



CLINICO-EPIDEMIOLOGICAL PROFILE OF CENTRAL LINE-ASSOCIATED BLOOD STREAM INFECTIONS AND ASSOCIATED MORBIDITIES AMONG PATIENTS IN A TERTIARY CARE HOSPITAL

Microbiology

Dr. Shuvi Sharan* Assistant Professor, Department of Microbiology, Madhubani Medical College and Hospital (MMCH), Madhubani, Bihar. *Corresponding Author

Dr. Jagat Narayan Nayak Associate Professor, Department of Microbiology, Madhubani Medical College and Hospital (MMCH), Madhubani, Bihar.

ABSTRACT

Background: Central line-associated bloodstream infection (CLABSI) is often a complication of the presence of indwelling medical devices. These Central line catheters provide long-term venous access for treatment, delivery of medications and blood testing. Use of Central venous Catheters lead to bloodstream infection often referred as Central line-Associated bloodstream infection.

Methods and Materials: Cross sectional retrospective data was collected among all the inpatients for the year 2020 covering 10, 954 inpatients. Data was collected as per ICD – 10 coding, analyzed using SPSS software OR17, interpreted and represented in the graph.

Results: Prevalence rate of CLABSI was 7/1000 population, High prevalence was seen among males 144 (65.7%), Mean age $\pm$ 40.6, Average length of stay increased to 11.7 days, patients admitted to ICU complex suffered more compared to ward category, Medical related diseases contributed to 132 (60.2%) and Respiratory organ system related diseases contributed to 96 (25.5%).

Conclusions: Patients with Central line -associated bloodstream infection had significantly longer hospital lengths of stay; Bloodstream infections are associated with a high rate of morbidity and mortality. In this context understanding the profile, demographic variables and associated morbidity becomes an important for prevalence of the diseases.

KEYWORDS

Blood stream infections, epidemiology, Bacteremia, Sepsis.

INTRODUCTION

Health care associated infections are the most common complication among hospitalized patients¹ and most serious issues related patient care safety. US studies reported that HAIs are the fifth leading cause of deaths in the acute-care hospitals².

Central line - associated blood stream infection type of Health care associated infections occurs due to the entry of disease causing pathogenic microorganisms into the bloodstream. CLABSI infection spreads through catheter hub its lumen contamination, local insertion site colonization, guide wire during insertion, and infusion of contaminated fluids.^{3,4,5}

Central – line catheter Insertion is a common procedure especially used for patients who are receiving care in intensive critical care settings. These Central -line catheters are associated with many infectious complications leading to bacteremia, sepsis, morbidity and mortality³. Clinical signs, quantitative culture test and symptoms of the disease will help in the diagnosis of Central – line catheter related infection⁴.

A study conducted in Indian tertiary care teaching hospital during last decade identified the CLABSI incidence in India varies from 0.2% to 27%⁵. Based on the number of catheter days, for 1000 catheter days the rate of incidence varies from 0.5 - 47 in hemodialysis catheters⁶. CLABSI are most common among Neonatal Intensive Care Units in India and they have a higher prevalence rate of CLABSI (27.02 per 1000 catheter days) compared to any other ICUs settings⁷.

Various risk factors of CLABSI incidence include the type patient setting like Intensive Care Units, hospital category (small/medium/larger, corporate/teaching, rural/urban or home), number of hospital days , Site of catheterization, type Insertion techniques and catheter used, Number of catheter lumens, type of antibiotic stewardship and antiseptic solution , placement of catheter Emergent versus elective placement, dressing frequency during catheterization, manipulation Frequency, trained personnel in- charge of catheter care, and criteria used for diagnosing central line – catheter related infections^{8,9,10}.

Many studies have been conducted about the prevalence rate, incidence rate, mortality and morbidity of central line associated blood stream infections.

But not many studies have been conducted to assess the system classification of diseases for the patients who had diagnosed with CLABSI. The present study is focused to determine the other diseases system wise classification which led to the central line associated

blood stream infection.

