Section: Microbiology

Original Research Article

ISOLATION AND CHARACTERIZATION OF STAPHYLOCOCCUS SPECIES FROM FREQUENTLY TOUCHED SURFACES IN INTENSIVE CARE UNIT AT A TERTIARY CARE CENTRE

Nigamananda Mishra[1], Tarana Sarwat[2], Zarine Khan[3], Dalip K. Kakru[4]

[1]Msc. Medical Microbiology, Department of Microbiology, School of Medical Sciences and Research, Sharda Hospital, Sharda University, Uttar Pradesh, India.
[2]Associate Professor, Department of Microbiology, School of Medical Sciences and Research, Sharda Hospital, Sharda University, Uttar Pradesh, India.
[3]Assistant Professor, Department of Microbiology, School of Medical Sciences and Research, Sharda Hospital, Sharda University, Uttar Pradesh, India.
[4]Head and Professor, Department of Microbiology Microbiology, School of Medical Sciences and Research, Sharda Hospital, Sharda University, Uttar Pradesh, India.

Received : 10/04/2024
Received in revised form : 01/06/2024
Accepted : 14/06/2024

Keywords:
Staphylococcus, Intensive Care Unit, Tertiary Care Centre.

Corresponding Author:
Nigamananda Mishra,
Email: mishra.nigam193@gmail.com

DOI: 10.47009/jamp.2024.6.3.88

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (3); 431-434

Abstract

Background: Intensive care units (ICUs) are the foremost fundamental working spaces in a hospital setting. Patients conceded in ICU are at a more noteworthy chance of nosocomial diseases and the detailed rate for this contaminations are 2 to 5 times much more prominent than common wards. Staphylococcus aureus, counting the resistant MRSA strain, may be a major cause of hospital setting diseases, from minor skin issues to dangerous septicemia. ICU surfaces can harbor these microbes, driving to expanded understanding hazard. Occasional microbiological reconnaissance of the ICU environment with successful disease control hones is anticipated to play down the bacterial defilement and transmission. **Materials and Methods:** Swabs were collected from frequently touched surfaces of various ICUs and growth was identified by standard bacteriological procedures. **Result:** A total of 216 swabs collected out of which growth was seen in 73 (33.79 %) swabs whereas the remaining 143 (66.20 %) swabs showed no growth of any type of microorganisms. Maximum growth was isolated from cardiac intensive care unit. Out of 73 positive isolates, Staphylococcus spp. isolated was maximum with coagulase negative staphylococcus being 41 and and methicillin sensitive staphylococcus spp. being 2 in numbers. No methicillin resistant staphylococcus aureus was isolated. **Conclusion:** Results from our study showed quite a low rate of bacterial contamination of the frequently touched objects in ICU. No MRSA and VRSA were found in our study which might be a potential danger of nosocomial infections. The display ponder emphasizes to continue existing cleaning/ sanitization methods in arrange to play down the defilement by potential pathogens and in the event that required certain alterations ought to be done.

INTRODUCTION

Staphylococcus aureus, is gram positive cocci arranged in clusters. It is the leading cause of a variety of hospital infections, ranging from minor skin infections to fatal septicaemia.[1] MRSA is one of the most common antibiotic-resistant strains associated with higher mortality, longer duration of hospital stays, and greater health care-associated costs.[2] Concerns have been raised because resistant strains of Staphylococcus aureus occur globally in both healthcare settings and communities. Hospital-acquired MRSA (HA-MRSA) infections have been recognized since the 1960s and are generally resistant to the multiple antimicrobial drugs. Infected patients and colonized hospital personnel are the main source of MRSA. The drug susceptibility pattern of MRSA may vary from region to region and this knowledge is crucial in selecting the antibiotics for treatment.[3] HA-MRSA strains are usually susceptible to vancomycin, linezolid and daptomycin.[4] The emergence of MRSA has posed a serious therapeutic challenge. Moreover, vancomycin-resistant Staphylococcus aureus (VRSA), which is rarely isolated but more aggressively threatening, has been reported as an emergence in several countries.[5,6]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

MATERIALS AND METHODS

The study was conducted in the Department of Microbiology, School of Medical Sciences and Research, Sharda University, Greater Noida-U.P. over a period of 12 months from November 2022 to October 2023. The study aimed to isolate and characterize Staphylococcus spp. from frequently touched surfaces in intensive care units. The study was approved by the Institutional Ethics Committee.

