

Original Research Article

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To Study the Prevalence of Methicillin Resistant *Staphylococcus aureus* (MRSA) Infection and their Antibiotic Susceptibility Pattern in a Tertiary Care Hospital in Jammu

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ABSTRACT

Aim is to note the prevalence and antibiotic susceptibility pattern of MRSA isolates in a tertiary care centre in Jammu. Study was done on 39 coagulase positive *Staphylococcus aureus* isolates isolated from a total of 110 specimens of patients admitted in dermatology section of Govt. Medical College, Jammu from Oct 2018-Nov 2019 (samples taken from various skin lesions). Routine antibiotic susceptibility testing was performed as per Clinical Laboratory Standards Institute (CLSI) guidelines. Methicillin resistance was detected using cefoxitin disc diffusion method as per standard protocols. A total of 28 (71.7 %) strains were found to be Methicillin resistant. Out of 28 MRSA isolates, 24 (85.7 %) were Hospital Acquired MRSA (HA- MRSA) isolates and 4 (14.28 %) were Community Acquired MRSA (CA- MRSA) isolates. Vancomycin resistance was not seen in any of the strain. Due to current rapid spread of MRSA isolates and infection being endemic in India, regular surveillance of MRSA infections and their antibiogram is of paramount importance for reducing prevalence of MRSA infections.

Keywords

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Introduction

Gram positive bacteraemia especially by *Staphylococcus aureus* is an important cause of morbidity and mortality among hospitalized patients. Due to increased number of immune- compromised patients, increased frequency of invasive surgery and increased use of intravascular devices, the incidence of *Staphylococcus* bacteraemia and complications such as endocarditis have been rising sharply⁽¹⁾. MRSA isolates though are

an important cause of hospital acquired infections (HAI), but are now also being encountered with increasing frequency in the community⁽²⁾ and the emergence of CA-MRSA with its ability to cause serious invasive infections is recognised as a major public health concern^(3, 4, 5).

Methicillin resistance in *Staphylococcus aureus* was seen soon after its introduction in October 1960 and MRSA has now become endemic in India. The incidence of MRSA in

India ranges from 30-70%. Resistance in MRSA strains is due to presence of *mecA* gene which encodes a modified (Penicillin binding protein) PBP2a with low affinity for methicillin and all β lactam antibiotics⁽²⁾. A mobile genetic element SCC *mec* (Staphylococcal cassette chromosome) encodes for *mecA* gene. Transfer of this mutant gene to another susceptible strain occurs via horizontal gene transfer⁽⁶⁾. Also, recently a new *mec* gene - *mec C* has been discovered from humans, animals, and food products and this gene has a $\leq 63\%$ similarity with the PBP 2a encoded by *mec A*. Risk factors associated with emergence of MRSA infections include immunosuppression, hemodialysis, advanced age, peripheral malperfusion, residency in long term care facilities, inadequacy of antimicrobial therapy, indwelling devices, among others⁽⁷⁾.

MRSA can be detected by Phenotypic and Genotypic methods. Phenotypic detection methods include culture and sensitivity test, oxacillin disc diffusion (ODD), mannitol salt agar (MSA), oxacillin screen agar (OSA), broth and agar dilution tests etc. Genotypic method is the polymerase chain reaction (PCR) based method for detecting *mecA* gene which remains the gold standard for MRSA⁽⁸⁾. Phenotypic methods in comparison to Genotypic methods are widely available, cost effective, easier to perform and interpret, but less discriminatory. Whereas Genotypic methods are expensive, technically demanding, more precise. Still no consensus has been given on the single best method for MRSA detection.

Because of resistance to all the β lactam antibiotics, there are limited therapeutic options for MRSA infections, Glycopeptides being the drugs of choice, but recently resistance to these drugs has also emerged in various parts of the country^(9,10). Hence, the present study was planned to see the prevalence of MRSA strains in our hospital

and also to identify correct antibiotic susceptibility pattern of these strains so as to prevent the spread of the infections and hence reduce morbidity and mortality caused by these infections.

