

Original Research Article

Study of incidence, microbiological profile of nosocomial infections in pediatric intensive care unit of tertiary care center

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Received: 25 May 2023

Revised: 16 June 2023

Accepted: 20 June 2023

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ABSTRACT

Background: Prevalence of nosocomial infections in pediatric intensive care unit (PICU) ranges between from 6-26%. Increased use of broad-spectrum antibiotics, urinary and central venous catheterization and endotracheal intubation put patients at an increased risk of affecting with nosocomial infections in pediatric patients.

Methods: A hospital based prospective study was carried out on 725 patients aged between 1 month and 12 years admitted in PICU of Al-Ameen medical college hospital, Bijapur, Karnataka, India and institute of child health and hospital for children, Madras medical college, Chennai, Tamil Nadu, India from 15-09-2020 to 15-08-2022. All patients who were admitted with fever or developed fever in first 48 hours of life were excluded from the study. The data obtained in the course of study was analyzed by appropriate statistical methods.

Results: Out of 725 pediatric admissions, the incidence of nosocomial infection in the present was found to be 108 (14.8%). Concerning the type of infection, the commonest reported types were central-line associated bloodstream infection (CABI) 59 (54.6%) and ventilator-associated infection (VAI) 52 (48.1%), followed by bloodstream infection 45 (41.6%), catheter associated urinary tract infection (CA-UTI) 38 (35.1%) and urinary tract infection (UTI) 30 (27.7%) respectively.

Conclusions: The incidence of nosocomial infection was 14.8%. The central line associated blood stream infection was the predominant cause of nosocomial infection. This information can help decision makers establish preventive strategies and implement effective and reliable plans.

Keywords: Nosocomial infections, Children, PICU, Microbiological profile, Mortality

INTRODUCTION

Hospital acquired infections (HAI) is one of the important clinical event and imposes significant morbidity and mortality, particularly in pediatric population.¹ The recent medical developments including: increased use of broad spectrum antibiotics, urinary and central venous catheterization as well as endotracheal intubation put patients at an increased risk of contracting HAI in those who undergo long hospital stay and large

treatment costs.² Although nosocomial infections (NI) in pediatric intensive care units occur universally, their frequencies vary greatly among different areas of the world. Indeed, the prevalence might range from 6.1% to 26%.³ In India, studies reporting nosocomial infections in ICU have ranged from 11-60%.^{4,5} Significant identified risk factors for acquiring NI were young age, MV, re-intubation, sedation, NGT feeding, prolonged hospital stay, underlying illness, impaired consciousness, neuromuscular disease, and aspiration of gastric content.⁶

Within hours after admission, a patient's flora begins to acquire characteristics surrounding bacterial pool.¹⁵

The spectrum of HAI identified in pediatric ICUs (PICU) differs from other inpatient pediatric settings and warrants specific evaluation.¹⁷ Knowledge regarding the epidemiology of HAI is crucial in establishing preventive strategies and implementing effective and reliable plans.¹⁸

In this backdrop, the present study was carried out to determine the pattern and frequency of nosocomial infections in pediatric intensive care unit at a tertiary care center.

METHODS

This was a prospective study carried out from 15-9-2020 to 15-8-2022 at Al-Ameen medical college and hospital, Bijapur, Karnataka, India and institute of child health and hospital for children, Madras medical college, Chennai, Tamil Nadu, India. After obtaining the parents' informed consent and ethical clearance from the institutional ethical committee, all pediatric patients aged from 1 month to 12 years who acquired nosocomial infection at PICU of Al-Ameen medical college and hospital, and institute of child health and hospital for children, Madras medical college were included.

All patients who were admitted with fever or who developed fever in the 1st 48 hours were excluded from study.

