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Prevalence of Methicillin Resistant Staphylococcus Aureus and it's Antibiogram- A Study from Government General Hospital, Ananthapuram Andhra Pradesh

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ABSTRACT

Background: Methicillin-resistant Staphylococcus aureus (MRSA) is becoming more prevalent and is a major issue for countries all over the world, including India. MRSA isolates are also becoming resistant to other chemotherapeutic drugs. Early detection of MRSA and its susceptibility pattern becomes vital for the treatment of the condition as very few antimicrobial agents can be used to manage the ailment. The present study aimed to determine the prevalence of MRSA and its susceptibility pattern in the study area.

Materials and methods: This was the cross sectional study carried out from May 2022 to November2022. A total of 180 non-repetitive clinical isolates of Staphylococcus aureus were isolated from various clinical specimens. These isolates were identified by conventional phenotypic methods. All the isolates of Staphylococcus aureus isolates were subjected to Cefoxitin disc diffusion testing to identify MRSA. All isolates were tested for their susceptibility to various antibiotics by Kirby Bauer disc diffusion method. Data analysis was done by simple percentage method.

Results: A total of 459 clinical samples were processed during the study period. Out of this, 180 were identified as Staphylococcus aureus (39.2%). Further, methicillin resistance was tested against all isolated strains of Staphylococci, 82 strains were identified as MRSA and accounted for 45.5% followed by methicillin sensitive strains 98(54.5 %). Majority of MRSA (85.3%) and MSSA (66.3%) were isolated from pus samples. Majority of MRSA strains were isolated from the samples of surgery (39%) followed Orthopaedics (28%) and Medicine (24.3%). All the isolates of MRSA and MSSA were susceptible to Linezolide (100%), Vancimycin(100%) and Rifampicin(100%). Majority of MRSA strains were found to be susceptible to Amikacin (67.1%) and Clindamycin (53.7%) followed by Erythromycin (36.5%).

Conclusion: In our study, overall prevalence of Methicillin Resistance Staphylococcus aureus was 45%. Majority of MRSA isolates were resistant to commonly used antibiotics. All strains of MRSA were remained 100% susceptible to vancomycin and Linezolide.

Key words: Methicillin resistant Staphylococcus aureus, Methicillin sensitive Staphylococcus aureus, Cefoxitin.

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1. INTRODUCTION:

The last ten years have seen the rise of methicillin-resistant Staphylococcus aureus (MRSA) strains, also known as multidrug-resistant S. aureus, as a cause of nosocomial infections, which can lead to rapidly progressing, potentially fatal diseases such as life-threatening pneumonia, necrotizing fasciitis, endocarditis, osteomyelitis, severe sepsis, and toxicnoses like toxic shock syndrome. [1]
Based on antibiotic susceptibilities, methicillin resistance in S. aureus is defined as an oxacillin minimum inhibitory concentration (MIC) of ≥4 μg/mL.[2] They differ with respect to clinical features, molecular biology, antibiotic susceptibility, and treatment.[3] In India, the prevalence of MRSA ranges from 40% to 70% among S. aureus isolates, with variations observed between hospital and community settings. [4]
The major way that MRSA is spread is by skin-to-skin contact. The use of antibiotics in cattle and poultry is unregulated in India, a country with a large population density and a very high rate of antibiotic use by people. The occurrence of drug-resistant microorganisms in the community is made possible by this combination.[5]
The mecA gene, which is found in the mobile portions of MRSA strains and encodes the penicillin-binding protein 2a with a low affinity for β -lactams and enables MRSA strains to survive in a wide range of concentrations of these antimicrobial agents, contributes to the methicillin resistance displayed by S. aureus.[6]

Due to the limited number of antimicrobial drugs that may be used to treat MRSA, early detection of the infection and its susceptibility pattern become essential for therapy. Consequently, it is vital to investigate, obtain the data of MRSA and its susceptibility pattern in the study area in order to design better and more effective management strategies.

2. MATERIALS AND METHODS:

This cross sectional study was carried out from May 2022 to November2022. A total of 180 non-repetitive clinical isolates of Staphylococcus aureus were isolated from various clinical specimens received in microbiology laboratory of a tertiary care centre. These isolates were identified by conventional phenotypic methods as per standard microbiological procedures.