MATERIALS AND METHODS

The present study mainly focused on the organ system wise classification of diseases which led the development of central line associated blood stream infections after the placing central venous catheters.

The study population included all in – patients who got admitted to Madhubani Medical College and Hospital, Madhubani, Bihar for the period of one year 2020 covering 10, 954 inpatients. The hospital offers Out Patient Services, In-Patient Services, Multidisciplinary Intensive Care, Pediatric ICU, Neonatal ICU services, Accident and Emergency services -24/7, Major Operation Theatres.

The study is based on the retrospective data using prospectively collected HAI surveillance data from hospital infection control committee and also from the ICD-10 Coding. The study focused on the data collected for the year 2015 from all the inpatients who were admitted for more than 48 hours and diagnosed as per ICD – 10 coding.

Data collected included patient related factors such as Demographic Details, Ward Category (General Ward / Private Ward / ICU) specialty of the department and organ system wise classification of diseases.

Every patient who was admitted for more than 48 hrs either in the General ward , Private ward or in the Intensive Care Unit (MICU , SICU, MITU, PICU, NICU) were observed for the symptoms of infections like Discharge , Swelling , Fever after 48 hrs of hospital admission ,Redness , Color change, Bleeding at the site. Patient Medical Records were screened for clinical symptoms and signs, Laboratory data, Microbiological data.

Quantitative analysis for continuous variables was done and summarized by using excel spread sheet presented in the form of tables, frequency of mean was calculated and the data was subjected to various data quantity checks and was exported to SPSS 16.

The percentage of CLABSI calculated. Discontinuous data were summarized using proportion in percentage. Analyzed results were expressed in the tabular format.

RESULTS

Patient clinical profile details

Study period included records of 1 year 2015, Total in-patient admissions to our hospital 10954 for the year 2015. among 30954 patients , 219 (0.7 %) patients were diagnosed as Central line-

associated blood stream infection patients in our study CLABSI occurred more among male patients 144(65.7%), female patients 75(34.3%), mean age 40.6, the Average length of stay was 11.7 days /patient.

Blood stream infection occurred most commonly in intensive care units¹¹ as mentioned in the table 1.

Specialty wise distribution of BSI

Among the total in patients 219 patients had confirmed BSI, this is represented in the table 2.

Table 1 : Distribution of patient clinical profile

Patient clinical profile	Frequency (%)
Total No. of cases	219
Total No. of Male patients	144(65.7%)
Total No. of Female patients	75(34.3%)
Mean age (SD)	±40.6
Average length of stay	11.7 days
MICU stay	57(26%)
NICU stay	7(3.1%)
PICU stay	17(7.7%)
Isolation ICU stay	13(5.9%)
Ward admission	125(57.0%)

Table 2 : Specialty wise diseases associated with BSI

Specialty wise distribution	Cases (n=219)(%)
Medical related	132(60.2%)
Nephrology	15(6.8%)
Paediatrics	46(21%)
Respiratory	10(4.5%)
Gastro	4(1.8%)
Surgery	5(2.2%)
Radiotherapy	1(0.4%)
Neurosurgery	1(0.4%)
Neurology	1(0.4%)
OBG	2(0.9%)
Ortho	1(0.4%)
Plastic surgery	1(0.4%)

Table 3 : Organ system wise classification (n=377)

Organ system wise classification	Cases (%)
Respiratory system	96(25.5)
Circulatory system	54(14.3)
Endocrine intestinal and metabolic disease	42(11.1)
Intestinal and parasitic diseases	39(10.3)
Genitourinary system	36(9.5)
Injury/poisoning/external causes	27(7.2)
Blood and blood forming organs	22(5.8)
Digestive system	20(5.3)
Nervous system	18(4.8)
Abnormal lab findings	9(2.4)
Conditions in prenatal period	5(1.3)
Factors of health status	3(0.8)
Others	6(1.7)

Table 4 : Morbidity profile of CLABSI

No. of diseases with CABS	Frequency (%)
1 st co-morbid condition	219(58%)
2 nd co-morbid condition	90(23.8%)
3 rd co-morbid condition	47(12.4%)
4 th co-morbid condition	18(4.7%)
5 th co-morbid condition	3(0.7%)
Total No. of co-morbid condition among all CLABSI patients	377

Organ system wise classification of diseases

Organ system wise classification of diseases is based on international classification of diseases- 10 (ICD-10) contains codes for abnormal findings, diseases, social circumstances, signs and symptoms, external causes of injury or diseases and complaints¹³.

