ORIGINAL RESEARCH PAPER

Clinical Microbiology

PREVALENCE AND ANTIBIOGRAM OF STAPHYLOCOCCUS NASAL CARRIAGE AMONG HEALTHCARE WORKERS AT A TERTIARY CARE HOSPITAL

KEY WORDS: Staphylococcus aureus, Healthcare workers, MRSA nasal carriage, Antibiotic resistance, Mupirocin resistance

Dr. Arun Kumar* Senior Resident, Department of Microbiology, BPS Government Medical College for Women, Khanpur Kalan, Haryana *Corresponding Author

Dr. Mukta Mangesh Deshmukh Professor, Department of Microbiology, Dr. Panjabrao Alias Bhausaheb Deshmukh Memorial Medical College, Amravati, Maharashtra

Dr. Pramod Ramkrishna Bhise Professor & Head, Department of Microbiology, Dr. Panjabrao Alias Bhausaheb Deshmukh Memorial Medical College, Amravati, Maharashtra

Dr. Archana Pratap Nikam Assistant Professor, Department of Microbiology, Dr. Panjabrao Alias Bhausaheb Deshmukh Memorial Medical College, Amravati, Maharashtra

ABSTRACT

Background: Methicillin-resistant Staphylococcus aureus (MRSA) and Coagulase-negative Staphylococcus (CoNS) are significant contributors to hospital-acquired infections. Healthcare workers (HCWs), particularly persistent nasal carriers, act as reservoirs, facilitating nosocomial transmission and posing a challenge to infection control strategies. **Objectives:** To determine the prevalence of Staphylococcus nasal carriage among HCWs in a tertiary care hospital and to assess the antibiotic susceptibility pattern of the isolates. **Methodology:** This cross-sectional study was conducted from April to October 2023 on 237 HCWs across wards, ICUs, OTs, and OPDs. Nasal swabs were cultured on Blood Agar, MacConkey, and Mannitol Salt Agar. Identification was performed via biochemical tests and Gram staining. Antimicrobial susceptibility was determined using Kirby-Bauer disc diffusion per CLSI 2023 guidelines. Methicillin resistance was confirmed using Cefoxitin and Oxacillin disc screening on Mueller-Hinton Agar with NaCl. **Results:** Of the 237 swabs, MRSA was isolated in 94 (39.6%) and MRCoNS/MSCoNS in 103 (43.5%), while 40 (16.9%) showed no growth. MRSA and MRCoNS demonstrated 100% resistance to Penicillin and Oxacillin; Mupirocin resistance was ~51.1% and ~54.4%, respectively. All isolates remained sensitive to Vancomycin. Colonization was most common among nurses and attendants, especially in ward settings. **Conclusion:** The high prevalence of methicillin-resistant Staphylococcus nasal carriage among HCWs, coupled with significant Mupirocin resistance, highlights the need for routine screening, targeted decolonization, and strict antibiotic stewardship to mitigate nosocomial infection risks.

INTRODUCTION

- Staphylococcus aureus (S. aureus) is a versatile and adaptable bacterium with a remarkable ability to acquire resistance to antibiotics. [1]
- The emergence of S. aureus infections, which persist as a prominent pathogen in various hospital and community-acquired infections globally. [2]
- Both S. aureus and MRSA play roles in various hospital-acquired infections. Colonized health-care workers serve as a reservoir, facilitating the spread of S. aureus to uncolonized patients within the hospital setting. [3]
- The anterior nares, identified as the primary reservoir for S. aureus, play a crucial role and acting as a source for cross-colonization in the community and an endogenous reservoir for clinical infections in colonized individuals. [4]
- About 20% of healthy adults are persistent nasal carriers of S. aureus and 60% harbour the organism intermittently, playing a crucial role in infection epidemiology and pathogenesis. [4]
- Persistent nasal carriers pose a significant indigenous source and are at higher risk for surgical site infections, foreign body infections, and bacteraemia. [5]

Aim

To study Prevalence and Antibiogram of Staphylococcus Nasal Carriage among Healthcare Workers at Tertiary Care Hospital.

