

A descriptive study on the resistance pattern of coagulase-negative staphylococci isolated from positive blood culture samples in a tertiary care hospital, Kolkata



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ABSTRACT

Background: Blood cultures are needed to establish the diagnosis of bloodstream infections and are useful in directing appropriate antimicrobial therapy. Coagulase-negative staphylococci (CoNS) are among the most frequently isolated pathogens in blood cultures and an important cause of nosocomial bloodstream infections that are typically resistant to multiple antibiotics. The infection caused by CoNS is increasing as the number of artificial devices and catheters being inserted through skin become higher. Another concern is the rising occurrence of methicillin-resistant-CoNS (MR-CoNS) in hospitalized patients. **Aims and Objectives:** The aim of the study was to identify the species of CoNS along with their antimicrobial resistance pattern of the isolated CoNS from positive blood culture samples. **Materials and Methods:** A record-based descriptive study conducted in the Department of Microbiology, College of Medicine and Sagore Dutta Hospital. The study includes only the record of positive blood culture samples isolated with CoNS from admitted patients, sent for culture and susceptibility testing to the Microbiology department from July 1st, 2022, to June 30th, 2024. **Results:** A total number of 1080 blood culture samples were tested. 44 CoNS was isolated (in paired sample) out of 150 positive blood culture samples. The predominant isolates were *Staphylococcus haemolyticus* (45%) followed by *Staphylococcus epidermidis* (32%). 35 (80%) CoNS strains were resistant to Methicillin (MR-CoNS). Maximum (44%) CoNS were isolated from critical care unit blood culture samples. **Conclusion:** This study also showed a high prevalence of MR-CoNS. It should be kept in mind that patients suffered from CoNS isolates in their blood samples should be carefully evaluated before instituting therapy to avoid unnecessary use of antibiotics and also necessitating judicious and rational use of antibiotics to prevent an increase of resistance patterns and the emergence of MR-CoNS species along with the preventive measures to reduce the spread of virulent CoNS. This study also underscores the urgent need for effective infection control measures and antibiotic stewardship in combating antimicrobial resistance among CoNS in tertiary care hospitals.

Key words: Coagulase-negative staphylococci; Methicillin-resistant coagulase-negative Staphylococci; Antibiotic resistance pattern

INTRODUCTION

Blood cultures are needed to establish the diagnosis of bloodstream infections and are useful in directing

appropriate antimicrobial therapy.¹ Coagulase-negative Staphylococci (CoNS) are among the most frequently isolated pathogens in blood cultures and an important cause of nosocomial bloodstream infections.² The infection

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caused by CoNS is increasing as the number of artificial devices and catheters being inserted through skin become higher.³ CoNS are also the most common contaminants of blood cultures and are proven to be especially problematic.⁴ To be clinically significant, repeated isolation of the same strain of CoNS is needed.^{5,6} Recovery of these organisms from specimens should always be correlated with the clinical condition of the patient and with their role to cause infections. The clinical criteria which are essential for the true bacteremia include whether has a fever or body temperature below 36°C, and blood pressure <90 mmHg. Furthermore, other predisposing factors like an intravenous catheter or indwelling foreign devices, immunosuppressed patients, post-surgical infections, patients undergoing hemodialysis/peritoneal dialysis, prolonged duration of hospitalization and other laboratory infections are also included.⁷ Another concern is the rising occurrence of methicillin-resistant-CoNS (MR-CoNS) in hospitalized patients. Overall higher incidence of resistance to all antibiotics is observed with MR-CoNS as compared to MS-CoNS, particularly to non-beta-lactam antimicrobials.⁸

The findings highlight a concerning prevalence of multidrug-resistant strains, underscoring the need for stringent infection control measures and judicious antibiotic use.

Aims and objectives

The aim and objective of the study was to identify the Species of Coagulase-negative staphylococci along with their antimicrobial resistance pattern of the isolated CoNS from positive blood culture samples in a tertiary care hospital.

MATERIALS AND METHODS

A record-based descriptive study was conducted in the Department of Microbiology, College of Medicine and Sagore Dutta Hospital. The study includes only the record of positive blood culture samples isolated with CoNS from patients of inpatient department and critical care units (CCUs), sent for culture and susceptibility testing to the Microbiology department from July 1st, 2022, to June 30th, 2024. Data analysis of the study was done by Excel spreadsheets after getting ethical clearance from the Institutional Ethics Committee of College of Medicine and Sagore Dutta Hospital. (IEC Memo no.:CMSDH/IEC/69/12-2024, dated: December 16, 2024).