In order to establish the diagnosis of urinary tract infection, the patient must have at least one of the following with no other recognized causes: fever ($>38^{\circ}\text{C}$), urgency, frequency, dysuria, and positive urine culture with counts $\geq 10^5$ colony-forming units per milliliter (CFU/ml).⁷

Patients who develop pneumonia with new pulmonary infiltrate on chest radiograph after 48 hours from admission are considered to have HAIs if they have two of the following: leukocytosis ($>12,000/\text{mm}^3$ or leukopenia ($<4,000$ hyperthermia ($>38^{\circ}\text{C}$) or hypothermia ($<35^{\circ}\text{C}$), purulent sputum, tracheal aspirate bacterial count of $\geq 10^6$ CFU/ml. Bacteremia is confirmed by positive blood culture.⁷

Information was collected regarding age, gender, length of hospital stays, underlying diseases, and invasive procedures, types of nosocomial infections, causative organisms, and mortality rate.

Statistical analysis

With 95% confidence level and margin of error of $\pm 5\%$, a sample size of 1024 subjects were allowed to study. Sampling method employed in the present study was simple random sampling. Categorical data was represented in the form of frequency and percentage.

Associations between variables were assessed with chi square test. $P < 0.05$ was considered statistically significant. Data was analyzed with IBM SPSS version 23 for Windows.

RESULTS

Out of 725 pediatric admissions, the incidence of nosocomial infection in the present was found to be 108 (14.8%). The baseline characteristic children ($n=108$) admitted with NI was shown in Table 1.

Concerning the type of infection, the commonest reported types were central-line associated bloodstream infection (CABI) 59 (54.6%) and ventilator-associated infection (VAI) 52 (48.1%), followed by bloodstream infection 45 (41.6%), catheter associated urinary tract infection (CA-UTI) 38 (35.1%) and urinary tract infection (UTI) 30 (27.7%) respectively. The results were shown in Figure 1.

Table 1: Demographics characteristic of the study participants, ($n=108$).

Demographics parameters	N	Percentage (%)
Age (In years)		
1-6 months	58	53.7
>6-12 months	32	29.6
1-3	11	10.2
>3	7	6.5
Gender		
Male	64	59.3
Female	44	40.7
Length of hospital stay (Days)		
<30	43	39.8
>30	65	60.2

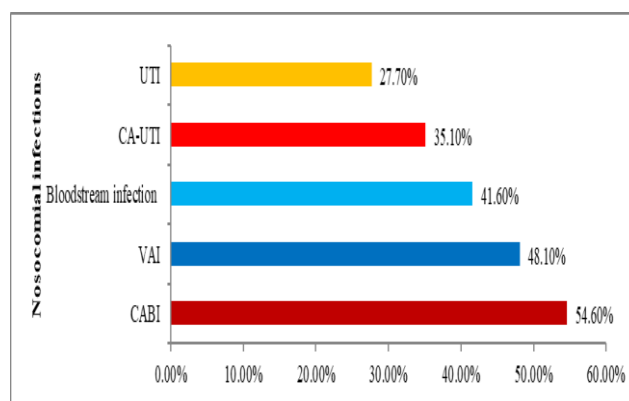


Figure 1: Types of nosocomial infection among the children admitted to PICU.

The commonest causative organism for CA-UTI and UTI was *E. coli* with 38 (35.1%) and 40 (37.03%) respectively. For bloodstream infection and central line associated blood stream infection, the commonest causative organism was *Klebsiella pneumoniae* (35.1% and 31.4%), respectively. The results were shown in Table 2.

Out of 108 nosocomial infection cases, 7 children died with a mortality rate of 6.4%. The results were shown in Figure 2.

Table 2: Association between the type of nosocomial infection and causative organisms.

