



Original Article

Nasal and Pharyngeal Carriage of Coagulase-Negative Staphylococci and Their Antimicrobial Susceptibility Pattern in a Tertiary Care Hospital in Central India

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ABSTRACT

Background: Coagulase-negative staphylococci (CoNS) are established colonizers of human skin and mucosal surfaces and are increasingly implicated in healthcare-associated infections due to their capacity to acquire antimicrobial resistance determinants. ¹ Nasal and pharyngeal carriage of CoNS has been identified as an important reservoir for the persistence and dissemination of resistant strains in hospital environments. ²

Objectives: To determine the prevalence, species distribution, and antimicrobial susceptibility pattern of coagulase-negative staphylococci isolated from nasal and throat swabs of patients attending a tertiary care hospital.

Methods: A prospective cross-sectional study was conducted on 200 patients. Nasal and throat swabs were collected under aseptic precautions and processed using standard microbiological techniques. Identification of CoNS was performed using conventional biochemical tests. Antimicrobial susceptibility testing was carried out by the Kirby–Bauer disc diffusion method, and results were interpreted according to Clinical and Laboratory Standards Institute guidelines.³ Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 26.0.

Results: CoNS were isolated from 82 patients, yielding a colonization prevalence of 41.0%. *Staphylococcus epidermidis* was the predominant species. High resistance was observed to beta-lactam antibiotics, and methicillin resistance was detected in 40.2% of isolates. Methicillin resistance was significantly higher among hospitalized patients compared to outpatients ($p = 0.031$). All isolates were susceptible to Vancomycin.

Conclusion: A substantial proportion of patients were colonized with coagulase-negative staphylococci exhibiting significant antimicrobial resistance, underscoring the importance of surveillance of colonizing flora to inform infection control and antimicrobial stewardship strategies.

Keywords: Coagulase-negative staphylococci; nasal carriage; antimicrobial resistance; methicillin resistance.

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INTRODUCTION

Coagulase-negative staphylococci constitute a major component of the normal flora of human skin and mucosal surfaces, including the nasal cavity and oropharynx.¹ These organisms are increasingly recognized as opportunistic pathogens, particularly among hospitalized patients and individuals with indwelling medical devices.⁴

The clinical significance of CoNS is primarily related to their ability to acquire and disseminate antimicrobial resistance determinants, including *mecA*-mediated methicillin resistance.² Methicillin-resistant CoNS have been implicated in healthcare-associated infections and are recognized as reservoirs of resistance genes that may be transferred to *Staphylococcus aureus*.^{2,5}

Nasal and pharyngeal carriage of CoNS contributes to the persistence of these organisms within hospital environments and plays a role in both endogenous infections and horizontal transmission.⁶ Studies from India have reported increasing resistance to beta-lactam antibiotics among CoNS isolates, reflecting selective pressure associated with widespread antibiotic use in healthcare settings.^{7,8}

Despite their clinical relevance, data on upper respiratory tract carriage of CoNS and their antimicrobial susceptibility patterns remain limited from Central India. The present study was undertaken to determine the prevalence, species distribution, and antimicrobial susceptibility pattern of CoNS isolated from nasal and throat swabs of patients attending a tertiary care hospital.

MATERIALS AND METHODS

Study Design and Setting

This prospective cross-sectional study was conducted in the Department of Microbiology of a tertiary care teaching hospital in Central India over a defined study period.

Study Population

A total of 200 patients attending outpatient departments or admitted to inpatient wards were included after obtaining informed consent. Patients of all age groups and both sexes were enrolled. Individuals who had received systemic antibiotics within the preceding two weeks were excluded from the study.

Sample Collection

From each participant, one nasal swab and one throat swab were collected using sterile cotton swabs under aseptic precautions. Samples were transported immediately to the Microbiology laboratory for further processing.

Microbiological Processing and Identification

Swabs were inoculated onto blood agar and MacConkey agar and incubated aerobically at 37 °C for 24–48 hours. Suspected staphylococcal colonies were identified based on colony morphology, Gram staining, catalase test, and coagulase test. Coagulase-negative isolates were further characterized using standard biochemical tests for species-level identification.

