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Original Article

Microbiology Section

Study Of Community Acquired- Methicillin Resistant *Staphylococcus Aureus* (CA-MRSA) Infections and Their Antibiotic Sensitivity Pattern

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ABSTRACT

Aims: Methicillin Resistant *Staphylococcus aureus* (MRSA) is a well recognized major source of nosocomial infections worldwide. Once prevailed in health care setup Hospital Acquired MRSA (HA-MRSA) for more than 40 years, MRSA has migrated to the community in recent years. They are termed as CA-MRSA and significantly differ from HA-MRSA in their anti-biotic sensitivity pattern.

Settings and Design: A prospective study which included 87 subjects attending surgery, dermatology, orthopaedics OPD with ailments like abscesses, carbuncles, osteomylietis and skin infections who fulfilled the criteria of absence of risk factors for MRSA.

Materials and Methods: The sample was cultured in laboratory and identified as *Staphylococcus aureus* and subsequently, as MRSA using standard methods. Antibiotic sensitivity pattern of these MRSA was studied using modified Kirby Bauers Disc Diffusion Method. Antibiotics used were Penicillin, Erythromycin, Vancomycin, linezolid, Clindamycin, Tetracycline, Co-trimoxazole, Ciprofloxacin, Cefoxitin.

Results: Out of total 87 *Staphylococcus aureus* isolates, 22 were CA-MRSA. CA-MRSA was highly susceptible to Linezolid (100%), Clindamycin (100%), Tetracyclin (100%) and Vancomycin (100%), moderately susceptible to Ciprofloxacin(59.09%) and Co-trimoxazole(54.54%) and low to Penicillin(4.54%). The results indicate that Vancomycin, Linezolid, Tetracycline and Clindamycin are to be used as 'Reserve Drugs' for resistant cases.

Conclusion: In the present study we found a high proportion of CA-MRSA infections- 25.29%. Most of the infections were from skin and soft tissues. A high proportion of resistance was found among CA-MRSA isolates. Susceptibility of Co-trimoxazole and ciprofloxacin was much lower than what was previously reported. As significant number of MRSA infections is being acquired from the community, treatment options of *Staphylococcus aureus* infections may need to be reviewed. Effective infection control programs for the community should be considered to prevent the spread of these infections.

Key Words: Community Acquired Methicilline Resistant *Staphylococcus Aureus* (CA-MRSA), Antibiotic Sensitivity, Kirby Bauers Disc Diffusion Method, Skin And Soft Tissues Infections Drug Resistant

INTRODUCTION

Staphylococcus aureus can cause mild skin infections to potentially life threatening infections. Eg-surgical site infections, osteomylietis, bacteraemia etc [1].

Earlier *Staphylococcus aureus* infections were susceptible to every antibiotic.

With the discovery of penicillin in 1928, the infection was controlled for a certain period. But by 1942 *Staphylococcus aureus* species had become resistant to penicillin by producing β-lactamase. In 1959, methicillin was introduced, which could resist β-lactamase. But in 1961, methicillin resistant *Staphylococcus aureus* appeared in UK [1].

Methicillin Resistant *Staphylococcus aureus* (MRSA) is a well organized major cause of nosocomial infections worldwide with more than 50% of *Staphylococcus aureus* isolates resistant to methicillin. Historically, MRSA has been linked to patients in hospital or nursing home settings (HA-MRSA) but outbreaks has been reported among previously healthy members of the community, further increasing awareness of CA-MRSA [2]. Due to its changing epidemiology, CA-MRSA have become a serious problem for clinicians in near future.

There are 3 main factors for the concern of CA-MRSA

- CA-MRSA is the leading cause of skin and soft tissue infections like boils, abscess, furuncles, carbuncles etc. in adults in the community often misdiagnosed as spider bite and this misdiagnosis unnecessarily delays proper treatment of the infection and facilitates its spread.
- CA-MRSA spreads more readily than MRSA.
- CA-MRSA has the potential to spread in a health care setting [1].

