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A Glimpse of the Burden and Antibiotic Pattern of Methicillin-Resistant *Staphylococcus Aureus* in a Tertiary Care Centre

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ABSTRACT

OBJECTIVE: Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the most important pathogens and a major cause of morbidity and mortality. The purpose of this study is to investigate the burden of MRSA and their resistance to different antistaphylococcal antibiotics.

MATERIAL & METHODS: A hospital-based study was carried out for a period of 2 years (January 2023 – December 2024) in the Microbiology department of Jorhat Medical College and Hospital, Jorhat, Assam, India where MRSA strains were isolated from various clinical specimens and drug resistance patterns analysed.

RESULTS: 1261 *Staphylococcus aureus* strains were isolated from various clinical samples. Of 1261 isolates, 981 (77.80%) were found to be methicillin-resistant. Maximum isolation of MRSA was from pus (48.42%), followed by blood (32.82%), urine (6.32%), high vaginal swab (5.20%), wound swab (3.46%), sputum (1.12%), aural swab (1.12%), endotracheal tube (0.81%), pleural fluid (0.51%), soft tissue (0.51%), synovial fluid (0.41%), central line catheter (0.30%), peritoneal fluid (0.10%), ascitic fluid (0.10%) and CSF (0.41%).

In MRSA isolates, 14.67% showed constitutive resistance, 2.54% showed inducible MLSB resistance and 42.91% showed MS phenotype. None of the MRSA isolates was found to be sensitive to penicillin.

CONCLUSION: Standard monitoring of antimicrobial susceptibility pattern of MRSA and infection control practices are essential in order to control their spread in the hospital setting and the community.

Keywords: Methicillin resistant *Staphylococcus aureus,* hospital infections, antimicrobial susceptibility pattern

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the most important pathogens and a major cause of morbidity and mortality. Large outbreaks of MRSA have been reported from various countries, where it had caused severe infections including septicaemia, endocarditis and meningitis. In India, studies have suggested that the prevalence of MRSA accounts for about 30% of *Staphylococcus aureus* infections in hospital.[1] The incidence of MRSA varies from 25 per cent in western part of India to 50 per cent in South India [2,3] The purpose of this study is to investigate the burden of MRSA and their resistance to different antistaphylococcal antibiotics.

The common sources of MRSA infections are infected patients and colonised health workers.[4] Transient hand carriage of the organism by healthcare workers, antibiotics

abuse, prolonged hospital stay, intravascular instrumentation are the major factors for these rampant infections. [5,6]

AIMS & OBJECTIVES:

To investigate the burden of MRSA isolates

To determine the antimicrobial sensitivity patterns of isolated MRSA

MATERIALS & METHODS

STUDY DESIGN – Hospital-based cross-sectional study

STUDY PERIOD – 01 January, 2023 – 31 December, 2024

STUDY AREA - This hospital-based study was carried out at the Bacteriology wing of Microbiology department in Jorhat Medical College and Hospital, Jorhat, Assam, India which caters to the health care needs of the population of Jorhat which includes various tea-estates as well as neighbouring districts. Assam is a north-eastern state of India covering an area of 78,438 km^2. The total population of Assam was 35,205,576 as per 2011 census comprising of 50.8% males and 49.25% females. The total literacy rate in the state as per 2011 was 72.19%.[6]

STUDY SAMPLE - *Staphylococcus aureus* isolated from various clinical specimens received in the microbiology laboratory were included in this study.