The International Classification of Diseases -10 uses unique alphanumeric codes to identify diseases and other health related problems¹⁴.

Patient who had blood stream infection along with the other primary causes of the diseases were coded as per the blocks of ICD – 10 blocks respectively. respectively, calculated the no of cases and analyzed in percentage.

Patients who had the diseases of respiratory system had more BSI infections when compared with any other system of classification, circulatory system being the second highest system to acquire BSI

Morbidity profile of CLABSI

Patients who had blood stream infection had diagnosed to have one or more diseases. First comorbid condition was present in almost all the cases contributing to 219 (58%), 2nd co-morbid condition 90 (23.8%), 3rd co-morbid condition 47 (12.4%), 4th co-morbid condition 18 (4.7%), 5th co-morbid condition 3(0.7%) contributing respectively.

DISCUSSION

Central line-associated bloodstream infection a major concern among the health care providers and the patients who are receiving the treatment at the various categories of the hospital .presence of Indwelling catheters used for hospitalized patients give rise to Central line-associated bloodstream infection (CLABSI) complication of patient care most commonly occurs in patients who receive treatment in various intensive care units (ICU)¹⁵. Central line-associated bloodstream infection (CLABSI) is associated with major morbidity and mortality¹⁶.

Risk of CLABSI increases due to aseptic technique which occurs during placement and maintenance of various catheters. The rate of frequency increases with the increase in the frequency of catheter access^{17,18}.

As per Egypt national cancer institute, a study was conducted and reported that CLABSI leads to prolonged hospitalization /longer hospital stay also increases the rate of HAI.¹⁹ Both the genders are at a greater risk of developing CABS, but the proportion of males is slightly higher, probable reason being high risk is due to increased comorbidities²⁰, increased susceptibility include epidemiological elements, immunosenescence, and malnutrition, age-associated physiological and anatomical alterations²¹. The type of microorganism encountered during CLABSI is different in the elderly population due to the immune compromised status of the host²².

Even in our study we found that CLABSI was most commonly occurred in male with the ratio of 144(65.7%) and 75(34.3%) respectively. Our study reported that the patient in the different intensive care units suffered more when compared to ward category MICU stay 57(26%), NICU stay 7(3.1%) , PICU stay 17(7.7%) , Isolation ICU stay 13(5.9%) and Ward admission 125 (57.0%).

Our findings revealed patient longer hospital days and increased average length of stay contributing to 11.7 days which is approximately double the length of stay. Mean age of CLABSI occurrence was prevalence was 40.6. Patients who got admitted to Medical related problems approximately 132 (60.2%) Pediatrics is the second most common department with the CABS rate of 46 (21%). Patients who had Respiratory system related diseases and Circulatory system were the most suffers of CLABSI 96(25.5%) and 54(14.3%) respectively

Central line associated Bloodstream Infections (CABS) –profile in India

In India the rate of Central line associated Bloodstream Infections (CABS) has been reported by many authors. The results vary from one study to another study due to variations in the type of health care setting. A study conducted by Pawar 2004²³ et.al found that % CLABSI is 2.6% (35/1314), Datta 2010²⁴ et.al found that % CLABSI is 13.34% (55/412), Singh 2010²⁵ et.al is 0.16% , Chopdekar 2011²⁶ is 7.6% (6/78), Patil 2011²⁷ et al is 27.77% (15/54), Parameswaran 2011²⁸ et al is 10.7% (25/232), Kaur 2012²⁹ is 1.67% (8/480), Our study found that the rate of CABS is 0.7% (219/10954).

