Original Article

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Microbiology Section

Speciation of Clinically Significant Coagulase Negative Staphylococci Isolates from Clinical Samples and their Susceptibility Pattern: A Cross-sectional Study from Western Uttar Pradesh, India

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ABSTRACT

Introduction: Coagulase-negative Staphylococci (CoNS) have emerged as predominant organisms associated with a variety of infections, particularly Bloodstream Infections (BSIs). As CoNS isolates become increasingly resistant to antimicrobials, this presents a potentially concerning emerging characteristic. There is a need to identify the species and resistance profile of CoNS. These organisms are increasingly recognised as nosocomial pathogens and are associated with multiple antimicrobial resistance mechanisms, particularly methicillin resistance. Rapid and reliable identification at the species level is essential to predict the potential pathogenicity or antibiotic susceptibility of each clinical isolate.

Aim: To isolate and assess the speciation of CoNS from various clinical specimens and to determine the antibiotic susceptibility profile, with special reference to linezolid and vancomycin.

Materials and Methods: This was a hospital-based cross-sectional study carried out in the Department of Microbiology at Subharti Medical College, a tertiary care teaching hospital in Western Uttar Pradesh (UP), India. The duration of the study was one year, from January 2019 to December 2019. A total of 1,061 clinically significant isolates of CoNS were presumptively identified by standard bacteriological techniques, which were further confirmed at the species level by an automated Vitek-2 Compact system. Antimicrobial Susceptibility Testing (AST) was conducted using the Kirby-Bauer disc diffusion method, and the Minimum Inhibitory Concentration (MIC) for vancomycin was assessed using the automated Vitek-2 Compact system. The data were analysed using the Statistical Package for the Social Sciences (SPSS) version 20.0. Statistical analysis included the Chi-square test.

Results: A total of 1,061 CoNS were isolated. CoNS were predominantly isolated from Inpatient Department (IPD) samples, with 993/1,061 (93.60%) coming from these sources, and the majority from blood (928/1,061; 87.46%), followed by pus (69/1,061; 6.50%) and urine (31/1,061; 2.92%). There was male predominance, with 606/1,061 (57%), and isolation rates were higher among the extremes of age. *Staphylococcus epidermidis* (472/1,061; 44.48%) was the predominant species isolated, followed by *Staphylococcus haemolyticus* (360/1,061; 33.93%). The majority of the isolates were resistant to penicillin (995/1,061; 93.77%), followed by erythromycin (896/1,061; 84.45%) and cotrimoxazole (798/1,061; 75.2%). The prevalence of methicillin resistance among CoNS was 964/1,061 (90.9%). The emergence of resistance to linezolid in 27/1,061 (2.54%) was concerning; however, all isolates were sensitive to vancomycin.

Conclusion: Multidrug-resistant CoNS are an emerging therapeutic problem in hospital settings because their prevalence not only limits treatment options but also acts as a reservoir for drug-resistant genes. Speciation and susceptibility testing of these isolates are essential for better clinical outcomes.

Keywords: Antibacterial agents, Bacterial, Drug resistance, Microbial sensitivity tests, Staphylococcal infection, Virulence factor

INTRODUCTION

The CoNS are normal commensals of human skin and mucous membranes that have emerged as predominant pathogens in hospital-acquired infections [1]. These pathogens have now confirmed their role in BSI, Urinary Tract Infections (UTIs), Surgical Site Infections (SSIs), and infections of prosthetic devices and shunts [2]. There are more than 40 recognised species of CoNS; to name a few, *Staphylococcus epidermidis, Staphylococcus haemolyticus* and *Staphylococcus lugdunensis* [3]. Infections caused by CoNS can be either community-acquired or hospital-acquired [4]. BSIs are major causes of morbidity and mortality and CoNS are the third most common cause of BSIs. As the pathogenic significance of CoNS increases, it becomes essential to learn about the epidemiology and pathogenic potential of individual species [1].