METHODOLOGY

A total of 1261 Staphylococcus aureus strains were isolated during a period of two years from January 2023 to December 2024. The organisms were obtained from various clinical samples like pus, blood, sputum, genital specimen, urine, body fluids, devices and tissues. All isolates were identified morphologically and biochemically by standard laboratory procedures. The samples were cultured on Blood agar and MacConkey agar and incubated overnight at 37°C. The isolates were identified based on the catalase and coagulase test results. Susceptibility testing for methicillin was performed using cefoxitin as surrogate marker by Kirby-Bauer's disk diffusion method on Mueller-Hinton agar.[7]

To determine inducible Macrolide Lincosamide type B Streptogramins (MLSB) resistance, erythromycin and clindamycin discs were placed 12-15 mm apart on Mueller Hinton agar. A truncated or blunted clindamycin zone of inhibition (D-shape) after 24-hour incubation at 37ºC indicated inducible resistance. The diameter of the zone of inhibition was compared according to Clinical and Laboratory Standards Institute guidelines (CLSI), 2023.[7]

RESULT

1261 *Staphylococcus aureus* (SA) strains were isolated from various clinical samples. Of 1261 isolates, 981 (77.80%) were found to be methicillin-resistant. The rest 280 (22.20%) were methicillin-sensitive. [Table 1]

Table 1: Number of MRSA and MSSA isolates from total *S. aureus* strains

TOTAL SA	MRSA	MSSA
1261	981	280

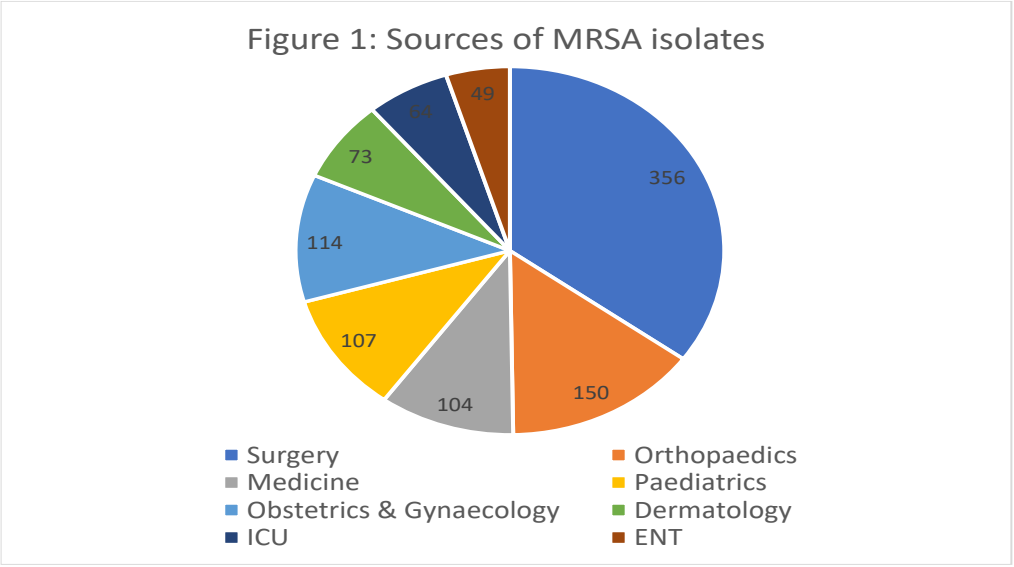
Out of 981 MRSA strains, the highest numbers were isolated from pus samples (47.09%), followed by samples sent for blood culture, urine, high vaginal swab, wound swab, sputum, aural swab, endotracheal tube, pleural fluid, soft tissue, synovial fluid, central line catheter, CSF, peritoneal fluid and ascitic fluid. [Table 2]