Identification of MRSA
All the isolates of Staphylococcus aureus isolates were subjected to Cefoxitin disc diffusion testing using a 30 μg cefoxitin disc. The results were interpreted according to CLSI guidelines 2013. An inhibition zone diameter of ≤ 21 mm was reported as methicillin resistant and ≥ 22 mm was reported as methicillin sensitive.[2]

Antibiotic susceptibility testing: All isolates were tested for their susceptibility to various antibiotics by Kirby Bauer disc diffusion method. Following antibiotics were tested against all the isolated strains against, Clindamycin 10 mcg, Amikacin 30mcg, Erythromycin 15mcg, Co-Trimoxazole25mcg, Vancomycin 30mcg, Rifampicin 5 mcg , Amoxycillin/Clavulanic acid 20/10 mcg, Gentamycin 10 mcg, Ciprofloxacin 30mcg, Penicillin 10units, Ampicillin 10mcg, Linezolid 30mcg.[2]

Quality control strains: Positive control: MRSA. ATCC 43300; Negative control: MSSA. ATCC 25923.
Data analysis was done by simple percentage method.

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3. RESULTS:

A total of 459 clinical samples were processed during the study period. Out of this, 180 were identified as Staphylococcus aureus (39.2%). Further, methicillin resistance was tested against all isolated strains of Staphylococci, 82 strains were identified as MRSA and accounted for 45.5% followed by methicillin sensitive strains 98(54.5 %). The prevalence was higher in males70.7% than females 29.3%. Majority of MRSA strains were isolated from the age group of 61-70 and accounted for 21.9 followed by 51-60(20.7%).
Majority of MRSA (51.85%) and MSSA (48.15%) were isolated from pus samples. Second predominant sample to yield MRSA was found to be Sputum (31.25%). Whereas MSSA strains were accounted for 168.75from sputum sample. (Table.1)

Distribution of MRSA and MSSA from different clinical samples (Table.1)

Specimen	**Total No. of cases**	**MRSA**		**MSSA**	
		No.	**%**	**No.**	**%**
Pus	135	70	51.85	65	48.15
Urine	8	2	25	6	75
Sputum	16	5	31.25	11	68.75
Blood	6	2	33.33	4	66.37
Suction tip	4	1	25	3	75
Pleural fluid	3	-	-	3	100
Bed sore	2	1	50	1	50
Throat swab	6	1	16.66	5	83.34
Total	180	82	45.5%	98	54.5%

Majority of MRSA strains were isolated from the samples of surgery (39%) followed Orthopaedics (28%) and Medicine (24.3%). MSSA distribution was predominantly from the samples of Surgery (31.6%) followed by Medicine (14.6%) and Orthopaedics (13.2%) Table.2

Distribution of MRSA and MSSA in different clinical departments.(Table.2)

Department	**No. of cases**		**MRSA**		**MSSA**	
	No.	%	No.	%	No.	%
Surgery	63	35	32	39	31	31.6
Medicine	34	18.9	20	24.3	14	14.6
Obstetrics &Gynaecology	14	7.8	1	1.5	13	13.2
Orthopedics	34	18.9	23	28	11	11.2
Pediatrics	11	6.1	1	1.2	10	10.2
E.N.T.	4	2.2	1	1.2	3	3
I.C.U.	14	7.8	2	2.4	12	12.2
Ophthalmology	6	3.3	2	2.4	4	4
Total	180	100	82	45.5%	98	54.5%

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All the isolates of MRSA and MSSA were susceptible to Linezolide (100%), Vancimycin(100%) and Rifampicin(100%). Majority of MRSA strains were found to be susceptible to Amikacin (67.1%) and Clindamycin (53.7%) followed by Erythromycin (36.5%). Least susceptibility of MRSA strains was observed towards Amoxycillin / Clavulinic acid (6%) and Ciprofloxacin (9.7%). Whereas MSSA strains were comparatively more susceptible to Amoxycillin / Clavulinic acid (22%) and Ciprofloxacin (48%)(Table.3).