The most frequently encountered CoNS species associated with human infections are *S. epidermidis*, followed by *S. haemolyticus*. These species are predominantly associated with intravascular catheters, prosthetic valve endocarditis, surgical wounds, central nervous system shunt infections, peritoneal dialysis-related infections and infections of prosthetic joints. Other CoNS species, such as *S. saprophyticus*, are important pathogens in human UTIs, especially among young, sexually active females, while *S. lugdunensis* has been implicated in arthritis, catheter infections and prosthetic joint infections [5].

This study aims to fill this gap and provide useful information to clinicians to improve diagnosis. This study is distinctive because it provides a comprehensive analysis of clinically significant CoNS isolates, identifying them up to the species level and assessing their antibiotic susceptibility patterns. Unlike previous studies that may focus broadly on CoNS infections, this research emphasises regional epidemiology, particularly from a hospital in Western Uttar Pradesh, India. The study also provides critical insights into emerging resistance trends in CoNS, which can guide treatment decisions and infection control measures. Additionally, the study contributes to global knowledge on the epidemiology and resistance profiles of CoNS, which may vary depending on geographical location, type of clinical sample and patient population. Therefore, this study has been carried out to identify clinically significant isolates of CoNS up to the species level and determine their antibiotic susceptibility patterns so that appropriate measures can be taken.

The rationale of the study is that it provides a comprehensive analysis of the speciation and antibiotic susceptibility patterns of clinically significant CoNS isolated from various clinical samples in a hospital in Western UP, India. The study highlights the importance of identifying and reporting CoNS infections, especially in immunocompromised patients, and the need for rational antibiotic use to prevent the emergence and spread of multidrug-resistant CoNS strains. The study also suggests possible factors that may influence the prevalence and resistance patterns of CoNS in different settings. This research seeks to identify and characterise clinically significant CoNS isolates from various clinical specimens, with a focus on their species-level identification and antibiotic susceptibility patterns. By understanding the epidemiology and resistance profiles of CoNS in a hospital setting in Western Uttar Pradesh, India, this research aims to improve diagnostic and treatment strategies for CoNS-related infections.

MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted in the Department of Microbiology at Subharti Medical College, a tertiary care teaching hospital in Western Uttar Pradesh (UP), India. The duration of the study was one year, from January 2019 to December 2019. Ethical approval was granted by the Institutional Ethics Committee (IEC) as per approval letter no. SMC/Micro/2019/92/03.

Inclusion criteria: All clinical isolates of *S. epidermidis* species that were tube coagulase-negative were included in the study.

Exclusion criteria: Other clinical isolates besides CoNS were excluded from the study.

Sample size calculation: The sample size was calculated based on an expected prevalence of CoNS of 43.26% from a previous study [6]. Using openEpi, Version 3, an open-source calculator—SSPropor [7]—the sample size was determined using the following formula:

$$n=\{deff*Np(1-p)\}/\{(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)\}$$

Where, n=Sample size, Z=Z statistic for a level of confidence, deff=Design effect=Population size, *p=Expected prevalence or proportion (in the proportion of one) and d=Precision (in the proportion of one).

A total of 1,061 clinically significant isolates of CoNS, collected from various clinical samples received from both the IPD and Out-Patient Department (OPD), were included in the study.

The isolates that were presumptively identified as CoNS by standard bacteriological techniques [8] were further confirmed up to the species level using the Vitek-2 system, employing a Gram-Positive Identification Card (GPID card, p-628). The GP ID card and p628 are two types of cards used for bacterial identification and AST with the VITEK® 2 automated system. The GP ID card is a prefilled, ready-to-use card for gram-positive bacterial identification (Biomerieux, France).

AST was carried out for bacterial isolates by the Kirby-Bauer disk diffusion method on Mueller-Hinton agar, as per Clinical and Laboratory Standards Institute (CLSI) recommendations 2018 [9], using commercially available antibiotic discs (Hi Media, Mumbai, India). The antibiotics tested for various microorganisms and their disc potency are as follows:

- Penicillin G (10 units)
- Cefoxitin (30 μg)
- Erythromycin (15 μg)
- Clindamycin (2 μg)
- Cotrimoxazole (1.25/23.75 μg)
- Tetracycline (30 μg)
- Ciprofloxacin (5 μg)
- Moxifloxacin (5 μg)
- Chloramphenicol (25 μg)
- Gentamicin (10 μg)
- Linezolid (30 μg)

Vancomycin (MIC determined with the Vitek-2 compact system).