Inclusion criteria

Coagulase-negative *Staphylococcus* (CoNS) isolated from paired sera of suspected sepsis patient were included in the study.

Exclusion criteria

- I. Incomplete data available (age, sex, ward, and place of admission, i.e. IPD, CCU, respiratory intensive care unit, special newborn care unit)
- II. Contaminated samples were excluded from the study.

Identification and speciation of isolates

We have considered CoNS as pathogen when it was isolated in paired blood culture sample and also correlated with patients' condition. The isolates were initially identified as CoNS by colony morphology (small, circular, low convex, opaque colonies), Gram staining (Gram-positive, cocci in cluster), catalase, and coagulase test (negative). Speciation of CoNS was done by conventional test (Catalase and coagulase) and also by automated VITEK 2 Compact (bioMérieux) system. All the procedures were carried out according to the manufacturer's instructions. Antibiotic resistance pattern were detected by automated VITEK 2 AST card and MIC-based method according to CLSI 34th edition.⁹

Detection of MR-CoNS

All isolates of MR-CoNS were identified by VITEK 2 Compact as well as MR-CoNS were detected by using cefoxitin DD method for methicillin sensitivity for reconfirmation as per CLSI 34th edition.⁹

Table 1: Isolated species of MR-CoNS

Pathogens	No. of isolates (Percentage)
<i>Staphylococcus haemolyticus</i>	19 (54)
<i>Staphylococcus epidermidis</i>	11 (31)
<i>Staphylococcus hominis</i>	3 (8)
<i>Staphylococcus saprophyticus</i>	2 (6)
Total (MR-CoNS)	35 (80)

Table 2: Distribution of CoNS

Ward/CCU/SNCU/RICU	No. of isolates (Percentage)
CCU	20 (44)
SNCU	7 (15)
RICU	3 (7)
PICU	1 (2)
Wards	13 (29)

CCU: Critical care units, SNCU: Special newborn care unit, RICU: Respiratory intensive care unit, PICU: Pediatric intensive care unit

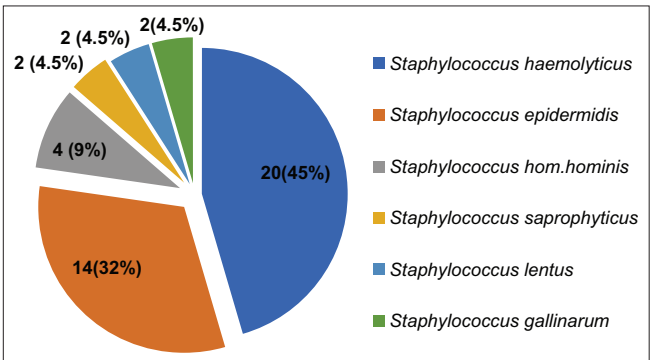


Figure 1: Species distribution of coagulase-negative Staphylococci

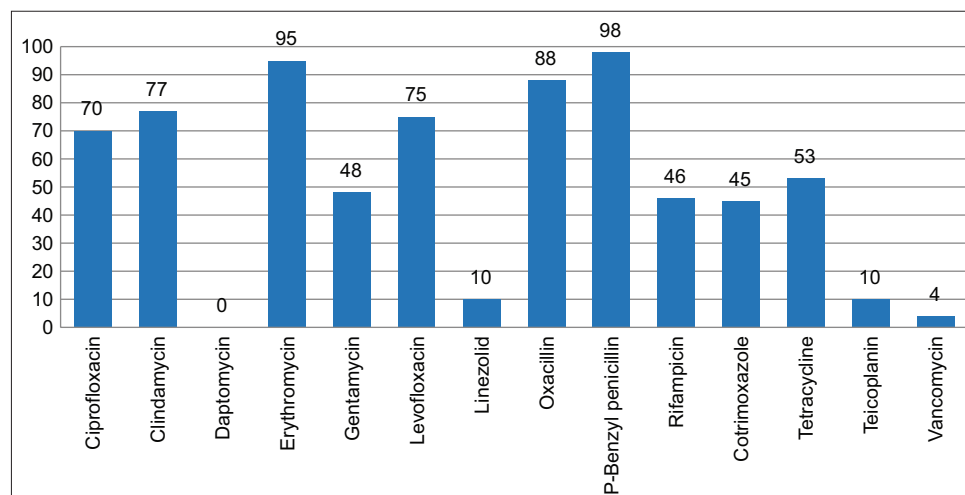


Figure 2: Antibiotic resistance pattern of coagulase-negative Staphylococci (in percentage)

Statistical analysis

All the statistical analyses were carried out using the Excel spreadsheet.

