Section: Miscellaneous

Original Research Article

PREVALENCE OF CLABSI AND CAUTI IN INTENSIVE CARE UNITS OF A TERTIARY CARE HOSPITAL IN ASSAM: A HOSPITAL BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Background: The burden of healthcare associated infections (HAIs) is higher in our country leading to increased mortality and morbidity causing significant impact on overall quality of healthcare. Current study was conducted in a major tertiary care hospital in Assam, Northeast India to analyse the prevalence of Central-line associated Bloodstream infections (CLABSI) & Catheter-associated urinary tract infections (CAUTIs) in critically ill patients admitted in different Intensive Care Units (ICUs) & compare the prevalence among different ICUs.

Materials and Methods: This cross-sectional study was carried out for one year in the Department of Microbiology of a tertiary care teaching hospital of eastern Assam, India. Patients admitted to the Central ICU, Medicine ICU & Neonatal ICU with central line and indwelling urinary catheter were studied. Data regarding patient credentials were collected from respective ICUs in Proforma.

Result: Out of 3134 patients, 2632 were screened for CLABSI, 108 (4.10%) were found positive. Another 502 patients were screened for CAUTI, of which 38 (7.57%) were tested positive for CAUTI. In Central ICU, 27(5.42%) were CLABSI positive while in Medicine ICU 9 (9.37%) and in Neonatal ICU 72(3.53%) were CLABSI positive. In Central ICU, 32(6.88%) were CAUTI positive while in Medicine ICU 6(16.22%) were CAUTI positive. No CAUTI was detected in neonatal ICU. Among all the organism reported, *Acinetobacter baumannii* was found to be the most prevalent organism followed by *Klebsiella pneumoniae, Escherichia coli, Staphylococcus aureus* etc. as the causative agents of HAI in ICUs.

Conclusion: This study has significant clinical implications for patient treatment. Both Central Line Associated Bloodstream infection (CABSI) and Catheter Associated Urinary Tract Infection (CAUTI) are life-threatening challenges; hence, timely detection, identification of pathogens and strict formulation and implementation of Infection Control Practices (IPC) and

hospital antibiotic policy are mandatory to reduce mortality and morbidity in patients admitted to Intensive Care Units (ICU).
Keywords: Healthcare-associated infections (HAI), Central Line Associated Blood stream infections (CLABSIs), Catheter-associated urinary tract infection (CAUTI), Intensive care unit (ICUs), Infection Control Practices (IPC).

INTRODUCTION

Healthcare-associated infections (HAI), are infections that are typically absent at the time of admission and manifest after 48 hours of admission to the hospital or within 30 days of having received health care in a facility.[1] As per the National Healthcare Safety Network (NHSN) criteria, CDC has classified HAIs into a number of different types, the major ones encountered in Acute care Hospitals (ACHs) being (a) Catheter-associated urinary tract infections (CAUTIs), (b) Central-line associated Bloodstream infections (CLABSIs), (c) Surgical site infections (SSIs), and (d) Ventilator-associated pneumonia (VAP).[2]

Blood stream infections (BSIs) are a common and potentially life-threatening problem in intensive care units (ICUs) of hospitals worldwide as they increase the length of stay and mortality in the ICUs.[3] The worldwide increase in the incidence of BSIs is mainly attributed to the increased use of invasive devices and aggressive drug therapy along with increased frequency of invasive procedures.[4] The extensive use of intravascular catheter, however is recognised as most important factor contributing to the occurrence of BSI.[5] ICU-BSI can occur either secondary to the dissemination of pathogens from a primary focus of infection at a clinical site into the blood stream, or can be primary, where the source of infection is unclear. The common clinical sites for secondary ICU-BSI are the respiratory, gastrointestinal and urinary tract.[6]

Catheter-associated urinary tract infection (CAUTI) is the most common hospital acquired infection. They are caused by endogenous native microflora of the patient.[7] It can lead to such complications as prostatitis, epididymitis and orchitis, cystitis, pyelonephritis, Gram-negative bacteraemia, endocarditis, vertebral osteomyelitis, septic arthritis, and meningitis in patient. CAUTI causes discomfort in patient, prolong hospital stay and increase cost and mortality.[8]

The current study was conducted in a major tertiary care hospital in Assam, Northeast India to analyse the prevalence of BSI & CAUTI in critically ill patients admitted in different ICU's & compare the prevalence among different ICUs of the said hospital.

MATERIALS AND METHODS

This cross-sectional study was carried out in the Department of Microbiology, of a Medical College and Hospital located in eastern Assam. It is a 1500 bedded tertiary care hospital, which was established in 1947. The study included all patients admitted to the Central ICU (under the department of Anaesthesia and critical care), Medicine ICU & Neonatal ICU with symptoms of HAI admitted between April 2023 to February 2024. A standard case requisition form was used for enrolling the study subjects after obtaining informed written consent from guardians/ attendants. The study was approved by institutional ethics committee (Human) (No. AMC/EC/186, dated 17th Jan, 2022).

