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Silent Passengers: MRSA Nasal Carriage in High-Risk Surgical Patients – Insights from a Six-Month Prospective Study

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ABSTRACT

Background: Nasal carriage of *Staphylococcus aureus*, particularly methicillin-resistant strains, poses significant risks for healthcare-associated infections in surgical wards. This study aimed to determine the prevalence of methicillin-resistant *S. aureus* (MRSA nasal carriage among patients in cardiothoracic and neurosurgery units.

Methods: This prospective cross-sectional study was conducted from January to July 2025 in cardiothoracic and neurosurgery wards of a tertiary care hospital. Nasal swab samples were collected from 100 patients and processed for bacterial identification and antimicrobial susceptibility testing using standard microbiological methods.

Results: Among 100 nasal swab samples, 36 (36%) yielded *Staphylococcus aureus* growth, while 64 (64%) showed coagulase-negative staphylococci (CoNS) or gram-negative bacteria. Of the 36 *S. aureus* isolates, antimicrobial susceptibility testing revealed varying resistance patterns, with implications for infection control protocols in surgical settings.

Conclusion: The study provides baseline data on *S. aureus* nasal carriage rates in high-risk surgical wards, emphasizing the need for targeted screening and decolonization protocols to prevent healthcare-associated infections.

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Introduction

Staphylococcus aureus is a major opportunistic pathogen capable of causing a wide spectrum of infections ranging from superficial skin infections to life-threatening systemic diseases (1). The emergence and widespread distribution of methicillin-resistant *S. aureus* (MRSA) has become a significant global health concern, particularly in healthcare settings where vulnerable patients are at increased risk of acquiring serious infections (2). Nasal carriage of *S. aureus* serves as an important reservoir for subsequent infections, with studies demonstrating that nasal carriers have a significantly higher risk of developing *S. aureus* infections compared to non-carriers (3). The prevalence of nasal *S. aureus* carriage varies widely across different populations and healthcare settings, typically ranging from 20-40% in hospitalized patients (4). Surgical patients, particularly those undergoing cardiothoracic and neurosurgical procedures, represent a high-risk population due to the invasive nature of procedures, prolonged hospitalization, and frequent use of indwelling devices (5). The consequences of MRSA infections in these patients can be devastating, resulting in higher morbidity, mortality, and healthcare costs (6).

Understanding the epidemiology of nasal *S. aureus* carriage in specific hospital units is crucial for developing targeted infection prevention strategies. Pre-operative screening and decolonization protocols have shown promise in reducing surgical site infections, but their implementation requires knowledge of local carriage rates and resistance patterns (7).

This study aimed to determine the prevalence of *S. aureus* nasal carriage among patients admitted to cardiothoracic and neurosurgery wards and to characterize the antimicrobial resistance patterns of isolated strains.

Materials and Methods

This prospective cross-sectional study was conducted from January 2025 to July 2025 at a 500-bed tertiary care super speciality hospital in New Delhi. Patients admitted to cardiothoracic surgery and neurosurgery wards for surgery during the study period were eligible for inclusion. Exclusion criteria included patients with active nasal infections, those who had received antibiotics within 48 hours of sample collection, and patients unable to provide informed consent. Nasal swab samples were collected within 24-48 hours of admission using sterile cotton swabs moistened with sterile saline. Both anterior nares were swabbed using a rotating motion for 10-15 seconds. Samples were immediately transported to the microbiology laboratory. Samples were inoculated onto 5% sheep blood agar, mannitol salt agar, and MacConkey agar plates and incubated at 37°C for 18-24 hours. Bacterial identification was performed using standard biochemical tests including catalase, coagulase (tube and slide), DNase, and mannitol fermentation tests.

S. aureus isolates were confirmed using the VITEK 2 automated microbiology system (bioMérieux, France) with GP identification cards following manufacturer's instructions.