CA-MRSA differs from Hospital Acquired Methicillin Resistant *Staphylococcus aureus* (HA-MRSA) in several important ways as shown in following [Table/Fig-1] [3].

HA-MRSA	CA-MRSA
1. Recent health care exposure	No history of health care exposure
2. Skin and soft tissue infections less common	Skin and soft tissue infections more common
3. Antibiotic resistance to many drugs Eg-gentamycin, clindamycin Flouroquinolones	Antibiotic resistance to fewer drugs
4. Resistance genes SCC † mec types I, II, III	Resistance genes SCC †mec types IV, V
5. PVL* toxin gene rare.	*PVL toxin gene common.

[Table/Fig-1]: Difference between HA-MRSA and CA-MRSA

- * PVL- Panton Valentine Leucocidin

† SCC-Staphylococcus Cassette Chromosome

In CA-MRSA, the risk factors for community transmission are:

- Crowding
- Skin to skin contact
- Cuts or abrasions
- Contaminated items and surfaces
- Lack of cleanliness

CA-MRSA has been commonly reported in people who are involved in competitive sports like football, wrestling, fencing etc. or in schools, dormitories, military barracks, prisons and day care centers [1].

CA-MRSA infections are an emerging problem in India and many parts of the world. These infections originate in communities as opposed to HA-MRSA.

In the present study, we will study skin and soft tissue infections caused by CA- MRSA and antibiotic sensitivity pattern of CA-MRSA.

MATERIALS AND METHODS

Sample Size: - n=87

Source Of Data: A prospective study was conducted between July and August 2011 in the Department of Microbiology, Bangalore Medical College and Research Institute, Bangalore, India. After obtaining permission from the Institutional Ethical Committee, pus samples were collected from 87 patients attending surgery OPD, orthopaedics OPD (Victoria and Vanivilas Hospitals) with ailments like abscesses, carbuncles, osteomylietis and skin infections that fulfilled the criteria of absence of risk factors for CA-MRSA.

Inclusion Criteria: Patients who fulfill the criteria of absence of risk factors for CA-MRSA like prior hospitalization, outpatient visit, antibiotic treatment in the past 12 months, chronic illness, intravenous drug use and close contact with health care personnel.

Exclusion Criteria: Hospitalized patients, patients undergoing dialysis, indwelling catheter or percutaneous medical device and history of MRSA infections in recent past.

Study Design: A prospective study was carried out in the Department Of Microbiology, Victoria and Vanivilas Hospital, BMCRI.

For detection of strain of bacteria:

After taking detail history, drained pus samples or a swab from the depth of skin lesion was collected and transported to laboratory within 30 minutes.

In the laboratory, pus or swab was cultured on to 5% sheep blood agar incubated at 37ºC for 24-48 hours.

Growth was identified based on colony morphology, gram staining, catalase and coagulase test.

MRSA was detected using cefoxitin (30µg) as per CLSI guidelines.

For antibiotic sensitivity pattern: Antibiotic sensitivity of these MRSA strains were studied using modified Kirby Bauers disc diffusion method and interpretation was done as per CLSI guidelines. Antibiotics used were Penicillin (10units), Vancomycin (30µg), Linezolid (30µg), Clindamycin (2µg), Tetracycline (30µg), Erythromycin (15µg), Ciprofloxacin (5µg), Co-trimoxazole (1.25/23.75 µg), and Cefoxitin (30µg). Zones of incubation were measured after 24hrs of incubation at 37˚C to the nearest millimeter with a slide gauge.

Statistical Analysis: The study results were entered and processed on a PC using EPI-INFO (for students). Chi-square test was used to assess the statistical significance of the CA-MRSA infections. The variable subjected to the statistical

analysis were age, antibiotic sensitivity pattern and infection sites.

