ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 6, Issue – 3, May – 2021 , Page No. : 71 - 77

Difference in antibiotic susceptibility pattern of CA-MRSA & HA-MRSA

[1]Mr. Sagar Sakure, MBBS IIIrd year, NKP Salve Institute of Medical Sciences & Research Centre and Lata Mangeshkar Hospital, Digdoh Hills, Nagpur 440019, Maharashtra

[2]Dr. Umesh Hassani, Assistant Professor, Department of Microbiology , NKP Salve Institute of Medical Sciences & Research Centre and Lata Mangeshkar Hospital, Digdoh Hills, Nagpur 440019, Maharashtra

[3]Dr. Khushbu Sakure, Consultant Microbiologist, Shiv-Kalp Clinical Laboratory, Gondia 441601

[4]Dr. Vilas Thombare, Professor, Department of Microbiology, NKP Salve Institute of Medical Sciences & Research Centre and Lata Mangeshkar Hospital, Digdoh Hills, Nagpur 440019, Maharashtra

Corresponding Author: Dr. Umesh Hassani, Assistant Professor, Department of Microbiology , NKP Salve Institute of Medical Sciences & Research Centre and Lata Mangeshkar Hospital, Digdoh Hills, Nagpur 440019, Maharashtra

Citation this Article: Mr. Sagar Sakure , Dr. Umesh Hassani , Dr. Khushbu Sakure , Dr. Vilas Thombare, “Difference in antibiotic susceptibility pattern of CA-MRSA & HA-MRSA.”, IJMSIR- May - 2021, Vol – 6, Issue - 3, P. No. 71 – 77.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Methicillin-resistant Staphylococcus aureus (MRSA) is a major cause of Hospital Acquired (HA) and Community Acquired (CA) infections. The prevalence and incidence of the MRSA can vary from country to country and can also vary from hospital to hospital in the same country.

Material and Method: The comprehensive particulars of the patients were meticulously noted in the case record form. All the nonduplicate staphylococcus aureus isolated from clinical samples during the study period were included in the study. A phenotypic test for the detection of the MRSA was done by using a cefoxitin (30 µg) disc.

Result: Total 125 Staphylococcus aureus samples were isolated. Majority of the Staphylococcus aureus, 60 (48%) were recovered from Pus/ Exudates from skin & soft tissue infections. Out of the total 125 isolates, 45 (36%) isolates were MRSA and 80 (64%) were MSSA. Out of 45 MRSA isolates, 25 strains (53.33%) were HA-MRSA and 20 (46.67%) were CA-MRSA.

Conclusion: MRSA has emerged as a major global health problem both in community and hospitals. MRSA poses a major health threat. Various antibiotics which are commonly used to treat variety of infections have developed resistance to these bacteria. Thus, there is a need for the development, adoption, and enforcement of appropriate guidelines for the judicious use of these antibiotics. The incidence of CA-MRSA is increasing and it needs to be controlled.

Keywords: Antibiotic susceptibility, MSSA, CA-MRSA, HA-MRSA.

Introduction

Staphylococcus aureus is a versatile human pathogen which causes infections which range from a relatively mild involvement of the skin and the soft tissue, to life – threatening sepsis and pneumonia, and the toxic shock syndrome[1]. This organism causes illness through

the production of numerous cell surfaces and secreted virulence factors, and the disease is facilitated by its propensity to develop resistance to multiple antibiotics. [2]

Originally, penicillin was the drug of choice for the Staphylococcus aureus infections, over the years Staphylococcus aureus has developed resistance against most of the therapeutic agents. The most notable example of this phenomenon was the emergence of Methicillin resistant Staphylococcus aureus (MRSA), They are usually found to be resistant to other β-lactam antimicrobial drugs.[3] Many of the MRSA isolates are becoming multidrug resistant and they are susceptible only to the glycopeptide antibiotics such as vancomycin. A low-level resistance, even to vancomycin, is emerging.