Procedure: Swabs were collected from frequently touched surfaces of different ICUs (SICU, NICU, MICU, CICU) on monthly basis. The surfaces included bed rails, IV stands, door handles, medicine trolley, pulse oximeters, monitors. The swabs were collected and were inoculated in tubes containing nutrient broth after 1 hour of incubation at 37°C. Subculture on blood and MacConkey agar plates were carried out after overnight incubation of the broth at 37°C. Identification of the growth was conducted employing conventional bacteriological techniques. Additionally, detection of Methicillin-resistant Staphylococcus aureus (MRSA) was achieved through the employment of a cefoxitin disc.

RESULTS

A total of 216 swabs were collected, with signnificant growth detected in 73 swabs, while the remaining 143 swabs exhibited no microbial growth of any kind.

Majority of the isolates were obtained from CICU (Cardiac Intensive Care Unit) followed by SICU (Surgical Intensive Care Unit), NICU (Neonatal Intensive Care Unit) and MICU (Medical Intensive Care Unit) as shown in [Table 1].

The various microorganisms isolated from the collected swabs included Coagulase negative staphylococcus spp., Methicillin sensitive Staphylococcus aureus, gram negative bacilli and micrococcus as shown in [Figure 1].

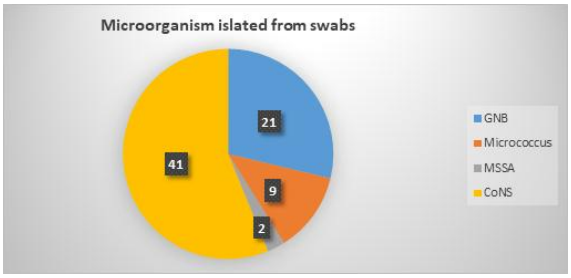

Figure 1: Microorganisms isolated from swabs

No Methicillin resistant Staphylococcus aureus was isolated from any of the surfaces of ICUs.

Staphylococcus was isolated from 43 swabs collected from various surfaces of different ICUs. Most of the species i.e. 41 strains were identified as Coagulase negative Staphylococcus species whereas only two strains were identified as methicillin sensitive Staphylococcus aureus [Figure 2].

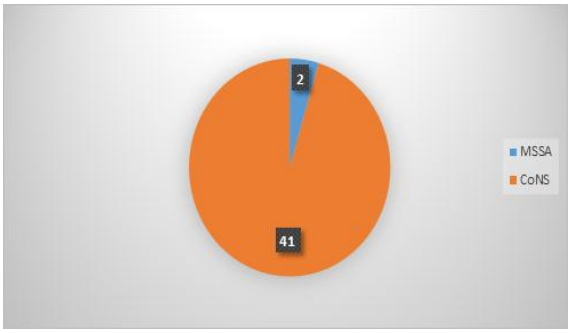

Figure 2: Total number of CoNS and MSSA isolated

Distribution of Staphylococcus isolated from frequently touched surfaces in different ICUs is shown in [Table 2-5].

Table 1: ICUs with swabs showing growth.