Cases satisfying the clinical case definition of BSIs and CAUTIs as per CDC/ NHSN guidelines were considered for inclusion (9-11). Data regarding the patient credentials, history, culture reports, etc. were collected from the respective ICUs in a standardized case report form. Data analysis was performed using Epi-info software (version 7.2.4, Atlanta, GA, USA). Chi-Square test was done to determine statistical significance among the variables.

Case surveillance definitions for CLABSI and CAUTI were followed for case recruitment in the current study. As per CDC guidelines, CLABSI is a laboratory-confirmed BSI unrelated to an infection at another site in a patient with a central line in situ for at least two consecutive days. Primary bloodstream infection (BSI) was classified as a Laboratory Confirmed Bloodstream Infection (LCBI) that is not secondary to an infection at another body site. Secondary BSI were defined as BSI that is thought to be seeded from a site-specific infection at another body site.[12]

Catheter-associated UTI (CAUTI) was defined as a UTI where an indwelling urinary catheter (IUC) was in place for more than two consecutive days in an inpatient location on the date of event or the day before, with day of device placement being Day 1. If an IUC was in place for more than two consecutive days in an inpatient location and then removed, the date of event for the UTI must be the day of device discontinuation or the next day for the UTI to be catheter-associated.[9]

RESULTS

A total of 3134 cases of suspected CLABSI and CAUTI admitted in the three ICUs were inducted into the study. These included 2632 cases of suspected CLABSI and 502 cases of suspected CAUTI. As per the case definitions of CLABSI and CAUTI, 108 cases of CLABSI and 38 cases of CAUTI were detected during the study period. For CAUTIs, no cases were included from the neonatal ICU, whereas, for CLABSI, cases were included from all three ICUs.

In central ICU, a total of 498 suspected BSI patients were admitted of which 471(94.58%) were culture

negative while 27 (5.42 %) qualified under the clinical case definition of CLABSI. Similarly, 9 (9.37%) cases admitted to the medicine ICU and 72(3.53 %) cases admitted in the neonatal ICU were laboratory confirmed BSI. [Table 1]

Table 1: Distribution of CLABSI cases in three ICUs

ICU	Negative	Positive	Total	p-value
	n (%)	n (%)	n	
Central ICU	471(94.58%)	27(5.42%)	498	0.0048
Medicine ICU	87(90.63%)	9(9.37%)	96	
Neonatal ICU	1966(96.47%)	72(3.53%)	2038	
TOTAL	2524(95.89%)	108(4.10%)	2632	

Out of 502 total CAUTI patients, 465 patients were admitted in Central ICU out of which 433(93.12%) patients were negative while 32(6.88%) were CAUTI positive. Similarly, 37 CAUTI patients were admitted in Medicine ICU out of which 31(83.78%) were negative, while 6 (16.22%) were CAUTI positive. In neonatal ICU, there were no suspected CAUTI cases admitted during this period. [Table 2]

Table 2: Distribution of CAUTI cases in two ICUs

ICU Name	Negative	Positive	Total	p-value	O.R (95% CI)
CICU	433(93.12%)	32(6.88%)	465	0.0388	2.619(1.018-6.738)
MICU	31(83.78%)	6(16.22 %)	37		
TOTAL	464(92.43%)	38(7.57%)	502		

It was observed that BSI rate was comparatively higher in Medicine ICU (9.37%) as compared to Central ICU and Neonatal ICU and the difference was statistically significant (Chi-squared p value=0.0048). Similarly, CAUTI rates were also higher in Medicine ICU.

Amongst all the organisms reported, Acinetobacter baumannii was found to be most prevalent followed by Klebsiella pneumoniae as the causative agents of BSI in ICUs. The frequency of isolation of different organisms from the three ICUs is shown in Table 3 below.

Table 3: Frequency of different organisms causing BSI in the three ICUs

Sl no.	Organism	Central ICU	Medicine ICU	Neonatal ICU	No. of BSI cases (total)	Overall BSI cases percentage of occurrence (%)
1.	Acinetobacter baumannii	9	4	24	37	34.26
2.	Klebsiella pneumoniae	5	0	14	19	17.59
3.	Escherichia coli	4	1	9	14	12.96
4.	Staphylococcus aureus	2	0	7	9	8.33
5.	Acinetobacter species	0	0	2	2	1.85
6.	Enterococcus faecalis	3	0	3	6	5.55
7.	Vancomycin Resistant Enterococcus faecalis	0	0	1	1	0.92
8.	Enterococcus faecium	1	1	1	3	2.77
9.	Vancomycin Resistant Enterococcus faecium	0	1	0	1	0.92
10.	Klebsiella oxytoca	2	1	2	5	4.63
11.	Methicillin Resistant Staphylococcus aureus	0	0	2	2	1.85
12.	Burkholderia cepacia	0	0	1	1	0.92
13.	Burkholderia pseudomallei	0	1	0	1	0.92
14.	Enterobacter cloacae	0	0	1	1	0.92
15.	Citrobacter freundii	0	0	1	1	0.92
16.	Serratia marcescens	1	0	0	1	0.92
17.	Pseudomonas fluorescens	0	0	1	1	0.92
18.	Pseudomonas putida	0	0	2	2	1.85
19.	Listeria monocytogenes	0	0	1	1	0.92