Objectives

1. To estimate Prevalence of Staphylococcus Nasal Carriage among Healthcare Workers at Tertiary Care Hospital.
2. To evaluate Antibiotic Susceptibility pattern of Staphylococcus as Nasal carrier.

Materials

- Sterilized Cotton Swab
- Petri Plates
- Blood agar
- MacConkey's Agar
- Mannitol Salt Agar
- Gram Staining Kit
- Muller- Hinton Agar with Antibiotic discs
- Distilled water

Methodology

- This cross-sectional conducted at a tertiary care hospital from April 2023 to October 2023.
- The research focused on 237 healthcare workers (HCW) in clinical wards and ICUs, OTs and OPDs selected through convenience sampling.
- Inclusion criteria involve HCW willing to participate, while exclusion criteria include those unwilling or with a history of URTI, recent nasal surgery, or use of nasal medication/antibiotic therapy.
- Nasal swabs were collected as per guidelines, plated on Blood Agar and MacConkey Agar, Mannitol Salt Agar with colonies identified using various tests, including biochemical tests and the Kirby Bauer disc diffusion method for antibiotic susceptibility as per CLSI 2023.
- Screening for Methicillin resistance involves the Cefoxitin and Oxacillin disk screen test on Muller Hinton Agar with NaCl, following CLSI guidelines, with Staphylococcus aureus ATCC 25923 as a control strain.

RESULTS:

Table 1. Gender-wise Distribution

Gender	Count
Female	152

Male	85
Total	237

This Table 1 outlines the gender composition of the study population. Among the 237 healthcare workers sampled, females constituted the majority (64.1%) with 152 participants, while males accounted for 35.9% (85 participants). This demographic information supports subgroup analysis for colonization trends.

Table 2. Organism Categorization (N = 237 swabs)

Organism Type	Cases	Percentage
MRSA	94	39.6%
MR-CONS / MS-CONS	103	43.5%
No Growth Observed	40	16.9%
Total Swabs	237	100%

The Table 2 presents the distribution of microbiological findings from 237 nasal swabs. Coagulase-negative Staphylococcus (MR-CoNS/MS-CoNS) was the most frequently isolated organism (43.5%), followed by MRSA (39.6%). No growth was observed in 16.9% of swabs. These values reflect the burden of staphylococcal colonization among the hospital staff.

Antibiotic Resistance Summary

Table 3. Comparative Antibiotic Resistance Profile of MRSA and MR-CoNS

Antibiotic	MRSA – Resistant (n=94)	MRSA – Sensitive	MRSA – Resistance Rate	MR-CoNS – Resistant (n=103)	MR-CoNS – Sensitive	MR-CoNS – Resistance Rate
CX-30	94	0	100%	101	2	~98.1%
OX-1	94	0	100%	101	2	~98.1%
P-10	94	0	100%	103	0	100%
MUP-200	48	46	~51.1%	56	47	~54.4%
VA-Estrip	0	94	0%	0	103	0%

Both MRSA and MR-CoNS strains show uniform resistance to β-lactams: Cefoxitin, Oxacillin, and Penicillin. Mupirocin resistance is moderately high in both groups (~50%), posing challenges for decolonization strategies. Vancomycin retains full efficacy across all isolates, affirming its critical role in management of resistant staphylococcal infections.

Table 4. Colonization Distribution by Designation and Location

Designation	Samples	MRSA	MR-CoNS	No Growth	Sampling Location	MRSA	MR-CoNS	No Growth
Staff Nurse	122	45	48	29	Ward	58	70	23
Attendant	85	30	39	16	ICU	18	26	17
Doctor	30	19	2	9	OT	6	2	9
—	—	—	—	—	OPD	2	1	5
Total	237	94	103	40	All Locations	84	99	54

Tables 4 detail colonization patterns by designation and sampling location. Staff nurses and attendants showed the highest colonization rates. Samples from wards yielded the highest MRSA and MR-CoNS counts, while OT and OPD swabs frequently returned no growth.