MRSA identification was based on cefoxitin (30µg) disk diffusion testing with zone diameters ≤21mm indicating methicillin resistance according to CLSI guidelines. Quality control was performed using *S. aureus* ATCC 25923.

Data analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics were used to calculate prevalence rates and resistance patterns. Chi-square test was used to compare categorical variables, with p-value <0.05 considered statistically significant.

Results

Study Population

A total of 100 nasal swab samples were collected during the six-month study period.

The study population included 58 patients from cardiothoracic surgery ward and 42 patients from neurosurgery ward. The mean age of participants was 54.2 ± 16.8 years, with 62% being male patients.

Among the 100 nasal swab samples processed, bacterial growth was observed in all samples. The distribution of isolates was as follows: *Staphylococcus aureus*: 36 isolates (36%)Coagulase-negative staphylococci (CoNS): 45 isolates (45%). Gram-negative bacteria: 19 isolates (19%) The gram-negative bacteria included *Klebsiella pneumoniae* (n=8), *Escherichia coli* (n=5), *Pseudomonas aeruginosa* (n=4), and *Acinetobacter baumannii* (n=2).

S. aureus carriage rates in patients admitted in different wards was comparable. Cardiothoracic surgery ward: 22/58 (37.9%) Neurosurgery ward: 14/42 (33.3%). The difference was not statistically significant (p=0.642).

MRSA detection and prevalence

MRSA detection was performed on all 36 *S. aureus* isolates using cefoxitin disk diffusion method, of which 14 isolates (38.9%) were resistant and classified as MRSA, while the remaining 22 isolates (61.1%) were sensitive and classified as Methicillin-Susceptible *Staphylococcus aureus* (MSSA) (Table 1).

Based on cefoxitin susceptibility testing, 14 out of 36 *S. aureus* isolates (38.9%) were identified as MRSA. This represents an overall MRSA nasal carriage rate of 14% (14/100) among all study participants.

Patients admitted in Cardiothoracic surgery ward: 9/22 *S. aureus* isolates (40.9%). Patients admitted in Neurosurgery ward: 5/14 *S. aureus* isolates (35.7%).

The identification of MRSA strains based solely on cefoxitin resistance testing provides important epidemiological data for infection control purposes. MRSA strains are typically associated with resistance to multiple antimicrobial classes, making them of particular concern in healthcare settings.

Table 1. Distribution of methicillin resistance among *Staphylococcus aureus* Isolates .

TEST	N (%)
Cefoxitin resistant (MRSA)	14 (38.9)
Cefoxitin sensitive (MSSA)	22 (61.1)

MRSA: Methicillin-Resistant *Staphylococcus aureus*

MSSA: Methicillin-Susceptible *Staphylococcus aureus*

N: Number of isolates

Discussion

This six-month prospective study provides important insights into the prevalence of *S. aureus* nasal carriage in high-risk surgical wards. The overall *S. aureus* carriage rate of 36% observed in our study is consistent with previous reports from similar healthcare settings (8, 9).

The MRSA prevalence of 38.9% among *S. aureus* isolates, representing 14% of all study participants, is concerning and highlights the significant burden of antimicrobial resistance in our institution. This finding is comparable to other studies from tertiary care hospitals in similar geographic regions (10, 11).

The identification of MRSA through cefoxitin disk testing provides crucial epidemiological information for infection control decision-making. MRSA strains are inherently resistant to all beta-lactam antibiotics and often exhibit co-resistance to other antimicrobial classes, making treatment more challenging.

Interestingly, we observed no significant difference in *S. aureus* carriage rates between cardiothoracic and neurosurgery wards, suggesting that patient-related factors rather than ward-specific factors may be more important determinants of carriage status.

The presence of gram-negative bacteria in 19% of nasal samples, including multidrug-resistant organisms such as Acinetobacter baumannii and Pseudomonas aeruginosa, indicates the complex microbial ecology of hospitalized patients and the potential for co-colonization with multiple resistant pathogens.