In CAUTI, E. coli was the most commonly isolated organism followed by Acinetobacter baumannii and Klebsiella pneumonia. [Table 4]

Table 4: Table showing Organism distribution of UTI cases among the ICUs and overall UTI cases percentage of occurrence (%) for the period (April 2023-February 2024)

Sl no	Organism	Central ICU	Medicine ICU	No. of UTI cases (total)	Overall UTI cases percentage of occurrence (%)
1	Acinetobacter baumannii	7	0	7	18.42
2	Klebsiella pneumoniae	7	0	7	18.42
3	Escherichia coli	7	1	8	21.05
4	Enterococcus faecalis	3	0	3	7.89
5	Enterococcus faecium	3	1	4	10.53
6	Vancomycin Resistant Enterococcus faecium	1	0	1	2.63
7	Klebsiella oxytoca	1	0	1	2.63
8	Pseudomonas aeruginosa	5	0	5	13.16
9	Providencia stuartii	1	0	1	2.63
10	Pseudomonas oleovorans	1	0	1	2.63

DISCUSSION

Intensive care units (ICUs), full of potential infections, with a vulnerable population possessing reduced host defences and multiple procedures with invasive devices such as endotracheal intubation, central venous cannulation, mechanical ventilation (MV), and urinary catheterisation, distort the anatomical integrity protective barriers of patients.[13] Central Venous Catheter (CVC) related bloodstream infection (CRBSI) and central line-associated bloodstream infection (CLABSI) are a major cause of morbidity, mortality, amidst increased cost with prolongation of hospital stay.[14]

Long-term CAUTIs might result in developing chronic diseases. Also affecting the socioeconomic condition of infected individuals, contributing largely to increase in intake of antibiotics. Healthcare-associated urinary tract infection is considered a serious public health issue and an economic burden.[15]

In a study conducted in Palestine, the incidence of HAI in ICUs of a tertiary care hospital was found to be 27.4% BSI and 33.7% CAUTI whereas in our study, the incidence rate is much lower at 4.10 % and 7.56 % respectively.[16] A study conducted by Bhabhor et al. found that the maximum number of blood stream infections were from paediatric ICU (71.09%), followed by medical ICU (16.76%) and surgical ICU (12.13%). In our study also, we have found higher incidence in NICU (2.73%), followed by Central ICU (1.02%) and Medicine ICU (0.34%).[17]

Gajovic O et al. conducted a study which found that infection caused in ICU patients was Coagulase-negative Staph. aureus (56.5%), Pseudomonas aeruginosa (30.3%), Klebsiella pneumoniae spp. (23.2%), E coli (15.8%) and Actinobacter spp (12.3%), while in our study we have found that infection caused by Acinetobacter was 34.25%, Klebsiella was 17.59%, E. coli was 12.96% and S. aureus was 8.33%.[18]

Mathur P et al. found that blood stream infections caused by Klebsiella (24.8%) were higher than those caused by Acinetobacter (21.3%), S. aureus (8.8%) and E. coli (5%) while in our study, we have found that infection caused by Acinetobacter was 34.25%, Klebsiella was 17.59%, E. coli was 12.96% and S. aureus was 8.33%.[4] The same study reported that incidence of CAUTI caused by Klebsiella was 22%, Acinetobacter was 18.8%, E. coli was 3.8% and P. aeruginosa was 8.0%, while in the present study, we have found that infection caused by E. coli was 21.05%, Klebsiella was 18.4%, Acinetobacter was 18.4%, and P. aeruginosa was 13.6%.[4]

Another Study done by Ullas Bhabhor et al. found that blood stream infection caused by S. aureus was 41.61%, Klebsiella was 15.02%, Acinetobacter was 9.82% and E. coli was 8.09%, while in our study, we have found that infection caused by Acinetobacter was 34.25%, Klebsiella was 17.59%, E.coli was 12.96% and S. aureus was 8.33%.[17]

Seleziak J et al. have reported that CAUTI caused by E. coli was 25.81% , Klebsiella spp. was 22.58%, Acinetobacter was 8.06%, and P. aeruginosa was 4.84%, while in our study, we have found that infection caused by E.coli was 21.05%, Klebsiella was 18.4%, Acinetobacter was 18.4%, and P. aeruginosa was 13.6%.[19]

Limitations

The current study included only three surveillance units (considering it to be high risk areas), which may not be able to depict the real burden of HAI in the institute which shows scope of further research.

CONCLUSION

This study has significant clinical implications for proper patient management in critical care settings. Both Catheter Associated Bloodstream infection (CABSI) and Catheter Associated Urinary Tract Infection (CAUTI) are life-threatening challenges; hence, timely detection, identification of pathogens and strict formulation and implementation of Infection Control Practices (IPC) and hospital antibiotic policy are mandatory to reduce mortality and morbidity in patients admitted to Intensive Care Units (ICU).

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