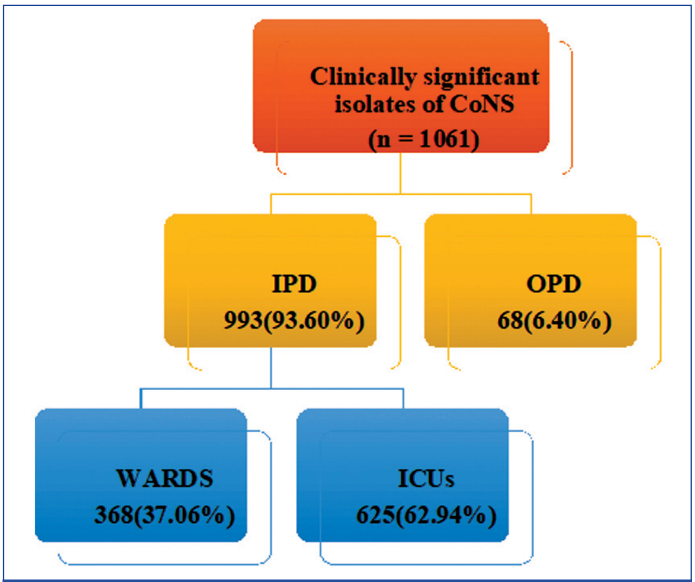
Quality control: Every batch of media prepared was checked for sterility over 24 hours. The potency of the discs used was verified with *Staphylococcus aureus* American Type Culture Collection (ATCC) 25923.

STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS version 20.0. The Chi-square test was utilised for the analysis. A p-value of <0.05 was considered significant.

RESULTS

A total of 1,061 clinically significant isolates of CoNS were processed during the study period. The CoNS were predominantly isolated from IPD samples, with 993 (93.60%) compared to Out-Patient Department (OPD) samples, which accounted for 68 (6.40%). Among the IPD samples, the maximum number of isolates were from the Intensive Care Units (ICUs) at 625 (62.94%), compared to 368 (37.06%) from the wards [Table/Fig-1].



[Table/Fig-1]: Hospital unit wise distribution of clinically significant CoNS (n=1061).

The CoNS were predominantly isolated in the extremes of age, with 290 (27.33%) being under 10 years of age and 189 (17.81%) being over 61 years of age. There was a male predominance, with 606 (57%) male patients compared to 455 (43%) female patients, resulting in a male:female ratio of 1.33:1 [Table/Fig-2].

Clinically significant isolates of CoNS were predominantly obtained from blood, accounting for 928 (87.46%), followed by pus with 69 (6.50%) and urine samples with 31 (2.92%) [Table/Fig-3].

Among the isolated CoNS, *S. epidermidis* was the most frequently isolated species, with 472 (44.48%), predominantly from blood and pus samples at 420 (88.98%) and 31 (6.56%) respectively. This was followed by *S. haemolyticus* with 360 (33.93%), of which 322 (89.44%) were from blood and 21 (5.83%) from pus samples. *S. hominis* was the third most frequently isolated CoNS, with 106 (9.99%), of which 101 (95.28%) were from blood samples. Other

S. No.	Age (in years)	No. of samples (%)	Gender	
			Male (%)	Female (%)
1.	<10	290 (27.33)	196 (32.3)	94 (20.64)
2.	11-20	70 (6.59)	33 (5.4)	37 (8.13)
3.	21-30	150 (14.13)	52 (8.5)	98 (21.53)
4.	31-40	102 (9.61)	54 (8.9)	48 (10.54)
5.	41-50	126 (11.87)	69 (11.33)	57 (12.52)
6.	51-60	134 (12.62)	81 (13.3)	53 (11.64)
7.	>61	189 (17.81)	121 (20)	68 (15)
	Total	1061 (100)	606 (57)	455 (43)

[Table/Fig-2]: Age and gender wise distribution of clinically significant isolates of CoNS (n=1061).