Antimicrobial susceptibility patternof MRSA and MSSA (Table.3)

Antimicrobials	Susceptibility pattern of MRSA		Susceptibility pattern of MSSA	
	No	%	No	%
Clindamycin	44	53.7	74	75.5
Amikacin	55	67.1	79	80.6
Erythromycin	30	36.5	50	51
Co-trimoxazole	19	23.1	61	62.2
Vancomycin	82	100	98	100
Rifampicin	82	100	98	100
Amoxycillin / Clavulinic acid	5	6.	22	22.4
Gentamycin	35	42.6	46	46.9
Ciprofloxacin	8	9.7	47	48
Pencillin	0	0	1	1
Cefoxitin	0	0	98	100
Linezolid	82	100	98	100

4. DISCUSSION:

Clinical samples used in our study revealed a 45.5% prevalence of MRSA. Similar findings were reported by other research published in recent years. According to a research done by the INSAR group (Indian Network for Surveillance of Antimicrobial Resistance), the total prevalence of MRSA was 42% in 2008 and 40% in 2009[4]. Mehta et al reported that 13–47% of S. aureus infections in India are due to methicillin resistance [7]. Critically ill patients, particularly those in a surgical ICU, frequently have wounds, drains, and intrusive monitoring devices that cause skin breaches and raise the risk of infection. Furthermore, individuals who use steroids, have chronic liver illness, or have diabetes may have low neutrophil ability, causing them to be more susceptible to MRSA. Moreover, several granulocyte function inadequacies, such as altered chemotaxis and diminished phagocytosis-related burst activity, have been connected with liver disease and diabetes. [7]

According to previous studies, the proportions of skin and soft tissue infections in the current study's two groups were 48.15 percent for MSSA and 51.85 percent for MRSA. According to a separate study by Charterjee et al, skin and soft tissue infections accounted for 49% of cases, while MSSA accounted for 46%.[8] In our study, 50% MRSA isolates from bed sore samples. Other specimens yielded the growth of MRSA ranging between 16.66-33.33%.As per the study conducted by Arora et al, MRSA isolation rate was 31.6 from blood .[9] Whereas Kaur et al observed 5.56% of MRSA from blood cultures. [10]Arora et al observed extremely low prevalence of MRSA from sputum samples (0.02%) .[9] But, Kaur et al showed 7.69% of MRSA from sputum samples. [10]

In our study, recommended phenotypic method, cefoxitin disc diffusion test used to determine methicilli. It has been described as a mecA gene surrogate marker and provides clearer, simpler, and more repeatable end points than studies using Oxacillin disc diffusion.

As a result, cefoxitin is now a recognised technique for reliably detecting MRSA and has been used as a PCR substitute in locations with limited resources..[11]
All isolates were Penicillin resistant based on the antibiogram pattern of MRSA. This concurs with the research done by Lohan et al. [12] In our study, Vancomycin , Rifampicin and Linezolide was found to be effective against all tested MRSA isolates. (100%). As per the study conducted by Al Zoubi et al, all MRSA isolates were found to be susceptible to Vancomycin (100%). [13] According to the study conducted by Babakir et al, Rifampicin was effective against 80% of MRSA isolates[14] Further, similar study conducted by Akhter et al, lower sensitivity to rifampicin (43%).[15] Our study results are similar to other studies regarding susceptibility pattern of Linezolide. It has been widely established that linezolid is a valuable antibiotic for addressing major developing Staphylococci resistance. Linezolid appears to be therapeutically effective for challenges with antimicrobial resistance, including severe infections caused by MDR MRSA. [16]

For life-threatening infections, antibiotics like clindamycin and amikacin can be administered instead of restricted antibiotics like vancomycin and linezolid. There are many causes of drug resistance in developing countries. Antibiotics can be bought over-the-counter in pharmacies and even grocery stores, where they are irresponsibly administered on humans, animals, and fisheries. Allopathic pharmaceuticals are used by traditional practitioners, and many drug-industry professionals prescribe more medications than are necessary.[17]
The lack of molecular tests for genotyping or Staphylococcal cassettee chromosome mec gene (SCCmec) type is one of the study's limitations. Financial constraints and work commitments prevented the calculation of the minimum inhibitory concentration for MRSA. Also, because just one hospital data was used for the study, the results do not apply to the entire community.

5. CONCLUSION:

In our study, overall prevalence of Methicillin Resistance Staphylococcus aureus was 45%. Majority of MRSA isolates were resistant to commonly used antibiotics. All strains of MRSA were remained 100% susceptible to vancomycin and Linezolide. This study's extremely high rate of MRSA resistance highlights the necessity for national or local monitoring to characterise and monitor MRSA and to create approaches that would enhance MRSA treatment and control.

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