The main aim of this study includes to study the prevalence of MRSA infection in a tertiary care centre in Jammu and also to identify the antibiotic susceptibility pattern of the detected MRSA isolates

Materials and Methods

The present study was conducted from Oct 2018-Nov 2019 in the Bacteriology Section of Govt. Medical College & Hospital Jammu. Samples from various lesions like pyodermas, simple scars, vesicobullous skin lesions were received from the Dermatology Department, GMC, Jammu. Samples were processed in the laboratory as per Standard Operating Protocols.

Simple and direct Gram staining was done on the specimens and culture was applied to Blood Agar and Mac Conkey agar plates. Plates were then aerobically incubated at 37°C for 24 hours. Next day growth obtained on plates was identified by performing Gram's staining procedure. Out of 110 specimens processed, Gram positive Cocci (GPC) were seen in 39 isolates. These GPC isolates were further identified by standard procedures⁽¹¹⁾ (catalase test, mannitol fermentation, slide coagulase and tube coagulase test). Tube coagulase was taken as the main criteria of identification. Hence, a total of 39 Coagulase positive *Staphylococcus aureus* isolates were identified.

Methicillin Resistance of isolates was tested by using Cefoxitin (30 μ g) Disk Diffusion method. The isolates were subjected to Antibiotic Susceptibility testing using Kirby Bauer disc diffusion method as per CLSI guidelines.

The various antibiotics tested were : Penicillin G, Oxacillin, Cefoxitin, Azithromycin, Ciprofloxacin, Cotrimoxazole, Linezolid, Vancomycin. Oxacillin disc was also placed on a separate Mueller Hinton Agar (MHA) plate supplemented with 4%NaCl. Zone diameters were measured using CLSI criteria. *Staphylococcus aureus* ATCC 25923 was used as a standard control strain.

Results and Discussion

Out of 110 specimens processed, *Staphylococcus aureus* was seen in 39 (35.45%) isolates (Figure 1).

Of the 39 *Staphylococcus aureus* isolates, 28 (71.7%) were found to be MRSA isolates. Further, among 28 MRSA isolates 24 (85.7 %) were HA- MRSA and 4 (14.28%) were CA-MRSA (Figure 2).

MRSA infections are emerging as an important cause of infections in hospitals as well as in the community, thereby causing significant morbidity as well as mortality. These infections are often difficult to treat because of multiple drug resistance, cost of treatment, long term hospitalization, psychological stress⁽⁶⁾.

Table.1 Antibigram of *Staphylococcus aureus* isolates

Antibiotic	Sensitive (number)	Sensitive (percentage)	Resistant (number)	Resistant (percentage)
Penicillin	1	2.56	38	97.4
Oxacillin	1	2.56	38	97.4
Cefoxitin	11	28.2	28	71.79
Azithromycin	10	25.6	29	74.3
Ciprofloxacin	12	30.76	36	92.3
Cotrimoxazole	15	38.4	24	61.5
Doxycycline	17	43.5	22	56.4
Linezolid	38	97.4	1	2.5
Vancomycin	39	100	0	0

