PREVALENCE AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) ISOLATES FROM DIFFERENT CLINICAL SPECIMENS IN A TERTIARY CARE HOSPITAL IN IMPHAL

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ABSTRACT

BACKGROUND
The prevalence of Methicillin-resistant Staphylococcus aureus (MRSA) is increasing worldwide and is a growing public health concern. Serious infections due to Staphylococcus aureus and especially due to Methicillin-resistant Staphylococcus aureus has become a major clinical challenge.

The present study was planned to determine the prevalence of Methicillin-resistant Staphylococcus aureus (MRSA) from clinical specimens and to determine their antibiotic susceptibility pattern.

MATERIALS AND METHODS
The study was carried out in the Department of Microbiology, JNIMS, Manipur, from the year 2016 to 2017. A total of 770 Staphylococcus aureus strains were isolated from clinical specimens like urine, pus, blood, sputum, etc. All strains were identified by standard microbiological techniques. S. aureus strains were subsequently tested for Methicillin resistance by using Cefoxitin discs. The antibiotic susceptibility pattern of all the MRSA strains identified was determined by Kirby-Bauer disc diffusion method.

RESULTS
A total number of 770 S. aureus was isolated, of which 560 were MRSA. The prevalence of MRSA was different among various clinical specimens with maximum seen in urinary isolates (88.4%) followed by pus (79.6%). All the 560 MRSA strains were found to be resistant to Penicillin (100%); 76.9% to Gentamicin, 73.5% to Amikacin, 74.1% to Erythromycin, 69.2% to Cotrimoxazole, 77.7% to Ciprofloxacine and 60.9% to Tetracycllne. MRSA strains were resistant to ≥ 8.0 drugs, multidrug resistance. Sensitivity to Linezolid and Vancomycin was seen. A few (3/560) Vancomycin intermediate Staphylococcus aureus (VISA) strains were identified by E-test.

CONCLUSION
High rate of prevalence of MRSA with multidrug resistance of MRSA towards commonly used antibiotics was observed. Linezolid was the only antibiotic found to give uniform sensitivity (100%). A few VISA strains were identified. The findings highlight the importance of in vitro susceptibility testing of every isolate of MRSA in clinical laboratories.

KEYWORDS
Staphylococcus aureus, Methicillin, Resistance, Vancomycin.

RESULTS

During the study period, 7200 clinical specimens were received; 770 isolates of *S. aureus* were identified, of which 560 were MRSA [Table 1].

![Table 1. Prevalence of *S. aureus* and MRSA in various Samples](image)

The antimicrobial susceptibility pattern was found to vary across all samples with maximum observed in urine isolates 200/226 (88.4%).

The antimicrobial susceptibility pattern of the MRSA isolates showed maximum resistance to Penicillin (100%). While all (100%) MRSA isolates were sensitive to Linezolid [Table 2].

![Table 2. Antibiotics Susceptibility Pattern of MRSA Isolates](image)

DISCUSSION

MRSA has been observed to be one of the major nosocomial agents causing significant morbidity and mortality. Infected patients are important reservoirs of MRSA in Hospitals/Institutions. Healthcare workers by transient hand carriage are a predominant mode of patient to patient transmission.¹

Unlike the Western world, the significance of MRSA came to be recognised late in India and emerged as a problem only in the 80s and 90s.² The present study identifies and analyses the prevalence and antimicrobial susceptibility pattern of MRSA isolates obtained from different clinical specimens in a specific geographical setting.

Out of 7200 clinical specimens, 770 were identified as *S. aureus*. Out of these 770 isolates, 560 (72.7%) were found to be MRSA, which compares well with the prevalence of MRSA in other parts of India (30 - 80%) in various studies.³ Kulkarni et al reported a similar prevalence rate of 70.33%, while D. Majumdar et al reported 52.9% among patients and carriers in their study in Assam.⁴ Prevalence rates as low as 6.9% have also been reported by Chakravarthy et al⁵ and 31% by Rajaduraipandi K et al.⁶

In the present study, highest percentage of MRSA strains were seen in urine isolates (88.4%) followed by pus (79.6%); 13.2% MRSA were isolated from miscellaneous samples like throat swab, ear swab, sputum and body fluids. Similar observations were found by Kulkarni et al⁷ and Anupurba et al⁸ who reported 82.38% and 76% MRSA from urine and 64.67% and 52.5% from pus respectively.⁹ Higher figures have however been reported by Bandaru et al⁹ and Mehta et al from pus samples, 67.28% and 74.28% respectively.⁹,¹⁰ Rajaduraipandi et al observed a higher percentage from sputum/throat swabs (35.7%).¹¹

The drug resistance patterns of MRSA, isolated from different samples were seen to be variable. All the 560 MRSA strains were found to be resistant to Penicillin (100%), Gentamicin (76.9%), Amikacin (73.5%), Erythromycin (74.1%) and Cotrimoxazole (69.2%). Ciprofloxacin and Tetracycline showed a sensitivity of 77.7% and 60.9%, respectively. Good response was also seen against Teicoplanin (79.9%). All the MRSA strains were sensitive to Linezolid (100%).