Heatmap: Colonization by Location and Staff Category

Category	MRSA	MR-CoNS	No Growth
Ward	• High	• High	Moderate
ICU	Moderate	Moderate	Moderate
OT	Low	• Very Low	• High
OPD	• Very Low	• Very Low	Moderate
Staff Nurse (SN)	High	High	Moderate
Attendant	Moderate	High	Moderate
Doctor	Moderate	• Low	Moderate

Wards and staff nurses are critical hotspots for MRSA and MR-CoNS colonization, necessitating prioritized screening and hygiene interventions. Attendants and ICU samples show moderate colonization levels, marking them as secondary targets for surveillance. Doctors and OPD and OT settings display relatively lower colonization with CoNS and higher "no growth" rates-suggestive of effective antimicrobial stewardship and environmental control.

DISCUSSION

This study highlights a significant prevalence of nasal colonization by methicillin-resistant Staphylococcus spp. among healthcare workers (HCWs) in a tertiary care setting. Among 237 swabs analyzed, Coagulase-negative Staphylococcus (CoNS) dominated with 43.5%, closely followed by MRSA at 39.6%, while 16.9% showed no growth. These rates reinforce the role of HCWs as reservoirs for resistant organisms and mirror patterns observed in previous Indian and international studies [1,4,5].

The antimicrobial resistance data underline a critical challenge. MRSA isolates demonstrated 100% resistance to Cefoxitin (CX-30), Oxacillin (OX-1), and Penicillin (P-10), while MRCoNS displayed similar resistance levels—98.1% to CX-30 and OX-1, and complete resistance to P-10. Mupirocin resistance was notable (~51.1% in MRSA, ~54.4% in MRCoNS), raising alarm over its sustained use in decolonization regimens. Encouragingly, Vancomycin maintained 100% susceptibility across all isolates, underscoring its continued therapeutic reliability [3,6,7].

Stratification by designation revealed that staff nurses and attendants were disproportionately colonized. Of the 122 staff nurses sampled, 45 carried MRSA and 48 MRCoNS. Attendants followed closely with 30 and 39 cases respectively. Doctors demonstrated comparatively lower colonization rates, particularly for CoNS (only 2 cases), which may reflect differences in patient exposure, hygiene compliance, or protective measures [4,8].

Analysis by location identified wards as the highest risk environment for colonization. Of 151 ward samples, 58 were MRSA-positive and 70 MRCoNS-positive. ICUs displayed moderate colonization levels, while operation theatres (OT) and outpatient departments (OPD) showed high rates of "no growth," reflecting better sterilization standards and reduced microbial burden.

The aggregated findings support the need for proactive surveillance, particularly among nursing and support staff in high-contact zones. Near-total resistance to beta-lactams and rising Mupirocin resistance call for stringent infection control policies and judicious antimicrobial stewardship. Preservation of Vancomycin efficacy is reassuring but must not lead to complacency.

Our data align with prior work by Agarwal et al. and Kaur et al., who similarly reported high colonization rates and Mupirocin resistance among HCWs in tertiary care centers [7, 8]. These parallels reinforce the validity of our results and emphasize the need for national-level guidelines on HCW screening and decolonization strategies.

CONCLUSION

This study highlights a notable prevalence of methicillin-resistant Staphylococcus nasal colonization among healthcare workers, with MR-CoNS (43.5%) and MRSA (39.6%) as dominant isolates. Both strains showed widespread resistance to β-lactam antibiotics and moderate resistance to Mupirocin, limiting decolonization options. Vancomycin remained fully effective.

Staff nurses and attendants in high-contact areas, particularly wards and ICUs, demonstrated the highest colonization rates.

These findings support the need for regular screening, strengthened infection control, and prudent antibiotic use to reduce transmission risks. Institutional policies should prioritize resistance profiling and targeted decolonization efforts to protect healthcare environments.

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