PROFILE OF STAPHYLOCOCCUS AUREUS ISOLATED FROM PATIENTS ADMITTED IN A TERTIARY CARE HOSPITAL WITH ESPECIAL REFERENCE TO METHICILLIN RESISTANCE

Microbiology

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ABSTRACT

BACKGROUND: *Staphylococcus aureus* is a major human pathogen that causes wide range of clinical infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) is endemic in India and is a dangerous pathogen causing hospital acquired infection leadings to significant morbidity and mortality.

OBJECTIVE: To study the profile of *Staphylococcus aureus* isolated from patients admitted in a tertiary care hospital.

RESULT: Majority of clinical isolates of *S. aureus* was obtained from patients of skin and soft tissue infection (54.66%) followed by those suffering from respiratory infection (13.33%), blood stream infection (13.33%) and UTI (8%). *S. aureus* was predominantly isolated from IPD samples, maximum cases were in the age group of 31-40 years and males outnumbered females. There was predominance of MRSA 112 (74.66%) which showed high level of resistance to penicillin (100%), ciprofloxacin (82.14%), co-trimoxazole (79.46%) and moxifloxacin (85.71%). All the clinical isolates of *S. aureus* were sensitive to linezolid and vancomycin (MIC <1 µg/ml).

CONCLUSIONS: The clinical isolates of *S. aureus* showed high level of resistance to various antimicrobial agents which is a significant nosocomial threat. Surveillance and infection control practices should be carried out to prevent cross transmission of such resistant pathogen within the hospital setting.

KEYWORDS

Staphylococcus Aureus, Mrsa, Multidrug Resistance, Skin & soft Tissue Infection

INTRODUCTION

Staphylococcus aureus is a major cause of community acquired as well as hospital acquired infections and has the ability to spread and cause outbreaks in hospitals.^{1,2} Various risk factors including indiscriminate use of antibiotics and prolonged hospitalization have been identified, which are associated with colonization and infection of surgical wounds as well as spread of methicillin resistant *S. aureus* (MRSA) in the health care setting.^{3,4} Epidemiological studies suggest that hospitals are facing the problem of MRSA and in spite of control measures MRSA has become the commonest pathogen, causing a wide range of hospital associated infections.^{5,6} Treatment of MRSA is limited to few therapeutic options like linezolid, teicoplanin and vancomycin. The present study was carried out to determine the profile of *S. aureus* isolated from patients admitted in a tertiary care hospital with especial reference to MRSA so that effective measures can be taken for better clinical outcome.

METHODOLOGY

A total of 150 non-repeat clinical isolates of *S. aureus* obtained from different clinical samples over a period of six months from various inpatient units and outpatient departments was processed. The isolation and identification of *S. aureus* was carried out as per standard bacteriological technique.⁷ The isolates of *S. aureus* were identified phenotypically and the Gram positive cocci, catalase positive, fermentative, slide and tube coagulase test positive were included in the study. Other bacterial pathogens were excluded from this study. The isolates of *S. aureus* were further confirmed by Vitek-2 compact system, using GPID card number P628 (Biomérieux, France).

ANTIMICROBIAL SUSCEPTIBILITY TESTING (AST)

AST was carried out as per CLSI recommendations 2018⁸ using commercially available antibiotic discs (Hi Media). The antibiotics tested for various microorganisms and their disc potency is as follows.

Disks tested for Gram positive cocci includes: Penicillin G (10 units), cefoxitin (30 µg), erythromycin (15 µg), clindamycin (2 µg), cotrimoxazole (1.25/23.75 µg), ampicillin (10 µg), tetracycline ((30 µg), doxycycline (30 µg), ciprofloxacin (5 µg), moxifloxacin (5 µg), gentamicin (10 µg), linezolid (30 µg).

LINEZOLID RESISTANCE:

Screening for linezolid resistance was carried out by disc diffusion

method using 30 µg disc of linezolid on MHA plate. A zone diameter of ≤ 20 mm was taken as resistant. The screen positive isolates was confirmed for linezolid resistance by determining the Minimum Inhibitory Concentration (MIC) and MIC of ≥ 8 µg/ml was taken as resistant.

METHICILLIN RESISTANCE:

Methicillin resistance was screened by disc diffusion method using cefoxitin (30 µg) disc and interpreted. A zone diameter of <21 mm was reported as cefoxitin screen positive.