Table 5: Prevention of central line- associated Bloodstream Infection as per the France author Denis Frasca et al in intensive care units³⁰.

1. Preparation of skin using >0.5% chlorhexidene plus alcohol before insertion/ procedure

2. Trained personnel insert catheters with appropriate PPE
 3. Limit the number of lumens used for central venous catheterization
 4. Adhere to hand hygiene thoroughly prior to insertion
 5. Insertion site should be covered with semipermeable transparent (changed after every 7 days) or gauze dressing, gauze dressings(changed after every 2 days)
 6. Intravascular catheters to be removed as soon possible when not required for patient care
 7. Use of subclavian vein instead of the femoral vein/internal jugular vein based upon risk of injury
26. Chopdekar K, Chande C, Chavan S, Veer P, Wabale V, Vishwakarma K, Joshi A, et al . Central venous catheter related blood stream infection rate in critical care units in a tertiary care, teaching hospital in Mumbai.Indian J Med Microbiol 2011;29:169-71.
 27. Patil HV, Patil VC, Ramteerthkar MN, Kulkarni RD et al. Central venous catheter-related bloodstream infections in the intensive care unit.Indian J Crit Care Med. 2011 Oct; 15 (4): 213-23.
 28. Parameswaran R, Sherchan JB, Varma D M, Mukhopadhyay C, Vidyasagar S et al . Intravascular catheter-related infections in an Indian tertiary care hospital.J Infect DevCtries. 2011 Jul 4;5(6):452-8.
 29. Kaur R, Mathai AS, Abraham J , et al. Mechanical and infectious complications of central venous catheterizations in a tertiary-level intensive care unit in northern India. Indian J Anaesth. 2012 Jul;56(4):376-81.
 30. Denis Frasca, Claire Dahyot-Fizelier, et al. Prevention of central venous catheter-related infection in the intensive care unit.Critical Care 2010 14:212

CONCLUSIONS

Central – line catheter associated blood stream infection is more common among the patients who get admitted to multi disciplinary intensive care unit approximately 57 (26%) when compared with any other ICU. The rate of CLABSI was more common among male patients 144 (65.7%), patients who had admitted to ward admission also had CLABSI 125(57.0%). Patients who the diseases related to medical type of diagnosis had the highest rate of CLABSI 132(60.2%), Pediatrics 46 (21%). Patients who had the diseases related to respiratory system 95(25.5%), circulatory system 54 (14.3%) had CLABSI. The co- morbid conditions also played an important role in the development of blood stream infection. the 1st co – morbid condition was present in almost 219 (58.0%), 2nd co–morbid condition was present in 90 (23.8%) patients. The rate of CLABSI – 0.7% (219/10954) patients. Risk of CABSI can be reduced by the following mentioned techniques in the table 5.