S. No.	Sample	n (%)
1.	Blood	928 (87.46)
2.	Pus	69 (6.50)
3.	Urine	31(2.92)
4.	Central line tip	11 (1.03)
5.	Stich line swab	8 (0.75)
6.	Ascitic fluid	2 (0.18)
7.	Cerebrospinal fluid	2 (0.18)
8.	Umbilical line tip	2 (0.18)
9.	High vaginal swab	2 (0.18)
10.	Nasal swab	2 (0.18)
11.	Placental membrane tissue	2 (0.18)
12.	Tracheal aspirate	2 (0.18)
	Total	1061 (100)

[Table/Fig-3]: Samples-wise distribution of clinically significant CoNS isolates (n=1061).

CoNS, such as *S. saprophyticus, S. warneri*, and *S. intermidius*, were less frequently isolated in our hospital [Table/Fig-4].

All isolates of CoNS exhibited a very high level of resistance to penicillin and erythromycin (between 85% to 100%). None of the isolated CoNS showed resistance to vancomycin. However, there was an emergence of linezolid resistance among various CoNS species, with 27 (2.54%) exhibiting this resistance. Detection of methicillin resistance was conducted using the cefoxitin (30 μg) disc on Mueller Hinton agar (Hi-Media Labs, Mumbai), revealing that 964 out of 1,061 (90.86%) were resistant to cefoxitin [Table/Fig-5].

These isolates were analysed using the Chi-square test, with a p-value ≤0.05 considered significant. *S. warneri* (p=0.00037), *S. xylosus* (p=0.011), and *S. saprophyticus* (p=0.03) exhibited statistically significant differences in resistance patterns compared to others, indicating potential intrinsic variations or adaptive mechanisms affecting antibiotic resistance. Other species, such as *S. epidermidis, S. haemolyticus, S. hominis* and several others, showed non significant differences, suggesting that their resistance profiles do not exhibit substantial variation across the tested population, possibly due to common genetic determinants governing resistance. Significant Chi-square values indicated that resistance in certain CoNS species might not be random but rather influenced by species-specific factors. This highlights the need for species-level identification in clinical settings to guide targeted antibiotic therapy.

DISCUSSION

The CoNS are widespread and are increasingly emerging as opportunistic and nosocomial pathogens. In recent years, there has been a surge in reports of CoNS from clinical samples obtained from hospitalised patients, with resistance to many important antimicrobial agents, including linezolid. However, there are limited

S. No.	Sample	*S. epidermidis*	*S. haemolyticus*	*S. hominis*	*S. warneri*	*S. scuiri*	*S. xylosus*	*S. lugdenensis*	*S. intermedius*	*S. auriculariae*	*S. cohnii*	*S. saprophyticus*
1	Blood (n=928)	420 (45%)	322 (34.69%)	101 (10.8%)	24 (2.5%)	14 (1.5%)	13 (1.4%)	11 (1.18%)	9 (0.96%)	6 (0.64%)	5 (0.53%)	3 (0.32%)
2	Pus (n=69)	31 (44.92%)	21 (30.43%)	05 (7.2%)	0	0	02 (2.89%)	02 (2.89%)	06 (8.69%)	0	2 (2.89%)	0
3	Urine (n=31)	03 (9.68%)	02 (6.45%)	0	0	0	0	0	01 (3.22%)	0	0	25 (80.65%)
4	Central line (n=11)	07 (63.6%)	04 (36.4%)	0	0	0	0	0	0	0	0	0
5	Ascitic fluid (n=2)	01 (50%)	01 (50%)	0	0	0	0	0	0	0	0	0
6	Stitch line swab (n=8)	03 (37.5%)	05 (62.5%)	0	0	0	0	0	0	0	0	0
7	CSF (n=2)	0	02 (100%)	0	0	0	0	0	0	0	0	0
8	Nasal swab (n=2)	02 (100%)	0	0	0	0	0	0	0	0	0	0
9	Umbilical line tip (n=2)	01 (50%)	01 (50%)	0	0	0	0	0	0	0	0	0
10	Tracheal aspirate (n=2)	02 (100%)	0	0	0	0	0	0	0	0	0	0
11	HVS (n=2)	01 (50%)	01 (50%)	0	0	0	0	0	0	0	0	0
12	Tissue (n=2)	01 (50%)	01 (50%)	0	0	0	0	0	0	0	0	0
	Total (n=1061)	472 (44.48%)	360 (33.93%)	106 (9.99%)	24 (2.26%)	14 (1.31%)	15 (1.41%)	13 (1.22%)	16 (1.50%)	6 (0.56%)	7 (0.65%)	28 (2.63%)