The high resistance rate against Gentamicin and Amikacin observed in our study is similar to those of Rajaduraipandi et al¹¹ (63.6%), Majumdar et al¹¹ (94%), Bandaru et al¹¹ (85.80%) and Kulkarni et al¹¹ (52.57%). However, Pulimood et al¹¹ observed a low resistance rate of 8%.

Gentamicin resistance has been reported worldwide and has been attributed to drug inactivation by cellular transferase enzyme.⁸ In our study, MRSA strains showed a high resistance to Erythromycin (73.7%) and are similar to the findings of Bandaru et al⁸ (95.67%) and Mukesh Pal et al⁸ (85.71%). Strains resistant to Erythromycin are generally cross resistant to Azithromycin and Clarithromycin.⁸ Various studies have also reported resistance to Ciprofloxacin ranging from 12.8% to 98.9%. Rajaduraipandi et al¹¹ reported 12.8%, Pulimood et al¹¹ 90% and 88% by Bandaru et al.⁸ Our present study showed 22.4% resistance rate.
The present study shows good sensitivity rate against Linezolid, Teicoplanin and Vancomycin. Linezolid showed good activity against all Staphylococci including strains resistant to Methicillin. It is thus a promising therapeutic option.

A very high prevalence rate of MRSA was observed in the present study (72.7%). Maximum of the MRSA strains were found to be resistant to ≥ 8 antibiotics, and hence were multidrug resistant MDR (MRSA). Even though Vancomycin is the drug of choice for MDR (MRSA), it is considered inferior to beta-lactams for the treatment of MSSA bacteraemia and endocarditis. The first generation Cephalosporins are the drug of choice for treatment of MSSA infections in patients who cannot tolerate anti-Staphylococcal Penicillins.

210 strains (27.3%) in the present study were found to be sensitive to Methicillin (MSSA). They were also seen to be sensitive to most of the antibiotics. Similar observation has been reported by Arora et al.11 It is thus imperative to encourage the de-escalation of the use of Vancomycin to beta-Lactams in all cases of MSSA. MRSA isolates being rampant, it is important that treating physicians de-escalate to beta-Lactams once culture results reveal an MSSA isolate, so as to preserve glycopeptides and Linezolid for use against MRSA.

MIC determination for Vancomycin was done using E-test strips (Bio-Merieux India Pvt. Ltd.) according to manufacturer’s instructions. Of the 560 isolates, 557 were found to be sensitive with MIC ≤ 2 mg/L. However, 3 strains were found with MIC of 4 mg/L, and could be identified as Vancomycin Intermediate S. aureus (VISA). They were all however sensitive to Linezolid. No Vancomycin resistant S. aureus (VRSA) was found by the E-test.

Our study was however limited by the non-inclusion of carriers, which would have helped us to correlate with the high rate of MRSA. Newer drugs like Daptomycin and 4th generation Cephalosporins like Cefaroline and Tigecycline could have been included to assess their activity against MRSA. Molecular studies could not be done.

CONCLUSION

Our study showed a very high incidence of MRSA in our Hospital. A regular surveillance of Hospital-associated infections including monitoring and strict anti-microbial stewardship and control measures to reduce the high incidence of MRSA infections to prevent the spread of such strains needs to be implemented.

MRSA isolates were more Multidrug Resistant (MDR) as compared to the MSSA isolates. Glycopeptides and Linezolid remains the mainstay for treatment of such MDR-MRSA.

In conclusion, our study has highlighted the high prevalence of MRSA and the emergence of S. aureus with intermediate resistance to Vancomycin. There is thus a need to enforce the judicious use of Vancomycin. Alternative anti-MRSA drugs should be used when appropriate in order to balance the antibiotic pressure of Vancomycin on the bacterial population.

One needs to keep in mind that the use of newer antibacterial drugs needs to be carefully defined to prevent misuse and subsequent resistance to these drugs.

REFERENCES


