Central line blood stream infection in intensive care unit: Importance of the care bundle

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Abstract

Introduction: Blood stream infections (BSIs) due to central venous catheterization are one of the major device-associated infections in the ICU. It can be a source of dangerous sepsis, bacteremia, multi organ failure and even death[1]

Objective: To determine the rate of central line associated blood stream infection (CLABSI), incidence rate and antibiotic sensitivity pattern of isolated organisms.

Materials and Methods: Central Line and Peripheral line blood samples were collected with proper aseptic precautions. After collection, blood samples were placed in BacT/ALERT 3D and Vitek 2 automated system for identification and their antibiotic sensitivity pattern.

Results: Out of 95 Central Line and Peripheral line blood samples, 30 culture were identified as blood stream infections, among them 14 have CLABSI. CLABSI rate in our study is 11 per 1000 catheter days. Coagulase negative staphylococci was the commonest organism isolated in the current study those were about 6(43%). Second most common organism was Klebsiella pneumoniae 4(29%) followed by Pseudomonas aeruginosa 3(21%) and Candida albicans 1(7%).

Conclusion: Central line blood stream infection, most commonly caused by colonization and duration of catheterization. Septicemia and multi organ failure may occur because of CLBSI.

Keywords: Central line associated blood stream infection, antimicrobial sensitivity testing.

Introduction

Central Line Associated Blood Stream Infections (CLABSI) is defined as clinical signs of infection, such as culture growth of the same bacteria from blood taken from a central line catheter or catheter tip and peripheral vein in a patient who did not have a source of infection other than the catheter.[2] Central venous catheters are used for delivery of medication and parenteral nutrition, hemodynamic monitoring and the collection of blood samples[3]. Decreasing catheter-related infection rates through regular education programs on how to properly insert a catheter, feedback and surveillance studies because some reports indicate that these strategies can reduce infection rates in the intensive care unit (ICU).[4] CLABSI is also defined as a development of blood stream infection within 48 hours of insertion of central line with laboratory-confirmed BSI (not related to an infection at another site).[5] The aims of our study were to determine the rate of central line associated blood stream infection, incidence rate and antibiotic sensitivity pattern of isolated organisms.

Materials and Methods

The study was conducted from July 2017 to August 2018 in microbiology department of Ananta Institute of Medical Science and Research center, Rajasthan, India. Inclusion criteria of this study were patients admitted in ICU aged ≥ 18 years, having sign and symptoms of septicemia after 48 hours of CVC insertion. In present study, we follow quantitative method, in which simultaneous blood sample collected through the catheter and by venipuncture. Central Line and Peripheral line blood samples were collected with proper aseptic precautions then blood sample were placed in BacT/ALERT 3D blood Culture system. Few drops from positive blood culture bottles were sub cultured on MacConkey agar, Nutrient agar and Blood agar plates and incubated overnight at 37°C.[13] After overnight incubation, culture plate were examined; identification and antimicrobial susceptibility tested by Vitek 2. Negative report of blood culture was dispatched after 7 days incubation in BacT/ ALERT system.[1]

The CLABSI rate was calculated by the following formula:[6]

$$\text{CLABSI rate per 1000 catheter days} = \frac{\text{Number of CLABSI cases } x\ 1000}{\text{No. of CVC days}}$$

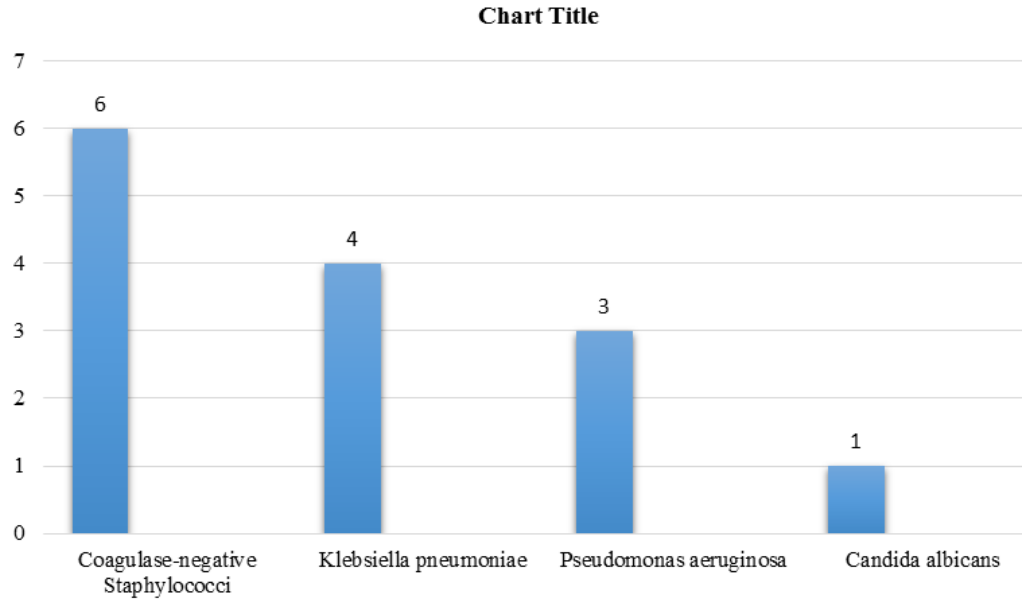
This study was approved by the hospital ethical committee

Result

Total 95 central line and peripheral blood samples were received in laboratory from patients admitted in ICU. In this study patients were selected from the age group of 18 years to 81 years who were diagnosed with sepsis after central venous catheterization. Male patients were more as compared to female.