Table 2: Number and Percentage of Isolated MRSA from different clinical samples

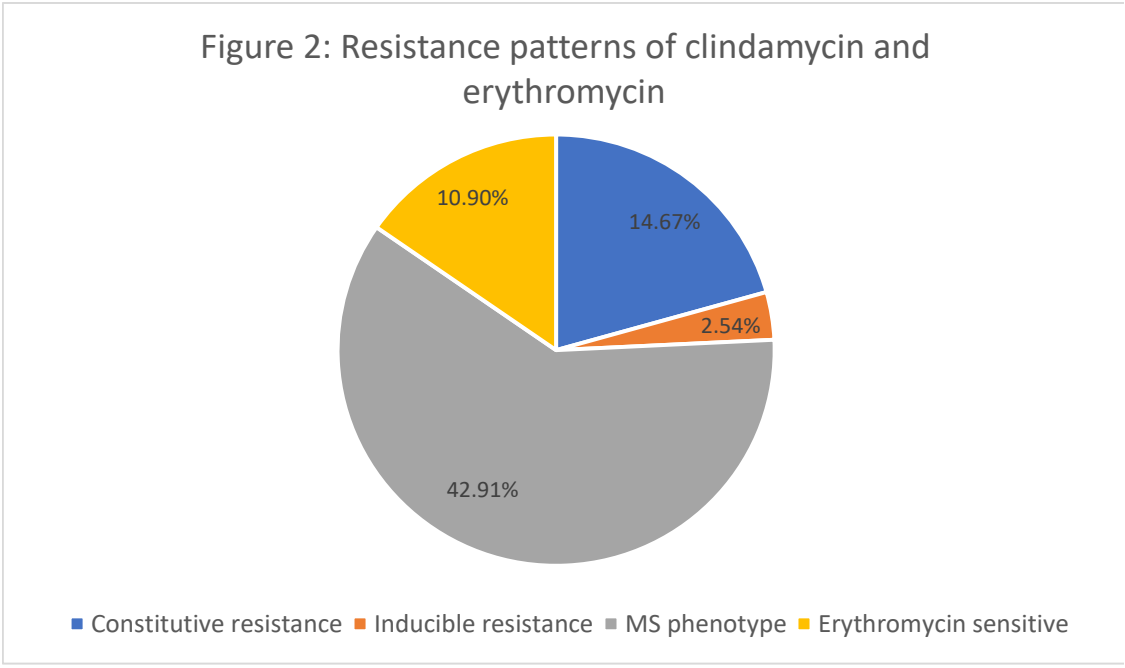
SAMPLES	NUMBER	PERCENTAGE
PUS	462	47.09%
BLOOD	322	32.82%
URINE	62	6.32%
HIGH VAGINAL SWAB	51	5.19%
WOUND SWAB	34	3.46%
SPUTUM	11	1.12%

AURAL SWAB	11	1.12%
ENDOTRACHEAL TUBE	8	0.81%
PLEURAL FLUID	5	0.51%
SOFT TISSUE	5	0.51%
SYNOVIAL FLUID	4	0.41%
CENTRAL LINE CATHETER	3	0.30%
CEREBROSPINAL FLUID	1	0.10%
PERITONEAL FLUID	1	0.10%
ASCITIC FLUID	1	0.10%

Samples were received from various wards – highest being from surgery (36.29%) and lowest from otorhinolaryngology/ENT (3.97%). [Figure 1]



In MRSA isolates, 14.67% showed constitutive resistance, 2.54% showed inducible MLSB resistance and 42.91% showed MS phenotype. None of the MRSA isolates was found to be sensitive to penicillin. [Figure 2]