RESULTS

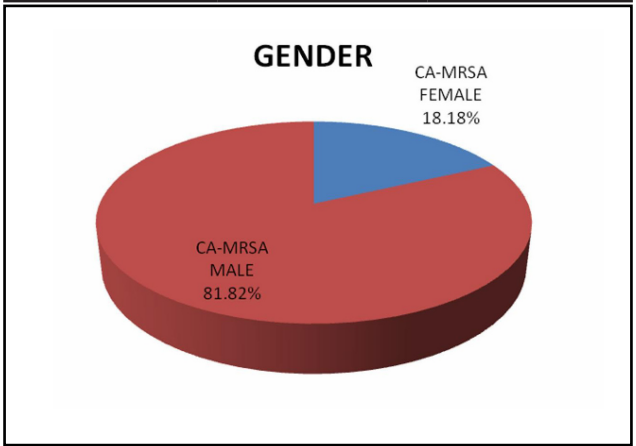
The study sample consisted of 87 subjects who included 55 males and 33 females of which 22 (25.29%) were CA-MRSA and 65(74.71%) were MSSA as shown in [Table/Fig-2]. The mean age was 30.48 years with a standard deviation of 17.22.

	Total Number of Cases	CA-MRSA	MSSA
Number	87	22	65
Percentage	100	25.29	74.71

[Table/Fig-2]: Number of patients infected with MSSA and CA-MRSA.

- The number of males vs. number of females affected with CA-MRSA were 18(81.82%) and 4(18.18%) respectively as shown in [Table/Fig-3].

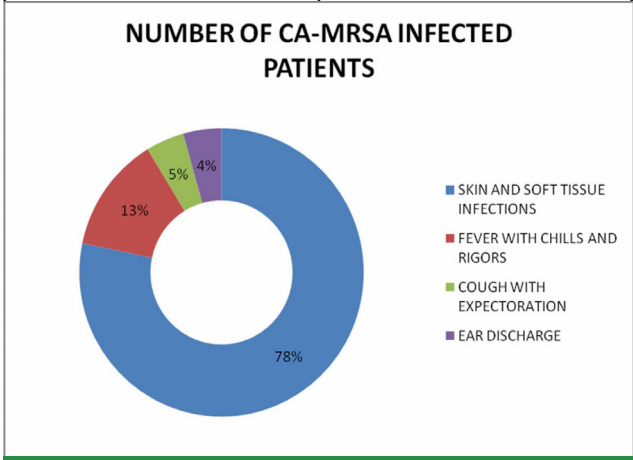
Gender	CA-MRSA	
	Number	Percentage
Female	4	18.18%
Male	18	81.82%
Total	22	100%



[Table/Fig-3]: Number of male and female infected with CA-MRSA

Skin and soft tissue infections were most common infection sites among all subjects while 3 cases of fever with chills and rigor,1 case of ear discharge and 1 case of cough with expectoration, were found as shown in [Table/Fig-4]. Significant difference (p<0.0001) was found in fever with chills & rigors, cough with expectoration and ear discharge patients.

Disease	Number Of CA-MRSA Infected Patients
Skin And Soft Tissue Infections	17
Fever With Chills And Rigors	3
Cough With Expectoration	1
Ear Discharge	1



[Table/Fig-4]: Number of CA-MRSA infected patients in different disease.

[Table/Fig-5] Shows antibiotic susceptibity of CA-MRSA strains to various antibiotics. It was found that CA-MRSA strains showed 100% sensitivity to Vancomycin, Linezolid, Clindamycin and Tetracycline. Susceptibility to Erythromycin was 90.90%, while Penicillin, Ciprofloxacin, Co-trimoxazole showed relatively low sensitivity of 4.54%, 59.09% & 54.54% respectively. Significant difference (p=<0.001) in susceptibility was observed in Co-trimoxazole & Ciprofloxacin and significant difference (p<0.0001) for Penicillin.

	* CA-MRSA-	† MSSA
Drugs	Susceptible Percentage	Susceptible Percentage
Penicillin	4.54	6.15%
Vancomycin	100	100%
Linezolid	100	98.46%
Clindamycin	100	69.23%
Tetracycline	100	93.84%
Erythromycin	90.9	56.92%
Ciprofloxacin	59.09	61.53%
Cotrimoxazole	54.54	75.38%
Cefoxitin	0	100%

[Table/Fig-5]: Antibiotic susceptibity of CA-MRSA and MSSA strains to various antibiotics.