This study shows the duration of catheter insertion ranging from 3 days to 48 days with a mean duration of 13 days with total 1256 days. There were 30 culture identified as bloodstream infection were observed from 95 blood samples. From these 30 culture positive sample, 14 were classified as CLABSI with giving a rate of 11 per 1000 catheter days. 14% incidence was found blood stream infection in central line.

Chart 1: Organisms isolated from culture positive sample.



In chart 1, Coagulase negative staphylococci was the commonest organism found isolated in the current study those were about 6(43%). Second most common organism was Klebsiella pneumoniae 4(29%) followed by Pseudomonas aeruginosa 3(21%) and Candida albicans 1(7%).

Table 1: Resistance pattern of antibiotics in gram negative bacilli isolates from CLSBI.

Antibiotic	Klebsiella pneumonia (n=4)	Pseudomonas aeruginosa (n=3)
Ampicillin	2(50%)	2(67%)
Amoxicillin-clavulanic acid	2(50%)	3(100%)
Piperacillin-Tazobactam	1(25%)	1(33%)
Cefuroxime	2(50%)	2(67%)
Cefuroxime Axetil	2(50%)	2(67%)
Ceftriaxone	2(50%)	2(67%)
Cefoperazone-sulbactam	1(25%)	2(67%)
Imipenem	2(50%)	2(67%)
Meropenem	2(50%)	1(33%)
Amikacin	1(25%)	3(100%)
Gentamicin	1(25%)	3(100%)
Nalidixic acid	3(75%)	2(67%)
Ciprofloxacin	2(50%)	3(100%)
Tigecyclin	1(25%)	2(67%)
Trimethoprime-Sulfamethoxazole	3(75%)	3(100%)
Levofloxacin	2(50%)	3(100%)

In table 1, Pseudomonas aeruginosa were 100% resistance to Amoxicillin-clavulanic acid, Amikacin, Gentamycin, Ciprofloxacin, Levofloxacin, Co trimoxazole. Whereas Klebsiella pneumoniae were 75% resistance to Nalidixic acid and Co trimoxazole.

Table 2: Resistance pattern of antibiotics in gram positive cocci isolates from CLSBI.

Antibiotics	CoNS (n=6)
Gentamicin	4(66%)
Ciprofloxacin	4(66%)
Levofloxacin	4(66%)
Trimethoprime-Sulfamethoxazole	4(66%)
Benzyl penicillin	6(100%)
Oxacillin	3(50%)
Erythromycin	4(66%)
Clindamycin	3(66%)
Linezolid	0
Teicoplanin	2(33%)
Vancomycin	0
Tetracycline	5(83%)
Rifampicin	2(33%)

In table 2, Coagulase negative staphylococcus were 100% resistance to Benzyl penicillin.

Discussion

Central line associated bloodstream infection is a serious and the most common cause of HAIs worldwide. Central line associated blood stream infection may result from health care interventions and constitutes an important cause of morbidity and mortality among ICU patients. Formation of Bacterial colonization in the catheter may be caused by many different conditions like poor hygiene, occlusive dressing, moist around the site of exit, nasal colonization and poor hygiene of hand.

According to G. Naveen et al,[10] the incidence of central associated blood stream infection was 18.6% which correlates with the result of our study had 14%.

According to National nosocomial infection surveillance system of the center for Disease Control and prevention, Atlanta, CRBSI rate is 5.8 per 1000 catheter days. Various studies carried out also reveals the findings with rate of 9.3 to 16.1 per 1000 catheter days in studies like Chopdekar et al,[3] Gahlot et al[1] and Kaur et al.[9]

Current study shows the similar result with CLABSI rate of 11 per 1000 catheter days which also favors the rate of other studies as well as the rate of national nosocomial infection surveillance system of the center for disease control and prevention with the positive predictive value of 0.147 which was very low. This low positive predictive value shows no any significant relation between duration of catheterization with CRBSI

Coagulase negative staphylococci was the commonest organism found isolated in the current study those were about 6(43%). Second most common organism was Klebsiella pneumoniae 4(29%) followed by Pseudomonas aeruginosa 3(21%) and Candida albicans 1(7%). This results correlates with the study of Gahlot et al,[1] Chopdekar et al[3] of respectively with 40%, 50% and 16% of gram positive cocci which were followed by gram negative bacilli and Candida spp. Colonization of the catheter tip by staphylococcal infection is due to migration of skin organisms at the insertion site and gram negative aerobes is because of infusate contamination and handling by health care personnel

According to study of McGee and Gould,[12] large percentage of CLABSIs can be minimized by proper application and use of full barrier precautions, aseptic skin preparation, the avoidance of femoral catheters, appropriate hand hygiene, use of antiseptic or antibiotic impregnated catheters, the removal of unnecessary catheters as early as possible, comprehensive educational programs for staff.

In Conclusion, the long duration of catheterization and colonization play important role in development of the central line blood stream infection along with various other factors which causes septicemia and multi organ failure. Prolong hospital stay of patients with catheterization leads to overburdening of the cost of treatment which can be minimized by using catheter lock solutions and application of local antibiotics. Even the deaths and morbid conditions can be reduced by regular surveillance of appropriate infection control practices. Culture results and sensitivity will also help to treat specific organism.

Conflicts of Interest: None.

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How to cite this article: Ninama A, Golia S, Bohra S, Central line blood stream infection in intensive care unit: Importance of the care bundle, *Int J Med Microbiol Trop Dis* 2019;5(1):1-3