Figure.1 Showing total *Staphylococcus aureus* isolates

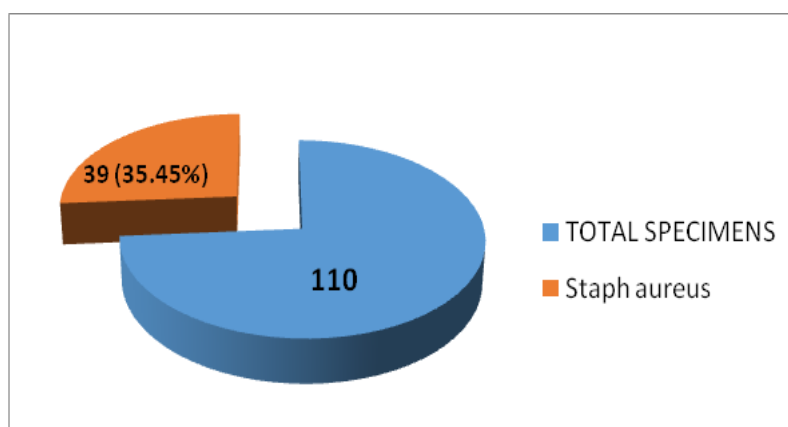
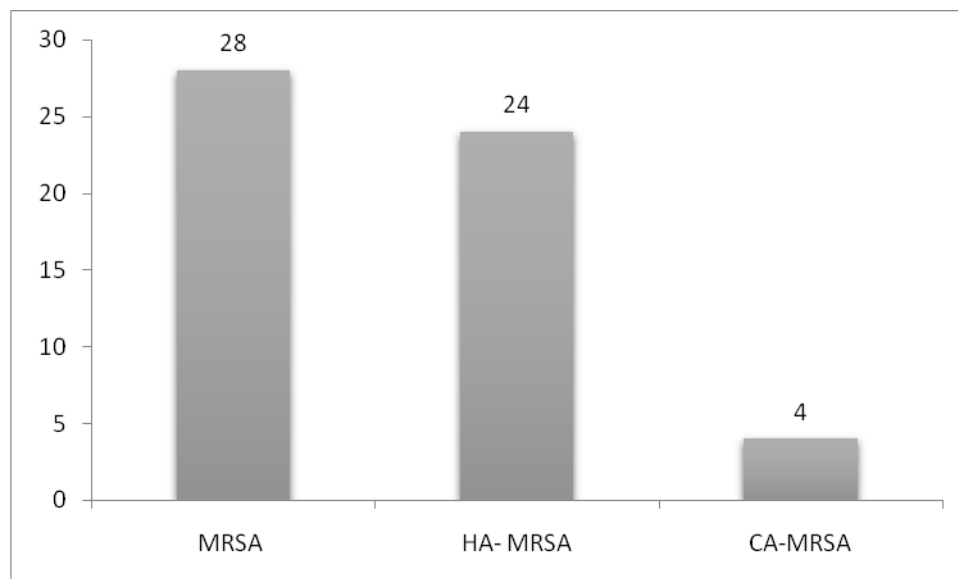


Figure.2 Showing distribution of HA- MRSA and CA- MRSA



The present study showed an alarmingly high prevalence (71.7%) of MRSA infections. Such high prevalence rates have also been reported in various studies ⁽¹²⁾, (40.6%), ⁽¹³⁾, (54.85 %) ⁽¹⁴⁾, (59.3%). However the previous study reported a comparatively low rate of MRSA infection, 31.1% and 23.6% respectively. Such differences in prevalence rates may be variations in usage of antibiotics in different hospitals, efficacy of infection control practices, healthcare facilities.

In our study rate of *Staphylococcus aureus* bacteraemia was 35.45 % while previous studies ⁽¹⁷⁾ ⁽¹⁸⁾ ⁽¹⁹⁾ reported rates of *Staphylococcus aureus* bacteraemia as 19 %, 13.86%, 29 % respectively.

In our study HA- MRSA -24 (85.7 %) outnumbered CA-MRSA isolates- 4 (14.28%). Similar results were seen in previous studies ⁽²⁰⁾ ⁽²¹⁾. Whereas study by ⁽²²⁾ 2013, reported CA-MRSA rate of 74% whereas rate of HA-MRSA was 26%.

In the present study, isolated MRSA strains were 100 % sensitive to Vancomycin, 97.4%

sensitive to Linezolid. This is in accordance with study ⁽²³⁾ 2015 where MRSA strains were 100 % sensitive to Vancomycin and Linezolid. MRSA isolates showed high degree of resistance to Antibiotics like Penicillin, Oxacillin and Ciprofloxacin (95-100 %). This was consistent with study done by Anupurba *et al.*, ⁽²⁴⁾, 2003. Varying resistance was seen with Azithromycin (74.3 %), Cotrimoxazole (61.5 %).

In conclusion, the present study shows that MRSA continues to be an important cause of mortality and morbidity in hospitals as well as in the community. The infections caused by these isolates are often difficult to eradicate because of multiple drug resistance, with Glycopeptides and Linezolid being the mainstay for their treatment. Even though phenotypic methods of detection of MRSA are preferred for species identification, genotypic methods are used as gold standards to confirm the infection. Hence, continuous surveillance of prevalence of MRSA infections and their antibiotic susceptibility pattern is important to prevent the spread of. Also, a proper hospital infection control

policy should be implemented so that clinicians can deliver better and proper health care to the patients.

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