[Table/Fig-4]: Sample wise species distribution among clinically significant CoNS isolates (n=1061).
CSF: Cerebrospinal fluid; HVS: High vaginal swab; S: Staphylococcus

Species	P (%)	E (%)	CD (%)	CIP (%)	COT (%)	TE (%)	MO (%)	NIT (%)	C (%)	GEN (%)	VA (%)	LZ (%)	MR CoNS (%)	Chi-square value	p-value	Level of significance
S. epidermidis (n=472)	447 (94.7)	413 (87.5)	269 (56.9)	332 (70.3)	355 (75.2)	156 (33)	267 (56.5)	NA	132 (27.9)	191 (40)	0	0	431 (91.3)	395.8	0	-
S. haemolyticus (n=360)	335 (93.05)	310 (86.1)	215 (59.7)	261 (72.5)	271 (75.2)	123 (34.1)	219 (60.8)	NA	90 (25)	151 (41.9)	0	19 (5.27)	326 (90.5)	509.3	0	-
S. hominis (n=106)	100 (94.3)	93 (87.7)	47 (44.3)	81 (76.4)	80 (75.4)	37 (34.9)	58 (54.7)	NA	29 (27.3)	30 (28.3)	0	0	96 (90.5)	109.5	0	-
S. warneri (n=24)	20 (86.3)	21 (87.5)	14 (58.3)	17 (70.8)	19 (79.1)	7 (29.1)	13 (54.1)	NA	02 (8.3)	6 (25)	0	0	21 (87.5)	30.4	0.00037	Significant
S. scuiri (n=14)	14 (100)	12 (85.7)	09 (64.2)	09 (64.2)	08 (57.1)	06 (42.8)	08 (57.1)	NA	05 (35.7)	03 (21.4)	0	0	13 (92.8)	12.8	0.167	Not significant
S. xylosus (n=15)	15 (100)	12 (80)	08 (53.3)	08 (53.3)	09 (60)	04 (26.6)	08 (53.3)	NA	05 (33.3)	05 (33.3)	0	01 (6.6)	14 (93.3)	22.8	0.011	Significant
S. lugdunensis (n=13)	11 (84.6)	10 (76.9)	05 (38.4)	09 (69.2)	10 (76.9)	05 (38.4)	07 (53.8)	NA	05 (38.4)	08 (61.5)	0	01 (7.6)	11 (84.6)	13.5	0.196	Not significant
S. intermedius (n=16)	15 (93.7)	14 (87.5)	13 (81.2)	14 (87.5)	13 (81.2)	07 (43.7)	09 (56.2)	NA	08 (50)	10 (62.5)	0	0	14 (87.5)	6.50	0.68	Not significant
S. auriculariae (n=06)	05 (83.3)	05 (83.3)	02 (33.3)	04 (66.6)	05 (83.3)	03 (50)	04 (66.6)	NA	0	0	0	0	04 (66.6)	02	0.95	Not significant
S. cohnii (n=07)	07 (100)	06 (85.7)	06 (85.7)	07 (100)	07 (100)	0	06 (85.7)	NA	05 (71.4)	01 (14.2)	0	06 (85.7)	07 (100)	5.10	0.82	Not significant
S. saprophyticus (n=28)	26 (92.8)	NA	NA	23 (82.1)	21 (75)	10 (35.7)	21 (75)	0	NA	11 (39.2)	0	0	27 (96.4)	13.9	0.03	Significant