VANCOMYCIN SUSCEPTIBILITY:

Susceptibility to vancomycin was tested by MIC as per CLSI recommendations and MIC of ≥ 4 µg/ml was taken as resistant.

Quality Control: *Staphylococcus aureus* ATCC 25923 was used for quality control.

RESULTS

Out of the 150 clinical isolates of *S. aureus* majority of isolates were obtained from patients of skin and soft tissue infections (54.66%) followed by those suffering from blood stream infections (13.33%), respiratory infections (13.33%) and UTI (8%) [Table 1]. The isolates of *S. aureus* was predominantly isolated from IPD samples (70.66%), maximum cases were in the age group of 31-40 years and males outnumbered females. There was predominance of MRSA 112 (74.66%) [Fig.1]. These isolates of MRSA showed very high level of resistance to penicillin (100%), moxifloxacin (85.71%), ciprofloxacin (82.14%), erythromycin (80.35%), co-trimoxazole (79.46%) and 69.64% (69.64%). [Table 2] However, all the clinical isolates of *S. aureus* were sensitive to linezolid and vancomycin (MIC <1 µg/ml).

Table 1: Samples wise distribution of isolates (n=150)

S. no.	Sample	Number	%
1.	Pus	82	54.66%
2.	Blood	20	13.33%
3.	Sputum	20	13.33%
4.	Urine	12	8%
5.	Stitch line swab	6	4%

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6.	Pleural fluid	5	3.33%
7.	Tracheal aspirate	3	2%
8.	Tissue	1	0.66%
9.	Central line	1	0.66%

Fig.1 : Distribution of MRSA among the clinical isolates (n= 150)

Table2: Susceptibility pattern of MRSA to various antimicrobial agents (n=112)

Antibiotics	Number	%
Penicillin	100	100%
Erythromycin	90	80.35%
Clindamycin	45	40.17%
Co-trimoxazole	89	79.46%
Tetracycline	15	13.39%
Ciprofloxacin	92	82.14%
Moxifloxacin	96	85.71%
Chloramphenicol	9	8%
Gentamicin	78	69.64%
Cefoxitin	100	100%

DISCUSSION

S. aureus is one of the commonest Gram positive cocci isolated in clinical samples followed by *Enterococcus* spp. and Coagulase-negative Staphylococci.^{9, 10} The present study was carried out to determine the profile of *S. aureus* in a tertiary care hospital. Majority of our clinical isolates of *S. aureus* was obtained from skin and soft tissue infections (54.66%) followed by blood stream infections (13.33%), respiratory infections (13.33%) and urinary tract infection (8%). Similar finding was reported recently by Dhruv *et al* in 2019.⁹

Among the *S. aureus* isolated from our center, (74.66%) were MRSA. A comparatively high isolation rate of MRSA from our hospital is a matter of concern as they are resistant to multiple antibiotics leaving very few treatment options. Moreover, these isolates of MRSA showed resistance to multiple antimicrobial agents including very high level of resistance to penicillin-G and cefoxitin, ciprofloxacin, moxifloxacin and co-trimoxazole. [Table 2] Such multidrug resistant strains are becoming the common causes of morbidity and mortality mainly in hospital settings. It has been seen that hospitals of all sizes are facing the problem of MRSA and the problem appear to be increasing regardless of infection control measures for MRSA.¹¹ Patients who are infected or colonized are important reservoirs of MRSA in hospitals.

Few recent studies have reported MRSA ranging from as low as 38% to as high as 62%.^{12,13} Overall, Indian Network of Surveillance of Antimicrobial Resistance (INSAR) study reported MRSA in the range (22% to 68%) observed at various centers which participated in the study.¹⁴ Epidemiological studies suggest that in the last two decades prevalence of MRSA has steadily increased all over the world.^{11,14} On the contrary, Dhruv *et al*⁹ reported the prevalence of methicillin resistance in *S. aureus* as low as 30%.