Once prevalent in healthcare setup for more than 40 years, MRSA has migrated to the community in recent years. Community-acquired MRSA (CA-MRSA) has evolved as a novel emerging pathogen in patients who had no contact with health care setup. The first case of a community – associated MRSA (CA-MRSA) infection in the United States was reported in 1980.[4]

CA-MRSA is different from HA-MRSA in terms of risk factors associated, drug susceptibility pattern, virulence factors and molecular properties. The studies show that the incidence of CA- MRSA is rising & various genotypic characteristics have spread from community to hospitals and major endemic HA-MRSA strains have spread from hospital to community in some Asian countries.[5]

Most of the CA-MRSA associated with skin and soft tissue infection (SSTI) and bacteremia respectively. These infections are acquired by persons who have not been hospitalized nor had certain medical procedures such as dialysis, surgery, or catheterization before admission to hospital. CA-MRSA strains often originate from isolates picked up in healthcare facilities on previous visits. They carry genes for Panton-Valentine leukocidin (PVL).Unlike HA-MRSA which typically are resistant to multiple antibiotics, CA-MRSA tend to be susceptible to other antibiotic classes and often are resistant to only β lactam antibiotics [6].

Changing pattern of resistance of S. aureus makes its periodic surveillance mandatory [7] and formulate treatment protocol accordingly in the hospitals, as an emerging pathogen. The current susceptibility patterns of local strains are essential for the judicious use of antibacterial agents as well as to become aware of the MRSA in hospitals and community areas in India. Hence, the present study is undertaken to find out the prevalence of MRSA isolates, proportion of HA-MRSA and CA-MRSA, and comparison of their antibiotic susceptibility profile.

Objectives

- To find out antibiotic susceptibility patterns of MSSA and MRSA.
- To find out incidence of CA-MRSA.
- To find out antibiotic susceptibility patterns of CA-MRSA and HA-MRSA.

Methodology

Case Definitions[7]

HA-MRSA - MRSA would be considered hospital associated, a) if the patient hospitalization is for ≥72 before culture acquisition) if in the year before the present hospitalization, the patient had any one of the following: hospitalization, surgery, residency in a long-term care facility, and hemodialysis or peritoneal dialysis, or at the present admission had indwelling percutaneous devices or catheters.

CA-MRSA- CA-MRSA is defined as a culture confirmed MRSA infection without any of the above criteria.

Material: All the nonduplicate staphylococcus aureus isolated from clinical samples during the study period were included in the study, and constitute the material for this cross sectional study. Ethical clearance was obtained from the institutional ethical research committee.

Methods: The comprehensive particulars of the patients were meticulously noted in the case record form mainly, date of admission, the presenting complaints, previous history of hospitalization or surgeries underwent was noted. Staphylococcus aureus was identified by standard microbiological techniques. Antibiotic sensitivity of the isolates was tested using disks –ampicillin (10 µg), erythromycin (15 µg), gentamicin (10 µg), tetracycline (3 µg), cotrimoxazole (25 µg), ciprofloxacin (5 µg), and vancomycin (30 µg). (CLSI), clindamycin, linezolid.

Detection of MRSA [8]

A phenotypic test for the detection of the MRSA was done by using a cefoxitin (30 µg) disc. A zone of inhibition which was equal to or more than 22 mm was considered as susceptible to Cefoxitin and the *Staphylococcus aureus* isolate produced it was reported as Methicillin Sensitive *Staphylococcus aureus* and those isolates which produced a zone of inhibition which was less than or equal to 21 mm were considered as Methicillin Resistant *Staphylococcus aureus.*

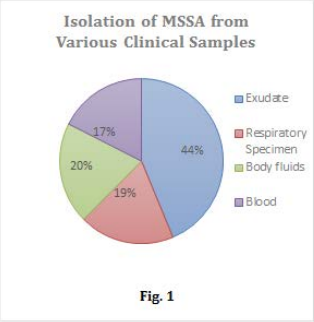
The MRSA isolates were classified into Community Acquired or Hospital acquired, based on the history of the patient as per the case definitions.

Results

Amongst 2797clinical samples screened during study period (April to October) 125 non duplicate isolates of Staphylococcus aureus, were recovered. Majority of the Staphylococcus aureus, 60 (48%) were recovered from Pus/ Exudates from skin & soft tissue infections, followed by 30 (24%) isolates from respiratory specimens (Sputum, BAL, Tonsillitis). Twenty (16%) & Fifteen isolates (12%) respectively were recovered from body fluids & blood culture specimen. (Table-1).

Table 1: clinical samples from where staphlylococcus aureus were isolated.

