ORIGINAL ARTICLE
pISSN 0976 3325 | eISSN 2229 6816
Open Access Article
www.njcmindia.org

# Clinico-Epidemiological Profile of Central Line-Associated Blood Stream Infections and Associated Morbidities among Patients in a Tertiary Care Hospital, Bangalore

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**Financial Support:** None declared
**Conflict of Interest:** None declared


**How to cite this article:**
Sarala KS, Nanda Kumar BS, Narendranath V. Clinico-Epidemiological Profile of Central Line-Associated Blood Stream Infections and Associated Morbidities among Patients in a Tertiary Care Hospital, Bangalore. Natl J Community Med 2017; 8(9):559-563.

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**Date of Submission:** 12-05-17
**Date of Acceptance:** 16-09-17
**Date of Publication:** 30-09-17

## 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 2015 covering 30, 954 inpatients. Data was collected as per ICD – 10 coding, analyzed using SPSS softwareOR17, 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 ± 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.

**Key words:** Blood stream infections, epidemiology, Bacteremia, Sepsis.

## INTRODUCTION

Health care associated infections are the most common complication among hospitalized patients[1] and most serious issues related patient care safety. US studies reported that HAIs are the fifth leading cause of deaths in the acute-care hospitals[2] . 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 mortality[3]. Clinical signs, quantitative culture test and symptoms of the disease will help in the diagnosis of Central – line catheter related infection[4].

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 catheters[6].CLABSI are most common among Neonatal Intensive Care Units in India and they have a higher prevalence rate of CLABSI (27.02per 1000 catheter days) compared to any other ICUs settings[7].

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 Ramaiah medical college hospital, Mathikere, Bangalore for the period of one year 2015 covering 30, 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 of1 year 2015, Total in-patient admissions to our hospital 30954 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 ,Mean amount paid by each patient was 73131.52/- .

Blood stream infection occurred most commonly in intensive care units[11]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%) |
| Mean amount paid by patient | 73131.52 |

**Table 2: Specialty wise diseases associated with BSI**

| Speciality 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)**

| ICD 10 Code[12] | Organ System wise classification | Cases (%) |
|---|---|---|
| J | Respiratory system | 96 (25.5) |
| I | Circulatory system | 54 (14.3) |
| E | Endocrine intestinal and metabolic ds | 42 (11.1) |
| A | Intestinal and parasitic diseases | 39 (10.3) |
| N | Genitourinary system | 36 (9.5) |
| S | Injury /poisoning/external causes | 27 (7.2) |
| D | Blood and blood forming organs | 22 (5.8) |
| K | Digestive system | 20 (5.3) |
| G | Nervous system | 18 (4.8) |
| R | Abnormal lab findings | 9 (2.4) |
| O | Conditions in prenatal period | 5 (1.3) |
| Z | Factors of health status | 3 (0.8) |
| | Others (B,V,Q,M,H) | 6 (1.7) |

**Others include** *Intestinal and viral infections(B), Transport accidents(V), Congenital malformations and abnormalities(Q), Musculoskeletal system and connective tissue(M), Diseases of eye , ear and mastoid process(H)

**Table: 4 Morbidity profile of CLABSI**

| No of diseases with CABSI | Frequency (%) |
|---|---|
| 1st co-morbid condition | 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%) |
| 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 complaints[13].The International Classification of Diseases -10 uses unique alphanumeric codes to identify diseases and other health related problems[14].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 , 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 co-morbid 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 mortality[16]. 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[1718].

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 CABSI , but the proportion of males is slightly higher , probable reason being high risk is due to increased co-morbidities[20], increased susceptibility include epidemiological elements, immunosenescence, and malnutrition, age-associated physiological and anatomical alterations[21] . The type of microorganism encountered during CLABSI is different in the elderly population due to the immune compromised status of the host[22].

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 reveled patient longer hospital days and increased average length of stay contributing to 11.7 days which is approximately double the length of stay, Mean amount paid by each patient came up to 73131.52 which more than the normal amount . 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 CABSI 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 (CABSI) –profile in India**

In India the rate of Central line associated Bloodstream Infections (CABSI) 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 2004 [23]et.al found that % CLABSI is 2.6% (35/1314) , Datta 2010 [24] et.al found that % CLABSI is 13.34% (55/412) , Singh 2010 [25] et.al is 0.16% , Chopdekar 2011 [26] is 7.6% (6/78) , Patil 2011 [27] et al is 27.77% (15/54), Parameswaran2011 [28] et al is 10.7% (25/232), Kaur 2012 [29] is 1.67% (8/480) , Our study found that the rate of CABSI is 0.7% (219/30954 )

**Table 5: Prevention of central line- associated Bloodstream Infection as per the France author Denis Frasca et al in intensive care units**[30].

| | |
|---|---|
| 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 semi-permeable 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 |

## 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% (219/30954) patients.

Risk of CABSI can be reduced by the following mentioned techniques in the table 5.

**Acknowledgements**

Authors wish to place on record the support of Doctors, Nursing personnel and Records section staff for undertaking this study.

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