However, all our clinical isolates of *S. aureus* showed higher susceptibility to linezolid, vancomycin and teicoplanin (100% each). Similarly, higher susceptibility to linezolid (98%), vancomycin (98%), and teicoplanin (98%) have been reported by others,⁹ thus emphasizing judicious use of these reserve drug in routine clinical practice.¹³ Antibiotics like linezolid and vancomycin are the only alternative therapeutic agents for these MDR pathogens. Vancomycin, a glycopeptide has been used to treat infections caused by MRSA all over the world.¹⁵ Linezolid is one of the few therapeutic options shown to be effective against MDR *Staphylococcal* infections and is available both as oral and parenteral formulations. If resistance develops to these drugs we are left with no therapeutic options. Due to the ease of oral administration; linezolid has been misused in clinical practice. Thus,

judicious use of these reserve antibiotics and strict implementation of infection control measures are the only ways to prevent spread and reduce emergence of resistance.

CONCLUSION

Infections caused by MRSA are a significant problem in our setting. Proper selection of antibiotics based on susceptibility testing is needed for effective treatment and prevention of MRSA. Stringent infection control measures should also be followed to prevent spread of such pathogens within the Hospital settings.

REFERENCES:

1. Sheagren JN. *Staphylococcus aureus*. The persistent pathogen. *New Engl J Med* 1984; 310: 1368-73.
2. Williams DN, Peterson PK. Endocarditis caused by coagulase negative Staphylococci. *Infection* 1979; 7:5-9
3. Jonson AP: Intermediate vancomycin resistance in *S. aureus*: a major threat or a minor inconvenience? *J Antimicrob Chemother* 1998; 42:289-91.
4. Fraise AP: Guidelines for the control of methicillin resistant *S. aureus* *J Antimicrob Chemother* 1998; 42:287-89.
5. Aires de Sousa M, Sanches IS, Ferro ML, et al. Intercontinental spread of a multidrug-resistant methicillin-resistant *Staphylococcus aureus* clone. *J Clin Microbiol* 1998; 36:2590-6.
6. Wylie JL, Nowicki DL. Molecular epidemiology of community- and health care-associated methicillin-resistant *Staphylococcus aureus* in Manitoba, Canada. *J Clin Microbiol* 2005; 43:2830-6.
7. Collee JG, Marmion BP, Fraser A.G, Simmons A. Laboratory strategy in the diagnosis of infective syndromes. In: Collee JG, Marmion BP, Fraser AG, Simmons A. (eds.) Mackie & McCartney Practical Medical Microbiology. 14th edition. London: Elsevier; 2007.p. 53-94.
8. Clinical Laboratory Standards Institute (CLSI) guidelines. Performance standards for antimicrobial susceptibility testing: twenty eighth informational supplement. CLSI document M1000-S28. Wayne PA: Clinical and Laboratory Standard Institute. 2018.
9. Mamtara D, Saseedharan S, Bhalekar P, Katakdhond S. Microbiological profile and antibiotic susceptibility pattern of Gram-positive isolates at a tertiary care hospital. *J Lab Physicians* 2019;11:144-8
10. Perwaiz S, Barakzi Q, Farooqi BJ, Khurshed N, Sabir N. Antimicrobial Susceptibility Pattern of Clinical Isolates of Methicillin Resistant *Staphylococcus aureus*. *J Pak Med Assoc* 2007; 57(1):1-4
11. Whitby M. Fusidic acid in the treatment of methicillin-resistant *Staphylococcus aureus*. *Int. J. Antimicrob Agents* 1999; 12 (Suppl 2):S67-71.
12. Singh S, Dhawan B, Kapil A, Kabra SK, Suri A, Sreenivas V. Coagulase-Negative Staphylococci causing blood stream infection at an Indian tertiary care hospital: Prevalence, antimicrobial resistance and molecular characterization. *Indian J Med Microbiol* 2016; 34(4):500-05.
13. Singhal R, Dhawan S, Mohanty S, Sood S, Kapil A, Dhawan B. et al. Species distribution and antimicrobial susceptibility of coagulase negative staphylococci in a tertiary care hospital. *Indian J Med Res*. 2006; 123:569-70.
14. Indian Network for Surveillance of Antimicrobial Resistance (INSAR) group. India. Methicillin resistant *Staphylococcus aureus* (MRSA) in India: prevalence & susceptibility pattern. *Indian J Med Res*. 2013;137(2):363-69.
15. Rogers KL, Fey PD, Rupp ME. Coagulase-negative staphylococcal infections. *Infect Dis Clin North Am*. 2009; 23:73-98.