Clinical Implications

These findings have several important clinical implications: Screening protocols: The high prevalence of MRSA carriage supports the implementation of routine pre-operative screening in high-risk surgical patients. Decolonization strategies: Patients identified as MRSA carriers may benefit from decolonization protocols using topical mupirocin and chlorhexidine bathing. Infection control measures: Enhanced contact precautions and isolation protocols should be considered for identified MRSA carriers. Infection control measures: Enhanced contact precautions and isolation protocols should be considered for identified MRSA carriers.

Conclusion

The substantial proportion of methicillin-resistant strains emphasizes the need for robust infection control measures, targeted screening protocols, and enhanced surveillance in high-risk surgical populations. Implementation of pre-operative MRSA screening and decolonization protocols should be considered to reduce the risk of healthcare-associated infections in these high-risk patient populations. Continued surveillance of MRSA prevalence patterns is essential for monitoring trends and guiding infection prevention strategies.

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Ethics approval and consent to participate

This article does not contain any studies with animals performed by any of the authors.

Conflict of interest

The authors declare that they have no conflict of interest.

References

1. Touaitia R, Mairi A, Ibrahim NA, et al. *Staphylococcus aureus*: A review of the pathogenesis and virulence mechanisms. *Antibiotics* (Basel). 2025; **14**(5):470.
2. Turner NA, Sharma-Kuinkel BK, Maskarinec SA, et al. Methicillin-resistant *Staphylococcus aureus*: An overview of basic and clinical research. *Nat Rev Microbiol* 2019; **17**(4):203-18.
3. Troeman DP, Hazard D, van Werkhoven CH, et al. Association of *Staphylococcus aureus* bacterial load and colonization sites with the risk of postoperative *S. aureus* infection. *Open Forum Infect Dis* 2024; **11**(8):ofae414
4. Piewngam P, Otto M. *Staphylococcus aureus* colonisation and strategies for decolonisation. *Lancet Microbe* 2024; **5**(6):e606-18.
5. Pongbangli N, Oniem N, Chaiwarith R, et al. Prevalence of *Staphylococcus aureus* nasal carriage and surgical site infection rate among patients undergoing elective cardiac surgery. *Int J Infect Dis* 2021; **106**:409-14.
6. Kapoor R, Barnett CJ, Gutmann RM, et al. Prevalence of *Staphylococcus aureus* in cardiothoracic and neurological surgical patients. *Front Public Health* 2014; **2**:204.
7. Portais A, Gallouche M, Pavese P, et al. *Staphylococcus aureus* screening and preoperative decolonisation with Mupirocin and Chlorhexidine to reduce the risk of surgical site

infections in orthopaedic surgery: A pre-post study. *Antimicrob Resist Infect Control* 2024; **13**(1):75.
8. Bezerra DT, Mesquita-Ferrari RA, Fernandes KP, et al. Prevalence of nasal *Staphylococcus aureus* carriage in patients undergoing hemodialysis and assessment of risk factors: A cross-sectional study of outpatients at a university hospital. *Healthcare* (Basel). 2025; **13**(3):245.
9. Abdullahi S, Abdullahi IN, Adekola HA, et al. Nasal carriage rate and multiple antimicrobial resistance indices of *Staphylococcus aureus* among healthcare students at the Ahmadu Bello University, Nigeria. *Afr J Lab Med* 2025; **14**(1):2667.
10. Trivedi N, Kamothi M, Gohil B. The prevalence of Methicillin Resistant *Staphylococcus aureus* (MRSA) and its antimicrobial susceptibility pattern at tertiary care hospital. *GAIMS J Med Sci* 2025; **5**(1):182-6.
11. Bawankar NS, Meshram PP, John R, et al. Uncovering the silent public health threat: Nasal carriers of linezolid-resistant, vancomycin-intermediate and mupirocin-resistant MRSA among healthcare workers in a tertiary care hospital in Central India. *GMS Hyg Infect Control* 2025; **20**:Doc18.