Intensive Care Unit	Number of swabs positive for growth
CICU	25
SICU	20
NICU	15
MICU	13
Total	73

Cardiac Intensive Care Unit (CICU)

Table 2: Samples collected from various sites of CICU

ICU	Surfaces	Number of swabs	Growth	No growth
	Bed rails	10	2	8
	IV stands	9	1	8
CICU	Medicine trolleys	9	3	6
	Door handle	10	5	5
	Pulse oximeters	7	1	6
	Monitors	6	1	5

Surgery Intensive Care Unit (SICU)

Table 3: Samples collected from various sites of SICU

ICU	Surfaces	Number of swabs	Growth	No growth
	Bed rails	10	3	7
	IV stands	12	2	10
SICU	Medicine trolleys	15	2	13
	Door handle	9	0	9

ISSN (O): 2687-5365; ISSN (P): 2753-6556

	Pulse oximeters	9	4	5
	Monitors	5	0	5

Neonatal Intensive Care Unit (NICU)

Table 4: Samples collected from various sites of NICU

ICU	Surfaces	Number of swabs	Growth	No growth
	Bed rails	10	2	8
	IV stands	8	0	8
NICU	Medicine trolleys	15	3	12
	Door handle	9	1	8
	Pulse oximeters	11	2	9
	Monitors	6	2	4

Medicine Intensive Care Unit (MICU)

Table 5: Samples collected from various sites of MICU

ICU	Surfaces	Number of swabs	Growth	No growth
	Bed rails	10	3	7
	IV stands	9	2	7
MICU	Medicine trolleys	9	1	8
	Door handle	7	2	5
	Pulse oximeters	6	1	5
	Monitors	5	0	5

DISCUSSION

Microbial colonization of objects and equipment within the ICU stands as a significant contributor to the heightened occurrence of nosocomial infections. Studies reveal that the prevalence of such infections in ICUs within developing nations exceeds that of developed ones by 2 to 20-fold.[7] Failure to comply with established hand hygiene practices among healthcare practitioners markedly increases the risk of contaminating inanimate surfaces and facilitates cross-transmission during patient interactions.

In our study, the overall bacterial contamination rate in ICU was detected to be 33.79 %. A study conducted by Bagwan N and Attar N in Sangli, India showed a bacterial contamination rate of 59%.[7] In another study done by Bhatta D. et al. in Nepal; the bacterial contamination of frequently touched objects/instruments in ICU was reported to be quite high i.e. 64.7%.[8] Similarly a study conducted by Yusuf et al. in North Eastern Nigeria also revealed concerning rates of bacterial contamination in ICU units. The overall contamination rate was 62.8%, with the adult ICU and the NICU showing rates of 40.8% and 59.2% respectively.[9]

The swabbed surfaces in the present study were contaminated with both gram negative and gram positive bacteria although more commonly by gram positive cocci. Coagulase negative staphylococcus spp. with 18.98% was the most common species which was isolated. The sites harboring the least and highest no. of isolates were the monitors and surfaces of bed rails as compared to other sites. A study done by Hajismaeli M et al. revealed significant variations in contamination rates across hospital surfaces. Side rails of beds exhibited the lowest contamination rate with (65.8%), while the floor was the primary source in both the surgical ICU (89.5%) and the NICU (68.5%) with Staphylococcus isolates. Overbed desks had the lowest contamination rate at 58%.[10]

In a study conducted within the environmental samples of the neonatal ICU at Manipal Teaching Hospital, findings revealed Staphylococcus aureus to be among the prevalent potential pathogens, with 33.3% of the isolates identified as MRSA.[11] In our study also Staphylococcus was the most commonly isolated gram positive organism, however it was CoNS and not Staphylococcus aureus which was the most common organism. Also, no MRSA were isolated in our study. A study done by Lama et al. reported 47.5% isolation of phenotypically confirmed MRSA isolates. MecA gene was detected in 84.2% (32/38) of MRSA isolates. 10.5% isolates were confirmed as vancomycin-intermediate Staphylococcus aureus (VISA) by MIC determination.[12]

The aforementioned studies illustrate the variability in bacterial contamination rates across hospitals both domestically and internationally. Elevated rates of bacterial contamination in ICUs may stem from the influx of patients with diverse clinical backgrounds from various departments, increased bed occupancy, extended hospital stays, and inadequate adherence to infection control protocols. Our research outcomes serve as a crucial tool for raising awareness among infection control teams and healthcare practitioners concerning ICU contamination by bacterial pathogens and their potential contribution to nosocomial infections.