Nosocomial infections					Type of micro-organisms
CABI	VAI	BSI	CA-UTI	UTI	
8	18	5		0	<i>K. pneumonia</i> , (n=32)
7	15	3	0	1	<i>Pseudomonas</i> , (n=25)
0	0	0	38	40	<i>E. coli</i> , (n=38)
0	0	0	5	2	<i>S. aureus</i> , (n=7)
0	0	0	12	3	<i>C. albicans</i> , (n=15)
0	0	0	5	3	<i>E. faecalis</i> , (n=8)

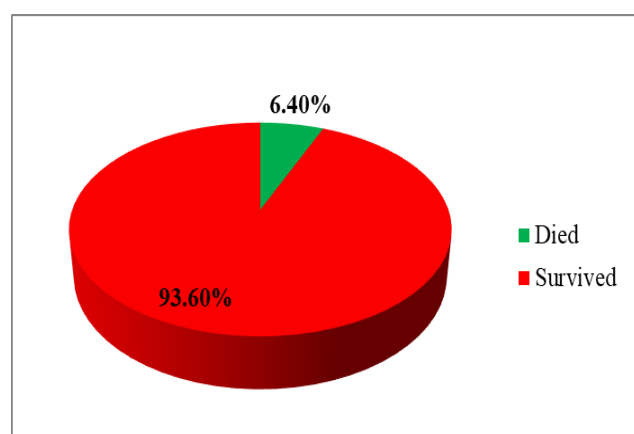


Figure 2: Outcome of children affected with nosocomial infections.

DISCUSSION

Pediatric nosocomial infections, when associated with high morbidity, mortality, and healthcare costs, particularly in PICU, constitute a major health problem.⁸ More than 20% of nosocomial infections are represented by patients in PICUs despite the fact that they represent a small number of inpatients as mentioned in the study conducted by Solomkin et al.⁹ The rate of pediatric nosocomial infections in the present study was 14.8% which is comparable to the rates of study conducted by Lodha et al that ranged between 6.1% and 26%.¹⁰

The current study revealed that the commonest causative organism for VAI was *Klebsiella pneumoniae*. Previous reports as seen in the study conducted by Rahman et al

show that *Klebsiella pneumoniae* was the commonest causative organism for respiratory tract infection, followed by *Pseudomonas*.¹¹

Staphylococcus aureus and *Pseudomonas* were reported to be the most frequent reported causative organisms for respiratory tract infection in the study conducted by Becerro et al.¹² In the present study *E. coli* was the major cause for UTI and CAUTI, which is in line with the reports of the study conducted by Brindha et al and Daptardar.^{13,14}

Hospitals provide the settings that facilitate genetic drift and shift as they act as nidus for all emerging and resistant organisms.¹⁶

Limitations

Since PICU patients constitute a very small proportion of inpatients in a hospital, the sample size would not be adequate enough to determine the exact incidence, organisms involved, severity and prognosis of nosocomial infections seen in that particular hospital or healthcare setup.

CONCLUSION

The incidence of nosocomial infection was 14.8%. The central line associated blood stream infection was the predominant cause of nosocomial infection. This information can help decision makers establish preventive strategies and implement effective and reliable plans.

Recommendations

Collection of samples prior to initiation of antibiotic therapy will improve the quality of study. In catheter associated infections, regular local site examination and maintenance of local hygiene will further improve the quality of study as local site infection will contribute to false positive results.

ACKNOWLEDGEMENTS

Authors would like to thanks to Dr. Shruthi Reddy and Dr. Ayesha Siddiqua for helping us in writing the script and all the teaching and non-teaching staff and post graduate residents of department of paediatrics, Al-Ameen medical college and hospital, Vijayapura, Karnataka, India and Department of paediatrics, institute of child health and hospital for children, Madras medical college, Chennai, Tamil Nadu, India, for their co-operation and support throughout the period of study and for timely help in preparing charts and tables.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Malagi NAN, Sushma U, Thangavelu S, Shanthi S, Ramchandran P, Indumathi et al. Study of incidence, microbiological profile of nosocomial infections in pediatric intensive care unit of tertiary care center. *Int J Contemp Pediatr* 2023;10:1258-61.