* CA-MRSA- Community Acquired Methicillin Resistant Staphylococcus aureus.

† MSSA- Methicilline Sensitive Staphylococcus Aureus.

DISCUSSION

The present study demonstrated that a high proportion of patients identified in our Institution had CA-MRSA (25.29%) infections. Our findings confirm our clinical impression that CA-MRSA had emerged in our community. Most of these CA-MRSA infections were of skin and soft tissues types (81.81%),which responded quickly to wound care (incision & drainage) when indicated and to out- patients oral antimicrobial therapy. The distribution of MRSA infection sites for CA-MRSA groups was consistent with those of previous studies [4].

Skin and soft tissue infections by CA-MRSA can be treated with antibiotics like Linezolid, Clindamycin, Tetracycline, Erythromycin and Vancomycin. In our study, Erythromycin susceptibility of CA-MRSA strains was 90.90%. Our results showed high susceptibility to erythromycin (90.90%) in contrast to 40%, 44% &7% by Wylie et al., Waimi et al., & Huang et al., [2,4]. Our results showed an unusually high prevalence of resistant to Co-trimoxazole (45.46%) and Ciprofloxacin(40%) in contrast to other studies which have noted susceptibility ranging between 90%-100% for Co-trimoxazole and 80%-90% to Ciprofloxacin. This may be attributed to the inadvertent use of Co-trimoxazole and Ciprofloxacin for various infections. High degree of susceptibility was shown to Vancomycin (100%), Clindamycin (100%), Linezolid (100%) and Tetracycline (100%). Clindamycin susceptibility was 100% in our study which corresponds to the study reported by Wylie et al (89%) and by Huang et al., (96%) [2].

Though we didn't perform the susceptibility testing for Rifampicin, it has excellent CA-MRSA coverage. Various studies have reported susceptibility of up to 100% with rifampicin [2]. The problem with rifampicin is that, it must be used in combination regimen, or resistance quickly emerges.

These findings and antimicrobial susceptibility patterns support the conclusion that CA-MRSA infection is not a nosocomial strain which originated in local health care facilities, but a distinct clone that has developed and is being propagated within the community. Overall a high proportion of resistance was found among CA-MRSA isolates, suggesting that the face of CA-MRSA has changed in both epidemiological and microbiological features. This calls for the formulation of specific treatment guidelines to prevent emergence of resistant to currently used drugs.

There were several limitations to our study. Firstly, due to the inclusion of only patients attending the hospital, we were unable to estimate the true prevalence of CA-MRSA infection in general population. Secondly, although patients were carefully interviewed, there is a risk of misclassifying MRSA acquisition due to incomplete history of hospital related exposure and failure to elicit an accurate history of drug use. Thirdly, due to limited resources, we did not test for the existence of the Panton-Valentine Leucocidin gene harboured among CA-MRSA isolates. Despite limitations, this study can contribute to our expanding understanding of CA-MRSA scope for Future Research.

CA-MRSA is an emerging as an important public health problem. The infections are on the rise in epidemic proportions. More community based surveillance studies are required, to determine the specific risk factors associated with acquisition and transmission of CA-MRSA, and to establish preventive measures within the community.

CONCLUSION

A high proportion of resistance was found among CA-MRSA isolates. Susceptibility to Co-trimoxazole and Ciprofloxacin for CA-MRSA was much lower than what was previously reported whereas susceptibility to Erythromycin for CA-MRSA was much higher than what was previously reported. The epidemiological, molecular and microbiological differences between Community Acquired and Hospital Acquired MRSA necessitate different strategies to prevent, control and treat these two types of infections. This suggest that, the face of CA-MRSA has changed in both epidemiological and microbiological features and calls for the formulation of specific treatment guidelines to prevent emergence of resistant to currently used drugs.

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