[Table/Fig-5]: Percentage wise distribution of resistance pattern of CoNS (n=1061).
P: Penicillin; E: Erythromycin; CD: Clindamycine; CIP: Ciprofloxacin; COT: Co-trimoxazole; TE- Tetracycline; MO: Moxifloxacin; C: Chloramphenicol; GEN: Gentamicin; VA: Vancomycin; LZ: Linezolid; NIT: Nitrofurantoin
*As per CLSI the number of isolates less than 30 are not significant. However, this data has been presented here for epidemiological reasons, so that it can be later on pooled in a different meta-analysis
*0: It typically indicates that no resistance was detected for that specific antibiotic. This indicates that the bacterial isolates were completely susceptible to the tested antimicrobial agent

studies reported in the literature [10-12]. CoNS are common causes of various types of infections, including BSIs, some of which are healthcare-associated [13].

In this study, CoNS were predominantly isolated from IPD samples, with 993 (93.60%) collected compared to OPD samples, which accounted for 68 (6.40%). Among the IPD samples, the maximum number of isolates was obtained from samples received from ICUs, with 625 (62.94%). A similar finding was reported by Mittal G et al., [14]. This may be attributed to our hospital's status as a tertiary care facility, where patients are often referred to us or come after having sought medical advice from local doctors and having undergone multiple or incomplete courses of antibiotics, potentially leading to a high isolation rate. Furthermore, this increased rate of isolation may also be due to the heightened use of implants, such as intravascular catheters and the presence of immunocompromised patients admitted to the ICUs of our hospital.

In present study, CoNS isolates were most prevalent in the extremes of age groups, with 290 (27.33%) in those under 10 years and 189 (17.81%) in those over 61 years. This may be due to the increased vulnerability of patients to infections resulting from lower immunity at these extremes of age. A recent study by Mahich S et al., showed a rising trend of CoNS in neonates [15]. However, present study could not compare data regarding the isolation of CoNS in the older population due to a lack of literature from this geographical area.

There was a male predominance in present study, with 606 (57%) males and a male:female ratio of 1.33:1. Similar findings have been reported in previous studies conducted on neonates [16-18]. This male predominance could be attributed to sex-dependent genetic factors.

Present study predominantly isolated CoNS from blood (87.46%), followed by pus (6.50%) and urine (2.92%) as shown in [Table/Fig-3]. A similar finding was reported in a recent study by Shah S et al., [4], where the maximum CoNS were isolated from blood (42.6%), followed by pus (40.5%) and urine (3%). In contrast, Badampudi SS et al., reported higher rates of isolation from pus (40%), followed by urine (28%) and blood (16%) [18].

S. epidermidis was the most frequently identified CoNS in present study, with 472 isolates (44.48%), predominantly from blood (420; 88.98%), followed by pus (31; 6.56%) and urine samples (3; 0.63%). Similar observations were made by Debnath and Sande, who found that the majority of *S. epidermidis* (44; 63.76%) were isolated from blood, followed by urine (11; 15.94%) [19]. Various other studies have also reported similar findings [4,20]. *S. haemolyticus* was the second most frequent isolate, with 360 (33.93%), predominantly from blood (322; 89.44%), followed by pus (21; 5.83%) and urine (2; 0.55%). A similar predominance of *S. haemolyticus* (38; 25.33%) was reported by Debnath and Sande [19], while Suhartono S et al., reported a predominance of *S. haemolyticus* at 45.8% [21].

Other studies conducted in India by Badampudi SS et al., and Chaturvedi and Pandey, also reported *S. epidermidis* as the most frequent isolate followed by *S. haemolyticus* [18,20].

S. hominis was the third most frequent CoNS isolated in present study, with 106 isolates (9.99%), predominantly from blood (101; 95.28%), followed by pus (5; 4.7%). *S. warneri, S. scuiri, S. xylosus, S. lugdunensis, S. intermidius* and *S. saprophyticus* were other CoNS species that were less frequently isolated from clinical samples, as shown in [Table/Fig-4]. The isolates of *S. saprophyticus* were predominantly from urine samples of female patients. A similar finding of maximum isolation (90.9%) of *S. saprophyticus* from urine samples of female patients has been reported by Sheikh AF and Mehdinejad M [22]. The CoNS isolates were multidrug-resistant, with all species showing a high level of resistance to penicillin (85% to 100%) as shown in [Table/Fig-5].

