that extreme of the ages were prone to get MRSA infection. The age group between 30-60 years have52% of prevalence in our study which is comparable to the study conducted by Mehrdad Askarian *et al.,* [13] showing high prevalence in the age group from 30- 50yrs with 62.5%

The age group between 15-30 years shows MRSA prevalence with 33.3% in comparison with the study of Rachel J Gorwiz *et al.,* [11]with 13.3 %.

In the Present study, Out of 83(55.3%) males and 67(44.6%) females screened from 150 isolates, 44(67.7%) MRSA were isolated from males and 21(32.3%) were isolated from females.

In comparison with our study, the study conducted by Nadia aslam *et al.,* [10] shows majority of MRSA were isolated from male patients with 65.2% and female with 34.8%

Similar findings were seen even in the study conducted by Rezvanmoniri *et al.,* [14], which shows male having higer prevalence than female with percent of 61 in male and 39 in female. Mathanraj *et al.,* [15], in his study found that prevalence of MRSA is more in male than the females. They also suggested that, this may also be due to more outdoor activities by males compared to females.

High prevalence were also reported in the study conducted by Hussain *et al.,* [16] showing 66.25%, Sasirekha *et al.,* [17] showing 57.7% MRSA, Tiwari *et al.,* [18] showing 69.1% and Khanal *et al.,* [19]showing 68%.Low prevalence was also noted in the study conducted by Baral *et al.,* [20] showing 26%, Subedi and Brahmadathan *et al.,* [21] showing 15.4%.Different studies show different rate of isolation of MRSA,this might be due to antibiotic policy & antibiotic pressure vary from hospital to hospital, different time period of studies and difference in their location. Difference in the socioeconomic status of study group between hospitals.

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.

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