

Study of methicillin-resistant *Staphylococcus aureus* among patients admitted in tertiary care rural hospital

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ABSTRACT


Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) has become a major health-care issue today in community hospitals, long-term care facilities, and tertiary care hospitals. Colonization and infection by *Staphylococcus aureus* are known to be significantly associated with infection among hospitalized patients. MRSA nasal carriage among hospital patients on admission will increase the likelihood of MRSA infection during the same episode of hospitalization. **Objectives:** The study was carried out to know the prevalence of MRSA and methicillin-resistant coagulase-negative staphylococci (MRCoNS) colonization from nasal swabs, gender-wise, age-wise, and stay-wise distribution of MRSA and MRCoNS. **Materials and Methods:** A prospective cross-sectional study was carried out from the period of December 2013 to April 2014. Nasal swabs were collected from 229 patients, who were admitted for more than 48 h admission in the hospital from various clinical departments. Informed consent was obtained from the patients or their relatives. **Results:** Of 229 patients, *S. aureus* was isolated in 63 (27.51%) and coagulase-negative *S. aureus* in 91 (39.74%). The prevalence of MRSA was 9.17% and MRCoNS - 11.79%. Colonization was seen more in males. Higher prevalence of MRSA was seen in <5 years and >60 years. Higher prevalence of MRSA was seen in the 1st week of admission and higher prevalence of MRCoNS was noted from the 2nd week onward. **Conclusion:** We observed higher prevalence of MRSA in the 1st week of admission and from the 2nd week onward MRCoNS among the hospitalized patients. The higher prevalence of MRSA was also seen in the under-fives followed by geriatric age group who are vulnerable. Hence, we strongly advised that every patient should be screened for MRSA at the time of admission to reduce the burden of MRSA infection during hospitalization.

KEY WORDS: Methicillin-resistant *Staphylococcus Aureus*; Hospitalized Patients; Nasal Swabs

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) has become endemic today in community hospitals, long-term care facilities, and tertiary care hospitals. Once a *S. aureus* isolate is characterized as an MRSA, it is instantly classified as

a multidrug resistant (MDR), because resistance to oxacillin or ceftoxitin infers non-susceptibility to all categories of β -lactam antimicrobials (i.e., all categories of penicillins, cephalosporins, β -lactamase inhibitors, and carbapenems).^[1] Thus, MDR-MRSA is the new or rather a continually evolving paradigmatic pathogen.^[2] Resistance of *S. aureus* to β -lactam antibiotics is attributed to the presence of the *mecA* gene. This *mecA* gene is located on mobile genetic element called the “Staphylococcal Cassette Chromosome *mec*.”^[3] The most striking situation is that MRSA strains have emerged with concomitant resistance to many commonly used antibiotics of groups, aminoglycosides, macrolides, fluoroquinolones, chloramphenicol, and tetracycline.^[4]

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First reported in 1960, the growing problem in the Indian scenario is that MRSA prevalence has increased from 12% in 1992 to 80.89% in 1999.^[5] The increase in the incidence of infections is partially a consequence of advances in patient care, older age, comorbidities of patients, irrational use of antibiotic, prolong duration of hospital stay, nasal and hand carriage in health-care staff, and patients,^[6-9] and also of the pathogen's ability to adapt to a changing environment, increasing burden on health care resources.

Methicillin resistance is not only confined to *S. aureus* but also "methicillin-resistant *Staphylococcus epidermidis*" in nosocomial infections.

Nasal carriage is a major risk factor for *S. aureus* infection, especially for MRSA.^[10] Anterior nares are the major reservoir of *S. aureus*: 20% of humans are persistently and asymptotically colonized, 60% are intermittently, and 20% are non-carriers.^[11]

Colonization may be either transient or persistent and may be at single or multiple body sites.^[12] MRSA colonization precedes infection and the nasal colonization with *S. aureus* has been linked to surgical site infection,^[13] bloodstream infection,^[14] and ventilator-associated pneumonia.^[15]

The fact that a patient can harbor MRSA at hospital admission has consequences not only for the choice of patient treatment but it also has an impact on effectiveness of hospital infection control. Hence, the present study was undertaken with the aim to know the:

- Prevalence of MRSA colonization from the nasal swabs of patient
- Gender-wise prevalence of MRSA isolates and methicillin-resistant coagulase-negative staphylococci (MRCoNS)
- Age-wise distribution of MRSA isolates and MRCoNS
- Stay-wise distribution of MRSA isolates and MRCoNS.

MATERIALS AND METHODS

A prospective cross-sectional study was carried out from the period of December 2013 to April 2014. Informed consent was obtained from the patients or their relatives. Patients who were admitted for more than 48 h admission in the hospital were included in the study. A total of 229 patients were randomly selected. The age, sex, duration of stay in the hospital, and other relevant information were obtained in a pro forma. The nasal swabs were collected from patient with informed consent from orthopedics, ICU, medicine, pediatric, surgery, and gynecology. Repeat and duplicate isolates from the same person during the study period were identified by the patient medical record number and excluded from the study.

Nasal swabs from both nostrils were collected by rotating a sterile cotton swab pre-wetted with sterile saline 5 times on the vestibule of both anterior nares. The swabs were immediately placed in test tubes for further processing in the laboratory.