There are few lacunae in our study. Firstly, No resampling was conducted after collecting samples from the ICUs to assess the effectiveness of the disinfectant or any cleaning materials used. Secondly, no further speciation of gram-negative bacilli was performed.

CONCLUSION

Our study outcomes revealed a minimal level of bacterial presence on frequently handled

ISSN (O): 2687-5365; ISSN (P): 2753-6556

objects/instruments within the ICU setting. Coagulase-negative Staphylococcus species were predominantly isolated, along with a negligible number of MSSA strains from various sources. While the emergence of MRSA and VRSA poses a potential threat of nosocomial infections, our investigation did not uncover any such occurrences. The findings underscore the importance of maintaining current cleaning and disinfection protocols to mitigate the risk of contamination by potential pathogens. If necessary, adjustments to these procedures should be considered to enhance cleaning efficacy. Routine microbiological surveillance of the ICU environment, coupled with rigorous infection control measures, is essential for reducing bacterial contamination and preventing transmission.

REFERENCES

1. Rasigade JP, Vandenesch F. Staphylococcus aureus: a pathogen with still unresolved issues. Infect Genet Evol. 2014;21:510–514.
2. Cosgrove SE, Sakoulas G, Perencevich EN, et al. Comparison of mortality associated with methicillin-resistant and methicillin-susceptible Staphylococcus aureus bacteremia: a meta-analysis. Clinl Infect Dis. 2003;36(1):53–59.
3. Vidhani S, Mehndiratta PL, Mathur MD. Study of methicillin resistant S. aureus [MRSA] isolates from high risk patients. Indian J Med Microbiol. 2001; 19: 13-6.
4. Weber JT. Community-Associated Methicillin Resistant Staphylococcus aureus. Clin Infect Dis. 2005; 41: S269-S72.
5. Ghahremani M, Jazani NH, Sharifi Y. Emergence of vancomycin-intermediate and -resistant Staphylococcus aureus among methicillin-resistant S. aureus isolated from clinical specimens in the northwest of Iran. J Glob Antimicrob Resist. 2018;14:4–9.
6. Assadullah S, Kakru DK, Thoker MA, et al. Emergence of low level vancomycin resistance in MRSA. Indian J Med Microbiol. 2003;21(3):196–198.
7. Attar N, Bagwan N . Effectiveness of Cleaning Practices of High Touch Surfaces Using Sodium Hypochlorite Disinfectant in an Intensive Care Unit. Saudi J Pathol Microbiol. 2021 Aug;6(8):271-276.
8. Bhatta D, et al. Methicillin-Resistant Staphylococcus aureus Contamination of Frequently Touched Objects in Intensive Care Units: Potential Threat of Nosocomial Infections. Can J Infect Dis Med Microbiol. 2022;2022:1023241.
9. J. Bara Yusuf, O. K. Okwong, A. Mohammed, et al. Bacterial contamination of intensive care units at a tertiary hospital in Bauchi, Northeastern Nigeria. Am J Intern Med. 2017;5(3):46-51.
10. Hajismaeli M, et al. Staphylococcus aureus contamination rate on environmental surfaces and hands of staff in ICU and NICU ward of Rohani hospital in Babol, Iran. Am J Hosp Med. 2024 Jan;8(1):1-14.
11. Bhatta DR, Hosuru Subramanya S, Hamal D, et al. Bacterial contamination of neonatal intensive care units: how safe are the neonates? Antimicrob Resist Infect Control. 2021;10(1):26.
12. Lama U, Shah D, Shrestha UT. Vancomycin resistant Staphylococcus aureus reported from tertiary care hospital in Nepal. Tribhuvan Univ J Microbiol. 2017;4(1):63–72.

ISSN (O): 2687-5365; ISSN (P): 2753-6556