Antimicrobial Susceptibility Testing

Antimicrobial susceptibility testing was performed using the Kirby–Bauer disc diffusion method on Mueller–Hinton agar. Results were interpreted in accordance with Clinical and Laboratory Standards Institute (CLSI) guidelines.³ Cefoxitin disc diffusion testing was used to determine methicillin resistance among CoNS isolates.

Ethical Considerations

The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants or their legally authorized representatives prior to sample collection.

RESULTS

Study Population

A total of 200 patients were included in the analysis. The cohort consisted of 114 males (57.0%) and 86 females (43.0%), with the age distribution predominantly comprising young and middle-aged adults. Outpatients accounted for 128 (64.0%) cases, while 72 (36.0%) were hospitalized patients.

Prevalence of Coagulase-Negative Staphylococci

Coagulase-negative staphylococci (CoNS) were isolated from 82 patients, yielding an overall colonization prevalence of 41.0% (95% CI: 34.2–47.8). The remaining 118 patients (59.0%) showed no CoNS growth.

Site-wise Isolation Pattern

Nasal swabs demonstrated a higher yield of CoNS compared to throat swabs. CoNS were isolated from 61 nasal swabs (30.5%) and 43 throat swabs (21.5%). Concurrent colonization at both nasal and throat sites was observed in a subset of patients.

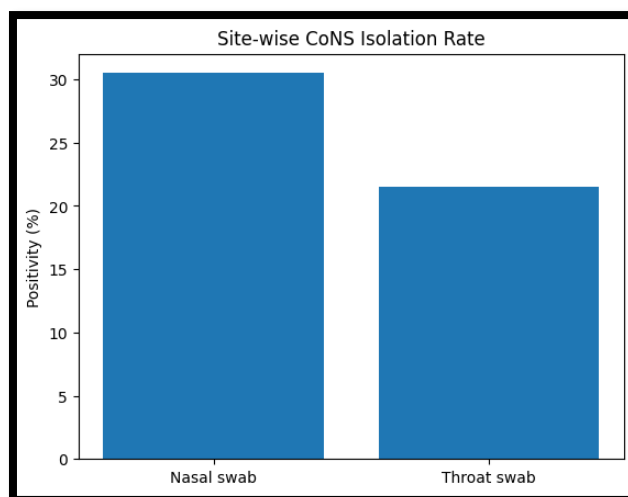


Figure 2 shows a higher isolation rate of CoNS from nasal swabs compared to throat swabs.

Species Distribution

Among the 82 CoNS isolates, *Staphylococcus epidermidis* was the predominant species (43.9%), followed by *Staphylococcus saprophyticus* (22.0%) and *Staphylococcus haemolyticus* (18.3%). Less frequently isolated species included *Staphylococcus hominis* and other coagulase-negative staphylococci.

TABLE 1

Antimicrobial Susceptibility Pattern of Coagulase-Negative Staphylococci (n = 82)

Antibiotic	Sensitive (%)	Resistant (%)
Ampicillin	29.3	70.7
Amoxiclav	37.8	62.2
Cefoxitin	59.8	40.2
Ceftriaxone	51.2	48.8
Amikacin	76.8	23.2
Vancomycin	100.0	0.0

Antimicrobial Susceptibility Pattern

Antimicrobial susceptibility testing revealed high resistance to beta-lactam antibiotics, particularly ampicillin and amoxiclav. Resistance to ampicillin was observed in 70.7% of isolates, while 62.2% were resistant to amoxiclav.

Methicillin resistance, determined using cefoxitin disc diffusion, was identified in 33 isolates, corresponding to a prevalence of 40.2% (95% CI: 29.6–51.6).

Aminoglycosides demonstrated comparatively better activity, with 76.8% of isolates sensitive to amikacin. All isolates were uniformly susceptible to vancomycin, with no resistant strains detected.