In terms of species-wise susceptibility patterns, *S. epidermidis* demonstrated a higher level of resistance to penicillin-G (94.7%) and cefoxitin (91.3%). A similar finding was reported by Perveen I et al., [23]. Comparatively, lower levels of resistance were observed against erythromycin (87.5%) and ciprofloxacin (70.3%), with the least resistance noted against tetracycline (33.05%), chloramphenicol (27.96%), and gentamicin (40.4%). Vancomycin was the only antibiotic effective against all of the isolates. Additionally, lower levels of resistance towards cefoxitin, erythromycin and tetracycline (21.9%, 43.7%, and 21.9%, respectively) in *S. epidermidis* were reported by Wojtyczka RD et al., [24].

In present study, the *S. haemolyticus* isolates exhibited resistance to multiple antibiotics, including penicillin-G, cefoxitin, erythromycin, tetracycline and ciprofloxacin, with resistance rates of 93.05%, 90.5%, 86.1%, 34.1%, and 72.5%, respectively. Similar findings were reported by Shah S et al., and Singh NH et al., [4,25]. In contrast, another study by Wojtyczka RD et al., reported only 54.8% of *S. haemolyticus* to be resistant to erythromycin, which was significantly lower than the findings of the present study [24]. However, 5.27% of the *S. haemolyticus* isolates were resistant to linezolid, which is a matter of therapeutic concern.

S. hominis also demonstrated a high level of resistance to cefoxitin, erythromycin, chloramphenicol, and ciprofloxacin, with resistance rates of 90.5%, 87.7%, 27.3%, and 76.4%, respectively. Similar findings have been reported by Roy P et al., [26].

Methicillin-resistant Coagulase-negative Staphylococci (MRCoNS) are frequently isolated from clinical samples, particularly in cases of Surgical Site Infections (SSI) and Device-Associated Infections (DAI), where biofilm formation on implants and tissue further reduces treatment success [27]. There was a predominance of MRCoNS in our hospital, with 964 isolates (90.85%). In line with the observations of Cui J et al., the proportion of methicillin resistance was notably high in a study conducted in China, where it ranged from 83.3% to 100% [28]. The prevalence of MRCoNS has previously been reported to range from 48.2-66% [25]. However, all MRCoNS isolates were found to be susceptible to vancomycin.

MRCoNS are increasingly becoming common causes of morbidity and mortality, particularly in hospital settings, and thus have emerged as a significant concern. Antibiotics such as linezolid and vancomycin are currently the only alternative therapeutic agents for infections caused by these Multidrug-Resistant (MDR) pathogens; if resistance develops to these drugs, we will be left with no therapeutic options. However, a study by Ahmed R et al., reported much lower levels of resistance at 52.83% in their study [29].

The isolation of CoNS and their antibiotic susceptibility patterns should be reported with caution and seriousness in clinical practice and epidemiology, as the increasing prevalence of multidrug-resistant CoNS—particularly methicillin-resistant CoNS—has serious implications. This trend not only limits therapeutic options but may also serve as a reservoir for drug resistance genes.

Limitation(s)

Present study had a few limitations due to a lack of resources; as a result, molecular methods for detecting resistance genes could not be performed on the clinical isolates of CoNS. However, in the future, authors aim to conduct a study to investigate the presence of the *cfr* gene and the *optrA* gene in these isolates.

CONCLUSION(S)

MRCoNS are an emerging therapeutic concern and pose a challenge to the treatment of infections caused by these organisms. To prevent the nosocomial spread of these pathogens, early and accurate identification of these isolates, followed by stringent infection control measures, is essential. Glycopeptides and linezolid should be used judiciously as the last resort for treatment against multidrug-resistant CoNS.

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