Nasal swabs from both nostrils were streaked on blood agar for 24 h at 37°C. Identification of *S. aureus* was done by standard biochemical techniques.^[16] *S. aureus* isolates were subsequently screened for methicillin resistance by modified Kirby-Bauer method using cefoxitin (30 µg) disk on Mueller-Hinton Agar. The isolates were considered methicillin resistant if the zone of inhibition was 21 mm or less.^[17] Statistical analysis was done using (Microsoft Excel) standard normal test (*z*-test). *P* < 0.05 was taken as statistically significant.

RESULTS

Nasal swabs collected from 229 patients, *S. aureus* was isolated in 63 (27.51%) and coagulase-negative *S. aureus* in 91 (39.74%). The prevalence of MRSA in our study was 9.17% and that of MRCoNS was 11.79% [Table 1]. Table 1 depicts that the male patient was more colonized when compared to female patient, but there is no statistical significance. Table 2 depicts higher prevalence of MRSA in the age group of <5 years (25%) and >60 years (11.27%). Table 3 depicts striking differences; higher prevalence of MRSA (13.76%) in the 1st week of admission, whereas in case of MRCoNS, higher prevalence was noted from the 2nd week onward.

DISCUSSION

Nasal carriage of *S. aureus* plays a key role in the epidemiology and pathogenesis of infection and is a major risk factor for the development of both community-acquired and nosocomial infections.^[18] A causal relationship between *S. aureus* nasal carriage and infection is supported by the fact that the nasal strain and the infecting strain share the same genotype.^[19]

In our study, of 229 patients, MRSA was isolated in 21 (9.17%) and MRCoNS in 27 (11.79%). Santos *et al.* in their screening of 297 adult patients and 176 pediatric patients

Table 1: Gender-wise prevalence of MRSA isolates and MRCoNS

Gender	Total number of patient	MRSA n=21 (%)	MRCoNS n=27 (%)
Male	120	14 (11.66)	16 (13.33)
Female	109	7 (6.42)	11 (10.09)
Total	229	21 (9.17)	27 (11.79)

MRSA: Methicillin-resistant *Staphylococcus aureus*,
MRCoNS: Methicillin-resistant coagulase-negative staphylococci

Table 2: Age-wise distribution of MRSA isolates and MRCoNS

Age	Total	MRSA n (%)	MRCoNS n (%)
0–5	4	1 (25)	1 (25)
6–19	14	1 (7.14)	1 (7.14)
20–59	140	11 (7.86)	18 (12.86)
60–90	71	8 (11.27)	7 (9.86)
Total	229	21	27

MRSA: Methicillin-resistant *Staphylococcus aureus*,
MRCoNS: Methicillin-resistant coagulase-negative staphylococci

Table 3: Stay-wise distribution of MRSA isolates and MRCoNS

Duration of hospitalization	Total number of patient	MRSA n (%)	MRCoNS n (%)
2–6 day	109	15 (13.76)	7 (6.42)
7–14 days	101	6 (5.94)	12 (11.88)
15 days onward	19	0	8 (42.10)
Total	229	21 (9.17)	27 (11.79)

MRSA: Methicillin-resistant *Staphylococcus aureus*,
MRCoNS: Methicillin-resistant coagulase-negative staphylococci

found that the prevalence of MRSA at admission was 6.1% in the adult population and 2.3% for children.^[20] Mathanraj *et al.* from Pondicherry noted that overall carriage rate was 8.5%, with the highest rate in inpatients (15.6%) while the lowest in HCWs (1.8%) in these patients the most common site of colonization of MRSA was the anterior nares.^[21]

Colonization and infection by *S. aureus* are known to be significantly associated with infection among hospitalized patients.^[14] In the era of high prevalence of methicillin resistance among *S. aureus*, a relatively high percentage (11–19%) of MRSA nasal carriage among hospital patients on admission will increase the likelihood of MRSA infection during the same episode of hospitalization.^[22]

Al-Anazi and Madani *et al.*^[23,24] in their study noted that majority of their patient were >60 years of age. However, in our study, higher prevalence of MRSA was seen among the under-five age group (25%) followed by the age group of 60 years and above (11.27%).

In our study, we observed that as compared to female patients 7 (33.33%) the number of male patients who were colonized was more 14 (66.67%). However, there is no statistical significance. In a study by Al Anazi *et al.*, 74.1% patients were males and 25.9% were females which is almost similar to the findings in our study. Al Anazi *et al.* also found the similar finding were similar.^[23]

When we studied the patients according to their days of stay at the hospital, the higher prevalence of MRSA 15 (13.76%)

was noted in the 1st week of admission, whereas from the 2nd week onward, higher prevalence of MRCoNS 8 (42.10%) was observed. Further studies are needed to explain the disparity.

Prolonged hospital stay was a risk factor for methicillin resistance, whereas stay for >25 days was found to be a highly significant risk factor.^[24,25]

Santos *et al.* in their study noted the proportion of patients in their study which became colonized each week increased and this is in accordance with the fact that patients who remain longer in hospital are exposed to more interventions (e.g., by invasive procedures, contacts with healthcare workers, and antimicrobials use) which may raise the risk of acquisition of a pathogen.^[20]

Studies have shown that among the hospitalized patients with medical devices, the 12-week mortality ranged from 17% for patients with long-term indwelling catheters to 35% for patients with cardiac devices.^[7] Multidrug resistance has made the care of these patients more difficult and expensive.

CONCLUSION

The higher prevalence of MRSA in the 1st week of admission and from the 2nd week onward MRCoNS among the hospitalized patients is a matter of concern. Furthermore, we noted higher prevalence of MRSA in the under-five followed by geriatric age group. Hence, we strongly advise that every patient should be screened at the time of admission to reduce the burden of MRSA infection during hospitalization.

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