RESULTS

During this study period, a total number of 1080 blood culture samples were collected from paired sample of 540 admitted patients. As a result, 44 CoNS out of 150 positive blood culture samples were purely isolated from both the right and left sites of each patient. Of these, 34 (77%) CoNS were isolated from adult (>12 years age) patients, and 10 (23%) CoNS were isolated from pediatric (≤12 years age) patients. Out of 44 CoNS, 23 (52%) CoNS were isolated from male patients, and 21 (48%) CoNS were isolated from female patients.

The predominant isolates were *Staphylococcus haemolyticus* (45%), followed by *Staphylococcus epidermidis* (32%), *Staphylococcus hominis* (9%), *Staphylococcus saprophyticus* (4.5%), *Staphylococcus lentus* (4.5%), and *Staphylococcus gallinarum* (4.5%) (Figure 1). Of these 44 CoNS, 35 (80%) strains were resistant to Methicillin (MR-CoNS) and among these MR-CoNS (80%), *S. haemolyticus* (54%) were the most isolated MR-CoNS (Table 1). Maximum CoNS (44%) were isolated from CCU blood culture samples (Table 2).

Most of the isolated CoNS showed resistance to penicillin (98%), erythromycin (95%), oxacillin (88%), clindamycin (77%), levofloxacin (75%), and ciprofloxacin (70%) and showing minimum resistance to linezolid (10%), teicoplanin (10%), vancomycin (4%), and daptomycin (0%) (Figure 2).

DISCUSSION

In the present study, *S. haemolyticus* (45%) was the common isolate followed by *S. epidermidis* (32%) and *S. hominis* (9%)

which was concordant with the study conducted by Singh et al., stated that the majority of CoNS isolated were constituted by *S. haemolyticus* (47.5%), followed by *S. epidermidis* (33.9%), *S. hominis* (11.86%).¹⁰ This study also shown most commonly isolated bacteria in blood culture samples is CoNS (29%) supporting the previous study conducted by Saha et al., in Kolkata stated that 24.04% of CoNS were isolated¹¹ and also stated by Wisplinghoff et al., that most-common organisms causing bloodstream infections (BSIs) were coagulase-negative staphylococci (CoNS) (31% of isolates).¹² Present study revealed a prevalence of MR-CoNS in 80% of isolates, this was concordant with Vijayasri Badampudi et al., who reported Methicillin resistance in 79 % of CoNS.¹³ Highest methicillin resistant was found in *S. haemolyticus* (54%), supporting the findings of other centers where resistance rates as high as 87% have been reported by Barros et al.,¹⁴ Usha et al., Asangi et al., have shown maximum resistance to penicillin, erythromycin, and ciprofloxacin with over 80% which can correlate with the present study.^{15,16}

Limitations of the study

Follow-up of patients to see what was the actual treatment given and the response to antimicrobial treatment, morbidity, and mortality if any could not be done. Genotyping of isolated CoNS sp. was not done.

CONCLUSION

Coagulase-negative staphylococci (CoNS) from blood samples were occasionally dismissed as mere contaminants. Recently, there has been an increased rate of CoNS BSIs. Therefore, accurate identification to species level using simple and inexpensive methodology is needed. In our study, *S. haemolyticus*, *S. epidermidis*, and *S. hominis* were the common species isolated. Most isolates were resistant to penicillin, erythromycin, oxacillin, clindamycin, levofloxacin, and

ciprofloxacin and this study also showed a high prevalence of MR-CoNS, thus it should be kept in mind that patients suffered from coagulase-negative staphylococci isolates in their blood samples should be carefully evaluated before instituting therapy to avoid unnecessary use of antibiotics and also necessitating judicious and rational use of antibiotics to prevent an increase of resistance patterns and emergence of methicillin resistance CoNS species along with the preventive measures to reduce the spread of virulent CoNS.

This study underscores the urgent need for effective infection control measures and antibiotic stewardship in combating antimicrobial resistance among CoNS in tertiary care hospitals. The findings provide valuable data for clinicians and policymakers in managing BSIs caused by these opportunistic pathogens.

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Authors' Contributions:

LTS- Definition of intellectual content, literature survey, prepared the first draft of manuscript, implementation of the study protocol, data collection, manuscript preparation; **DD-** Concept, design, manuscript preparation, editing, data analysis, interpretation, manuscript revision, and submission of article; **PSC-** Review manuscript.

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