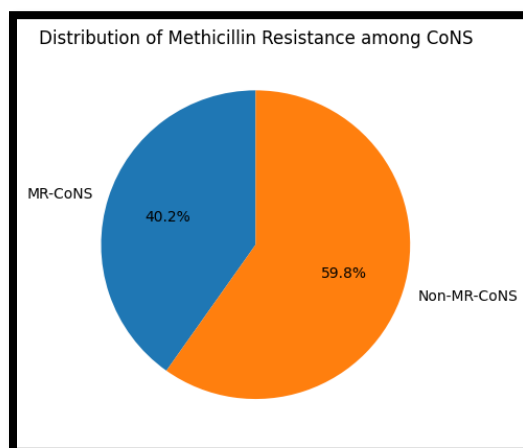


Figure 1 demonstrates the proportion of methicillin-resistant and methicillin-sensitive coagulase-negative staphylococci isolated in the study

Association Between Methicillin Resistance and Clinical Setting

A statistically significant association was observed between patient setting (inpatient versus outpatient) and methicillin resistance.

Methicillin-resistant CoNS were detected in 55.9% of inpatients compared to 29.2% of outpatients. Chi-square analysis demonstrated a significant association ($\chi^2 = 4.62$, $df = 1$, $p = 0.031$).

Hospitalized patients had significantly higher odds of harbouring methicillin-resistant CoNS (OR = 3.06; 95% CI: 1.21–7.75).

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages. Prevalence estimates were presented with 95% confidence intervals. Associations between categorical variables were assessed using the chi-square test or Fisher's exact test where appropriate. Odds ratios with 95% confidence intervals were calculated to estimate the strength of association. A two-tailed p value <0.05 was considered statistically significant.

DISCUSSION

The present study demonstrates a substantial prevalence of coagulase-negative staphylococcal carriage in the upper respiratory tract, supporting the established role of CoNS as common colonizers of human skin and mucosal surfaces.¹ The observed predominance of *Staphylococcus epidermidis* is consistent with its recognized ecological fitness for colonization and its frequent recovery from nasal and pharyngeal sites.^{1,4}

A key finding of this study is the high level of resistance to beta-lactam antibiotics among CoNS isolates. Such resistance patterns have been widely reported and are attributed to selective pressure from extensive antibiotic use in healthcare environments.² Studies from Indian tertiary care centres have similarly documented increasing resistance among CoNS, underscoring the relevance of local surveillance data to guide empirical therapy.^{7,8}

Methicillin resistance detected in a considerable proportion of isolates is of clinical concern. Methicillin-resistant CoNS are increasingly implicated in healthcare-associated infections and are recognized as important reservoirs of resistance determinants, including *mecA*, with the potential for horizontal gene transfer.^{2,5} The presence of methicillin resistance among colonizing strains emphasizes the role of asymptomatic carriage in maintaining resistant populations within hospitals.¹

The significantly higher odds of methicillin resistance among hospitalized patients observed in this study highlight the influence of the inpatient environment on colonization with resistant strains. Similar associations between hospitalization and increased resistance have been reported from other settings, reflecting cumulative exposure to antibiotics and healthcare-associated selective pressures.^{7,8}

Uniform susceptibility to vancomycin among all isolates in the present study aligns with existing literature and supports its continued role as a reliable therapeutic option for serious CoNS infections.¹ However, reliance on last-resort agents reinforces the need for antimicrobial stewardship and infection control measures to limit further emergence of resistance. Overall, the findings of this study reinforce the clinical relevance of CoNS colonization and its contribution to the antimicrobial resistance burden in tertiary care hospitals. Regular monitoring of colonizing flora, particularly in hospitalized patients, may aid in early identification of resistance trends and support targeted infection prevention strategies.

Limitations

This study was conducted at a single tertiary care centre, which may limit the generalizability of the findings to other settings. Molecular characterization of resistance mechanisms was not performed, which could have provided additional insight into the genetic basis of methicillin resistance among coagulase-negative staphylococci. Longitudinal follow-up to assess persistence of colonization was also not undertaken.

Ethical Approval

The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants or their legally authorized representatives.

Conflict of Interest

The authors declare no conflict of interest.

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