REFERENCES

1. Burke JP et al. Infection control: A problem for patient safety. N Engl J Med. 2003;348(7):651–656.
2. Klevens, R. M., J. Edwards, C. Richards, T. C. Horan, R. P. Gaynes, D. A. Pollock, and D. M. Cardo. 2007. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Rep. 122:160-166.
3. Perez ER et al . Catheter related bloodstream infections in critical care. J Antimicrob Chemother (2013) 68 (1): 206-213 2012.
4. Patil HV, Patil VC, Ramteerthkar MN, Kulkarni RD et al. Central venous catheter-related bloodstream infections in the intensive care unit.Indian J Crit Care Med. 2011 Oct; 15 (4): 213-23.
5. Avinash Rode, Prasad Y. Bansod, Ajit Gujela, Alok Singh et al .Study of central line-associated bloodstream infections in intensive care unit: a prospective observational study. Indian J Chest Dis Allied Sci. 2014 Apr-Jun;56(2):85-91.
6. PavelNapalkov, Diana M Felici, Laura K Chu, Joan R Jacobs, and Susan M Begelman et al. Incidence of catheter-related complications in patients with central venous or hemodialysis catheters: a health care claims database analysisBMC cardiovascDisord. 2013; 13: 86.
7. Chopdekar K, Chande C, Chavan S, Veer P, Wabale V, Vishwakarma K, Joshi A et al . Central venous catheterrelated blood stream infection rate in critical care units in a tertiary care, teaching hospital in Mumbai.Indian J Med Microbiol 2011;29:169-71.
8. Perez ER. Catheter related bloodstream infections in critical care. 2012.
9. Rosado V, Romanelli RM, Camargos PA et al . Risk factors and preventive measures for catheter-related bloodstream infections. J Pediatr (Rio J). 2011 Nov-Dec;87(6):469-77.
10. Pawar M, Mehta Y, Kapoor P, Sharma J, Gupta A, Trehan N et al . Central venous catheter-related blood stream infections: incidence, risk factors, outcome, and associated pathogens. J CardiothoracVascAnesth. 2004 Jun;18(3):304-8.
11. VinayKhanna, ChiranjayMukhopadhyay, Vandana K. E., MurlidharVerma, and ParthaDabke et al.Journal of Pathogens Volume 2013 (2013), 6 pages
12. ICD-10 Second Edition Volume 2 – World Health Organization www.who.int/classifications/icd/ICD-10_2nd_ed_vol_ume2.pdf Retrieved 23 May 2017.
13. International Classification of Diseases (ICD). World Health organization. www.who.int/classifications/icd/ICD10Vol_ume2_en_2010
14. ICD-10-CM (International Classification of Diseases, Tenth Revision, Clinical Modification) www.cdc.gov/nchs/icd/icd10cm.htm
15. Harshal Shah, Wendelyn Bosch, Kristine M. Thompson, and Walter C. Hellinger et al. Intravascular Catheter-Related Bloodstream Infection J . Neurohospitalist. 2013 Jul; 3(3): 144–151.
16. LauplandKB .Incidence of bloodstream infection: a review of population-based studies. ClinMicrobiol Infect. 2013 Jun; 19 (6): 492-500.
17. O'Grady NP, Alexander RN, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Am J Infect Control. 2011;39(4 suppl 1):S1–S34
18. Beekmann SE, Henderson DK., Principles and Practice of Infectious Disease caused by percutaneous intravascular devices. editors. , eds.Vol 1 6th ed Philadelphia, PA: Elsevier; 2005:3347–3361.
19. Emily R. M. Sydnor, Trish M. Perl et al. Hospital Epidemiology and Infection Control in Acute-Care Settings. ClinMicrobiol Rev. 2011 Jan; 24(1): 141–173.
20. Lissauer ME1, Leekha S, Preas MA, Thom KA, Johnson SB et al J Trauma Acute Care Surg. 2012 May;72(5):1174-80.
21. Kevin P High . Infection in an ageing world - The Lancet Infectious Diseases, Volume 2, Issue 11, November 2002, Page 655.
22. TT Yoshikawa . Epidemiology and unique aspects of aging and infectious Diseases Clin Infect Dis, 30 (2000), pp. 931–933.
23. Pawar M, Mehta Y, Kapoor P, Sharma J, Gupta A, Trehan N et al. Central venous catheter-related blood stream infections: incidence, risk factors, outcome, and associated pathogens. J CardiothoracVascAnesth. 2004 Jun;18(3):304-8.
24. Datta P, Rani H, Chauhan R, Gombar S, Chander J, et al. Device-associated nosocomial infection in the intensive care units of a tertiary care hospital in northern India. J Hosp Infect. 2010 Oct;76(2):184-5.
25. Singh S, Pandya Y, Patel R, Paliwal M, Wilson A, Trivedi S, et al . Surveillance of device-associated infections at a teaching hospital in rural Gujarat-India.Ind J Med Microbiol. 2010; 28(4): 342-7.