SAMPLES	MSSA	MRSA	Total
Exudate (Pus/Debris)	35	25	60
Respiratory Specimen (Sputum, BAL, Throat Swabs)	15	15	30
Body fluids	16	4	20
Blood	14	1	15
Total	80	45	125



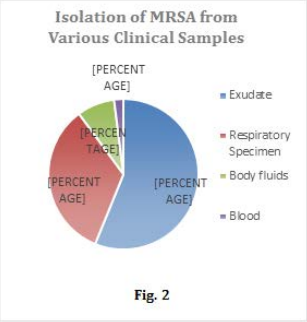


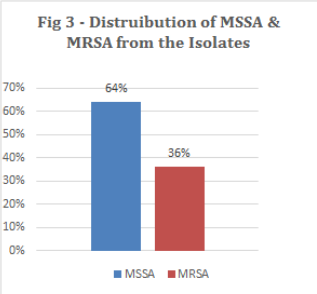
Fig 1 & 2 - Isolation of MSSA and MRSA from Various Clinical Samples

Table 2: Distribution of MSSA AND MRSA

Type	No.
1. MSSA	80
2. MRSA	45
• CA MRSA	20
• HA MRSA	25

Out of 125 isolates of Staphylococcus aureus, 45 (36%) isolates were MRSA and 80 (64%) were MSSA Among

these, 45 MRSA isolates, twenty-five strains (56 %) were HA-MRSA and 20 (44 %) were CA-MRSA as per the case definitions. [7]



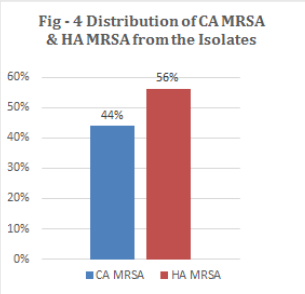
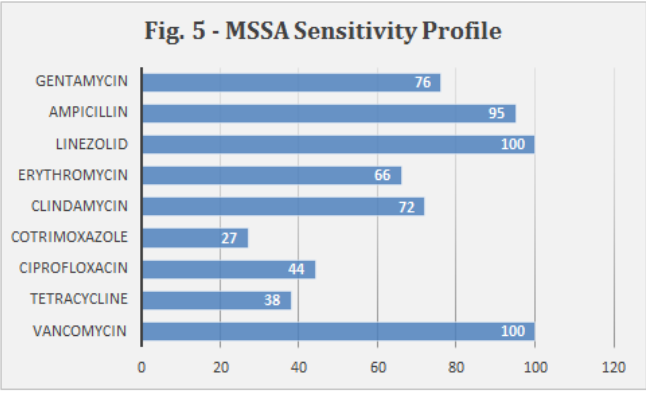
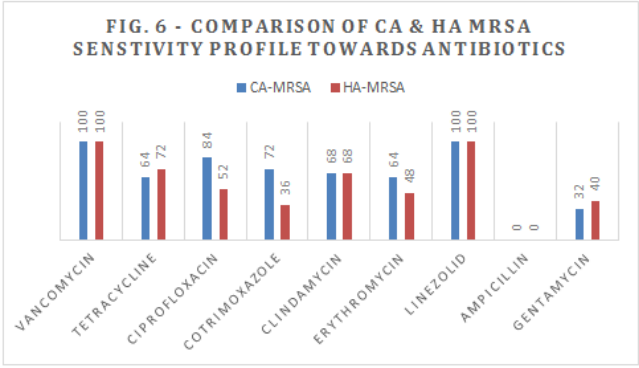


Fig 3 & 4 - Distribution of MSSA and MRSA (CA & HA) from the Isolated Samples

Table 3: Sensitivity profile of MSSA, CA-MRSA AND HA-MRSA.

	MSSA (80) (%)	CA-MRSA (20) (%)	HA-MRSA (25) (%)
Vancomycin	100	100	100
Tetracycline	38	64	72
Ciprofloxacin	44	84	52
Cotrimoxazole	27	72	36
Clindamycin	72	68	68
Erythromycin	66	64	48
Linezolid	100	100	100
Ampicillin	95	0	0
Gentamycin	76	32	40





All the MRSA isolates were sensitive to Vancomycin and Linezolid, amongst CA-MRSA isolates, least sensitivity was to Ampilcillin (0%), followed by Gentamicin (32%.) Antibiogram for other antibiotics was Tetracycline (64%), Ciprofloxacin (84%), Cotrimoxazole (72%), Clindamycin (68%), Erythromycin (64%).

