

Original Research Article

Prevalence of Mupirocin Resistance in Clinical Isolates of *Staphylococcus aureus* in a Tertiary care Hospital

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Abstract: **Introduction:** MRSA is one the most common cause of nosocomial infections. Decolonization of MRSA from the anterior nares by mupirocin ointment is most commonly performed modality to prevent the transmission of infection among patients and health care personnel. Unprecedented use has led to development of resistance to mupirocin. The present study is conducted to determine the prevalence of mupirocin resistant *S. aureus* to understand the risk of transmission of nosocomial infections due to *S. aureus* in our health care setting **Materials and methods:** All clinical isolates of *S. aureus* obtained from various specimens sent for routine culture and sensitivity in the laboratory was included in the study. Methicillin resistance was determined by using cefoxitin disc 30 µg as per Clinical and Laboratory Standards Institute (CLSI) guidelines. Mupirocin resistance among *S. aureus* was determined by disk diffusion method using mupirocin discs of 5 µg and 200 µg. **Results:** Out of 310 *S. aureus* isolates, 141 isolates were MRSA. Mupirocin resistance among the MRSA isolates was found in 9 (6.4%) isolates. Among the mupirocin resistant strains, none of the isolates showed low-level of mupirocin resistance. **Conclusion:** Routine nasal decolonisation of health care personnel and surveillance of mupirocin resistance among the isolates obtained from the patients and the health care personnel should be done to prevent the transmission of infections.

Keywords: MRSA, MuH, Mupirocin resistant *S. aureus*.

INTRODUCTION

Infections due to *Staphylococcus aureus* is one of the most common infections seen among the patients admitted in hospital [1]. The presence of *S. aureus* as a part of commensal flora especially in the anterior nares, axillary region, perineum and hands is an important cause of transmission of infections among the patients and the health care personnel [2]. Treatment of the infections caused due to *S. aureus* is more challenging due to high prevalence of methicillin resistant *S. aureus* (MRSA) especially in health care settings [3].

Decolonization of MRSA from the anterior nares is most commonly performed modality to prevent the transmission of infection among patients and health care personnel [4]. The antibiotic commonly used for this is mupirocin which is a topical agent acts by inhibiting the protein synthesis by binding to bacterial isoleucyl-tRNA synthetase [5]. Apart from being used

as a decolonizing agent it can also be used for skin and soft tissue infections caused due to *S. aureus*. However, due to irrational use and over the counter sale, resistance to mupirocin has been increased [6].

Mupirocin resistance is categorized phenotypically into low-level (MuL) and high-level (MuH) with minimum inhibitory concentration (MIC) 8-256 µg/ml and >512 µg/ml, respectively. Novel isoleucyl RNA synthetase encoded by *mupA* gene is responsible for high-level resistance, whereas base pair change in native gene coding for the enzyme is responsible for low-level resistance [7].

The present study is conducted to determine the prevalence of mupirocin resistance among routinely obtained clinical isolates of *S. aureus* to understand the risk of transmission of nosocomial infections due to *S. aureus* in our health care setting.

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MATERIAL AND METHODS

The present study is a cross-sectional survey conducted in the Department of Microbiology, Mayo Institute of Medical Sciences, Barabanki, Uttar Pradesh during January to March 2019. All clinical isolates of *S. aureus* obtained from various specimens sent for routine culture and sensitivity in the laboratory was included in the study.

The growth of *S. aureus* was identified on the basis of its colony morphology, gram staining reaction, catalase, coagulase, dimethyl sulfoxide oxidase and DNAase test. All confirmed isolates of *S. aureus* were further tested for determination of methicillin resistance by using cefoxitin disc 30 µg as per Clinical and Laboratory Standards Institute (CLSI) guidelines [8].

Mupirocin resistance among *S. aureus* was determined by disk diffusion method using mupirocin discs of 5 µg and 200 µg. A lawn culture of *S. aureus* was performed on Mueller Hinton Agar (MHA) and both mupirocin discs were applied on the surface of agar and plates were incubated aerobically overnight at 37°C. After incubation the plates were examined for the zone diameter of inhibition. A zone of >14 mm for both discs was considered as mupirocin sensitive. Whereas, a zone of <14 mm in 5 µg and >14 mm in 200 µg was considered as low-level mupirocin resistance and zone

of <14 mm in both the discs was considered as high-level resistance [7].