DISCUSSION

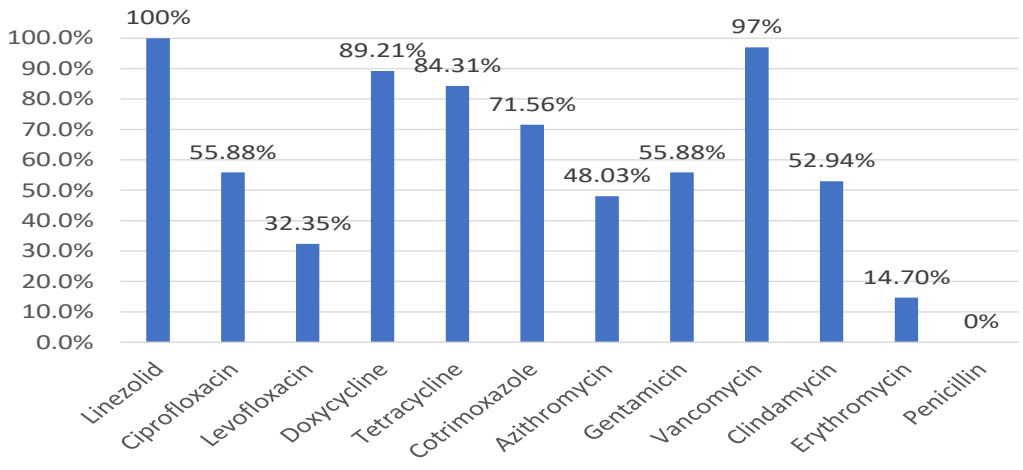
In our current study, the burden of MRSA was found to be 77.80%. It is higher than the findings in other parts of Assam evidenced from studies by Choudhury D *et al.* and Saikia L *et al*. where the prevalence of MRSA strains were found to be 42.96% and 34.78% respectively.[6,8] Various investigators have reported a prevalence rate of MRSA ranging from 13% to 68% in India.[9] MRSA prevalence of 31% was reported from Tamil Nadu and 38.56% from Delhi, whereas in Madhya Pradesh it was very high (80.89%).[10-12] In Maharashtra, high variability in prevalence rates was observed. It was very 19.56% in Nagpur and 34.2% in Mumbai. [13,14] A study from a rural healthcare setting in India showed MRSA cases even went up to 70.33% which is similar to our finding.[15] In Karnataka, 32.2% MRSA prevalence was reported.[16] A study from Nepal accounted MRSA cases to be 68%.[17] Globally, a prevalence rate ranging from 2% in the Netherlands and Switzerland, to 70% in Japan and Hong Kong is reported.[18]

In our study, maximum isolation of MRSA was from pus samples (47.09%). This finding is similar to a study by Anurupa et al and another study by Ankur Goyal et al where the maximum number of MRSA isolates were recovered from pus samples (52.5%) and (66.03%) respectively. [19,20] An article by Sangeeta *et al* revealed that overall MRSA strains was highest for skin and soft tissue infections (64% in 2008 and 61% in 2009).[9] A study by Purav Patel *et al* in a tertiary care teaching hospital, Western India also found out that skin and soft tissue infection (72.37) accounted for most of the MRSA cases.[21]

Within MRSA strains, male predominance was observed (62%).

The antimicrobial susceptibility patterns showed 100% sensitivity to Linezolid followed by Vancomycin (97%). None of the isolates were sensitive to Penicillin. Other antibiotics showed sensitivity range from 14.70 – 89.21%. [Figure 3] The study by Purav *et al* showed that MRSA strains showed high resistance to gentamicin (61.54%). The research work by M Prakash revealed that the highest resistance showed by MRSA isolates was 38.10 percent to levofloxacin. All the other antibiotics exhibited a sensitivity range of 62.0 to 82.0 percent. [21,22]

Figure 3: Sensitivity patterns of MRSA strains (n=981)



In our study, 2.54% showed inducible Clindamycin resistance and 14.67% showed constitutive resistance which was slightly lower than another study conducted in our state where inducible Clindamycin resistance was 9.38% and constitutive resistance was 50%.[8]

CONCLUSION

In India, the significance of MRSA had been recognized relatively late. Because of the ability of these pathogens to acquire resistance to new classes of antimicrobial agents, surveillance studies should be carried out to select appropriate antibiotics and detect the emerging trends of antibiotic susceptibility patterns. Healthcare settings should follow strict infection prevention and control practices consistently in order to control their spread in the hospital and community. Knowledge about MRSA and carrier status needs to be raised among the health staff of the hospital order to reduce the burden of MRSA infection in the hospital environment.

Declaration by Authors

Ethical Approval: Approved

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