Antibiogram of HA-MRSA isolates showed following sensitivity pattern, Tetracycline (72%), Ciprofloxacin (52%), Co-trimoxazole (36%), Clindamycin (68%), Erythromycin (48%), Ampilcillin (0%), gentamicin (40%).

Discussion

S. aureus continues to be the major cause of skin and soft tissue infections (SSTI) in the community as well as invasive infections in the hospitalized patients. In the present study also majority of the MRSA isolates were obtained from pus in patients suffering from SSTI **(48%) (**Table-1**)**.

The incidence of MRSA in the present study was 36%. Various studies have found varying rates of MRSA, the proportion of MRSA varies among countries ranging from 0.4 per cent in Sweden to 48.4 per cent in Belgium**.** [10] & Various studies conducted across India revealed varying incidence of MRSA, 64% (Jindal et al)[11] in Punjab, 58.33% in Maharashtra (Rupali et al)[12], 45.42% in Karnataka (Bouchiat et al) [13,] 31.1% in Tamil Nadu (Armugam et al)[14] and 25% in West Bengal

(Bhattacharya et al). [15] **I**n another study in northern India by Devi P et al 46%. [16] strains were found to be methicillin resistant. So, the incidence in our part is similar as reported in majority of studies that is between 30-40%.[17]

Till recently MRSA was considered to be Hospital acquired pathogen but now CA-MRSA isolates are being increasingly reported from India. D' Souza *et al*. studied 412 confirmed cases of MRSA and found that 54 per cent were true CA-MRSA possessing the *SCCmec IV* and *SCC mec V* genes. [18]

In a Study by Prasanth V et al, out of the 42 MRSA isolated, 33 turned out to be CA-MRSA (78%) and 9 (22%) were HA-MRSA [19], Yukti Sharma et al, reported the incidence to be 17%. [20]

In a study in US **spanning** over 10 years, there was an increase in the overall incidence of *S. aureus* during this period with an increase in community onset MRSA SSTI. [21]

In the present study 53.33% isolates were HA- MRSA & 46.67% were CA- MRSA, which were similar to the incidence seen in most of the studies.

Vancomycin is considered inferior to β-lactams for the treatment of MSSA bacteremia and endocarditis, and the first-generation cephalosporins are the drugs of choice for the treatment of MSSA infections.[22]

Hence treating physicians must de-escalate to β-lactams once the culture sensitivity results reveal a MSSA isolate. The antibiogram of isolates obtained in present study revealed significant difference in the sensitivity patterns of MSSA& MRSA. Although no resistant was shown to Vancomycin and Linezolid by all the isolates of MSSA, CA-MRSA & HA-MRSA still, 33.36% Methicillin resistant isolates were multi-drug resistant showing resistance to three or more antibiotics. Drugs like Tetracycline (38% in MSSA & 64% in MRSA), Ciprofloxacin (44% in MSSA &84% in MRSA), & Co trimoxazole (27% in MSSA & 72% in MRSA), which showed less in vitro sensitivity in MSSA isolates were found to have good in-vitro activity against the isolates of CA- MRSA, although there was no significant difference in sensitivity pattern of these drugs between MSSA & HA- MRSA. In the study by INSAAR group there was no resistance against documented against vancomycin and linezolid. The Sensitivity for other drugs varied Erythromycin (33-72%), Clindamycin (34-96%), Gentamicin (47-91%), Cotrimoxazole (14-64%) from the data obtained from network of microbiology laboratories at premier medical colleges and hospitals in India.[23] For HA-MRSA the drug of choice is Vancomycin but in case of CA-MRSA other options are available which should be tried if indicated in in-vitro susceptibility result. As PV gene is present in CA-MRSA, which is responsible for Toxic Shock Syndrome, causing morbidity and mortality, this organism should be notified to a physician and treated aggressively.

Conclusion: Antibiotic resistance among the MRSA isolates is increasing and treatment options available are few. Anti-MRSA drugs like Vancomycin, Linezolid, etc. should be used judiciously after appropriate antibiotic susceptibility testing. Regular monitoring of Antibiotic susceptibility pattern is essential to guide empirical therapy. There is increasing incidence of CA-MRSA, which may require higher antibiotics for treatment.

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