Antimicrobial susceptibility testing was performed on *S. aureus* isolates by Kirby-Bauer disc diffusion method. The antibiotic discs used were as follows: erythromycin (15 µg), clindamycin (2µg), cotrimoxazole (1.25/23.75 µg), tetracycline (30 µg), rifampin (5 µg), chloramphenicol (30 µg), ciprofloxacin (5 µg), linezolid (30 µg),

RESULTS

A total of 310 non-duplicate clinical isolates of *S. aureus* were included in the present study. Among them 141 (45.5%) isolates were found to be MRSA. Distribution of *S. aureus*, MRSA and MuH in various specimens is depicted in Table 1. Mupirocin resistance among the MRSA isolates was found in 9 (6.4%) isolates. Whereas, none of the methicillin sensitive isolates of *S. aureus* showed mupirocin resistance. Among the mupirocin resistant strains, none of the isolates showed low-level of mupirocin resistance.

Antimicrobial susceptibility profile of MRSA isolates showed a higher resistance to erythromycin (63.8%), clindamycin (61.7%), ciprofloxacin (58.9%) and cotrimoxazole (54.6%) whereas all strains were sensitive to linezolid. The antimicrobial susceptibility profile is depicted in the Table 2.

Table-1: Distribution of *S. aureus*, MRSA and MuH among various specimens

Sample	<i>S. aureus</i>	MRSA	MuH
Pus	151	83	5
Respiratory specimens	62	25	2
Urine	26	13	1
Blood	21	06	-
Wound swab	36	9	1
Synovial fluid	14	05	-
Total	310	141	9

Table-2: Antimicrobial susceptibility profile of MRSA and MuH isolates

Antibiotics	MRSA (%)	MuH (%)
Erythromycin	51 (36.2)	4 (44.4)
Clindamycin	54 (38.3)	3 (33.3)
Cotrimoxazole	64 (45.4)	4 (44.4)
Tetracycline	79 (56.1)	5 (55.5)
Rifampin	71 (50.3)	6 (66.6)
Chloramphenicol	98 (69.5)	7 (77.7)
Ciprofloxacin	58 (41.1)	4 (44.4)
Linezolid	100 (100)	9 (100)

DISCUSSION

Mupirocin is a well-known topical antibiotic agent commonly used for treatment of skin and soft tissue infections [5]. Lately, due to increasing prevalence of MRSA use of mupirocin ointment has been increased drastically which led to its unprecedented and irritational use [6,7]. Nosocomial

infections caused due to MRSA is a major challenge to the clinicians and resistance to mupirocin is adding to it.

In the present study, 141 (45.5%) MRSA isolates were obtained from a total of 310 *S. aureus* isolates. The prevalence is quite high as compared to few other studies conducted in this region [9,10]. However, this finding is consistent with a surveillance

study conducted by Indian Network for Surveillance of Antimicrobial Resistance – INSAR [11].

Among 141 MRSA isolates, only 9 isolates found to have high-level mupirocin resistance. This finding is consistent with various studies which has showed a lower prevalence of mupirocin resistant *S. aureus* [7,12,13]. However, studies conducted by Chaturvedi *et al.* and Shivanna *et al.* have shown a high prevalence of mupirocin resistant *S. aureus* [6,14].

Antimicrobial susceptibility pattern of MRSA and MuH showed that most of the commonly used antibiotics for the treatment of various skin and soft tissue infections are not much effective and there are chances of poorer treatment outcome. Isolates are resistant to erythromycin, clindamycin and cotrimoxazole are most commonly used topical antibiotic agents apart from mupirocin for treatment of *S. aureus* infections. Similar findings were observed by various other studies [6,7,15].

CONCLUSION

Transmission of nosocomial infections is a major challenge in every health care setting. The present study has found a very high prevalence of MRSA which is a very common cause of nosocomial infection. MRSA along with mupirocin resistance may lead to treatment failure and increases the chances of transmission of infections. Therefore, it is advisable to do routine nasal decolonisation of health care personnel and surveillance of mupirocin resistance among the isolates obtained from the patients and the health care personnel.

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