Catheter related bloodstream infections in a Tertiary Care hospital

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ABSTRACT

Central-venous-catheter-related blood stream infections (CRBSIs) are an important cause of hospital-acquired infection associated with morbidity, mortality. In modern medicine, the use of temporary intravascular catheters for vascular access and hemodynamic monitoring has become a central part in treating the patients. Central venous catheters (CVC) have significant benefits in many clinical situations but the major consequence of CVC is colonization of the catheter by either bacteria or fungi, which can lead to catheter related infection (CRI) and serious catheter related blood stream infection (CRBSI). Central venous catheter-related blood stream infections remain a major cause of nosocomial infections leading to significant patient morbidity, mortality and hospital costs. Recovery of the patient's condition depends on underlying pre-morbid conditions, associated micro organisms, and appropriate treatment. On this background this study was done in the Institute of Microbiology, Madras Medical College, Chennai for a period of one year from September 2011 to August 2012.

Materials and Methods: A total number of 150 inpatients between the age group of 18-65 who are admitted for Hemodialysis in Nephrology ward were taken for the study. Peripheral Blood, Catheter tip, were processed according to standard microbiological techniques . The risk factors associated in developing Central venous catheter related bloodstream infections (CRBSIs) were observed.

Results: A total of 23.3 % of Catheter related infection with positive blood culture was observed. 20.8 % of the infection was noted from patients with Internal Jugular vein. 6.6% of the infection was noted from patients with Subclavian vein and Femoral vein. CRBSI was noted most commonly in the age group of 51-60 years (33.3%) followed by 27.4% between 21-30 yrs

KEYWORDS: Catheter related bloodstream infections, Central-venous-catheter, Poly microbial infection, Immunosuppression.

INTRODUCTION: CRBSI have increased in incidence during the past few decades. More than three fourth of the nosocomial bacteremias occurring in case clusters are primary bacteremias and the case fatality rate of CRBSI has been estimated about 10-20% and more than 90% of CRBSI are associated with CVC[[1,2],

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Catheter-related bloodstream infection (CRBSI) is defined as the presence of bacteremia originating from an intravenous catheter. Central venous catheters (CVCs) pose a greater risk of device-related infections than any other types of medical device and are major causes of morbidity and mortality[3,4] . They are also the main source of bacteremia and septicemia in hospitalized patients. Majority of CRBSIs are associated with CVCs and in prospective studies, the relative risk for CRBSI is up to 64 times greater with CVCs than with peripheral venous catheters. CRBSI incidence was 2.1 per 1000 catheter days for respiratory Intensive Care Units, 5.1 for medical-surgical ICUs, 5.8 for trauma ICUs, 30.2 for burn units[4,5]. Potential risk factors for CRBSI include underlying disease, method of catheter insertion, proper aseptic procedures, site of catheter insertion and duration, immune status of the patient, and purpose of catheterization. Enhanced susceptibility secondary to the alterations in the immune response induced by uremic state play a major role in determining the type, incidence and outcome of infectious complications[4,7]

Local risk factors, such as poor personal hygiene, occlusive transparent dressing, moisture around the exit site, *S. aureus* nasal colonization, and contiguous infections support the role of bacterial colonization in the pathogenesis of CRBSI. Colonization of the tip of the intravenous catheter is often observed in the ICU practice and can be the source of dangerous bacteremia (CRBSI) and sepsis with multi-organ failure[8,14-16]

DATA COLLECTION

Data collection included name, age, address, date of admission, diagnosis at admission, physical examination finding. Duration of hospital stay, nutritional status, underlying illness like diabetes mellitus, uremia, hypertension, history of previous infections, type of catheter, duration of catheterization and concurrent other infections were recorded.

MATERIALS:

Catheter tip, Peripheral venous blood

Sample collection and Processing:

The samples were collected and processed following the Standard Microbiological techniques

Gram Staining of Impression Smear of Catheter Tip[4,5].

A shallow narrow line of sterile saline solution was made along centre of long axis of glass slide with pasteur pipette. The catheter was removed from transport container by inserting microbiological straight wire into lumen. The external surface of catheter segment was rotated on the spot in line of saline solution by rotating handle of straight wire between index finger and thumb and attempting to keep the saline solution as

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narrow as possible. A zigzag manner along the long axis of slide was also used to dislodge as much as material as possible from outside of catheter. Slides were air dried, heat fixed and stained by Gram Stain method and examined by conventional light microscopy under oil immersion.

Semi quantitative Culture of Catheter [4]

Roll plate method [6]

Catheter related blood stream infection:

The isolation of the same organism from a quantitative culture of the distal segment of the catheter and from the blood of a patient with clinical symptoms of sepsis in the absence of any other noticeable source of infection.

BLOOD FROM PERIPHERAL VEIN

1. Qualitative Culture of Peripheral Blood [7,8]

The site for venipuncture identified and tourniquet was applied. The skin was prepared exclusively with 70 % isopropyl alcohol then swabbed concentrically and 11 ml blood was collected using a sterile disposable syringe and needle.

10 ml was added aseptically into brain heart infusion broth (BHI) and The remaining 1 ml of blood was used for quantitative culture. After collection the ratio of blood to medium should be 1:10. The contents are mixed well for uniform distribution. The BHI broth was incubated at 37°C aerobically and examined daily for a period of ten days. If turbidity, or haemolysis was observed in the bottle, subcultures were done into Blood Agar, MacConkey Agar .The plates were incubated at 37°C aerobically for 48 hrs and observed for growth.

Quantitative Culture of Peripheral venous Blood[7,8,9-14]

One ml of sterile blood which was collected aseptically was added to 9cms sterile petridish which contains l9ml of previously melted Nutrient agar base at 46°C. The plates were rotated to distribute blood uniformly and left to solidify before incubating it aerobically at 37° C for

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48 hours. Once colonies were seen, they were counted accordingly and when the count was greater than 100cfu/ml it was considered significant.

Results:

A total of 23.3 % of Catheter related infection with positive blood culture was observed. 20.8 % of the infection was noted from patients with Internal Jugular vein. 6.6% of the infection was noted from patients with Subclavian vein and Femoral vein.

CRBSI was noted most commonly in the age group of 51-60 years (33.3%) followed by 27.4% between 21-30 yrs.(Table 1) The commonest site of central venous catheterization was the internal jugular vein. CRBSI was detected in 20.8% of these catheters. Femoral venous catheterization was done in very few patients and they have the higher risk of developing CRBSI. (Table 2) The frequency of CRBSI was 51.4% in patients with catheter in place for >15 days followed by 34.3% when the duration was between11-15 days(Table 3).

Among the 35 cases of CRBSI predominant risk factor observed was diabetes mellitus 94.2%,followed by anaemia 91.4% (Table 4). Among the 35 cases of CRBSI, 11.4% developed hypotension and 5.7% septic thrombophlebitis. Mortality was seen in 2.8% cases. (Table 5). Among the total of 6 cases of polymicrobial growth, *Staphylococcus aureus* and *Candida* species was isolated in 11.4% followed by *Staphylococcus aureus* and *Klebsiella oxytoca* in 5.7%.(Table 6).

TABLE 1: CORRELATION OF CRBSI WITH AGE

Age in years	No.of Cases	Positive cultures	Percentage of positive culture
18-20	6	1	16.6
21-30	51	14	27.4
31-40	30	6	20.0
41-50	40	7	17.5
51-60	15	5	33.3
>60	8	2	25.0

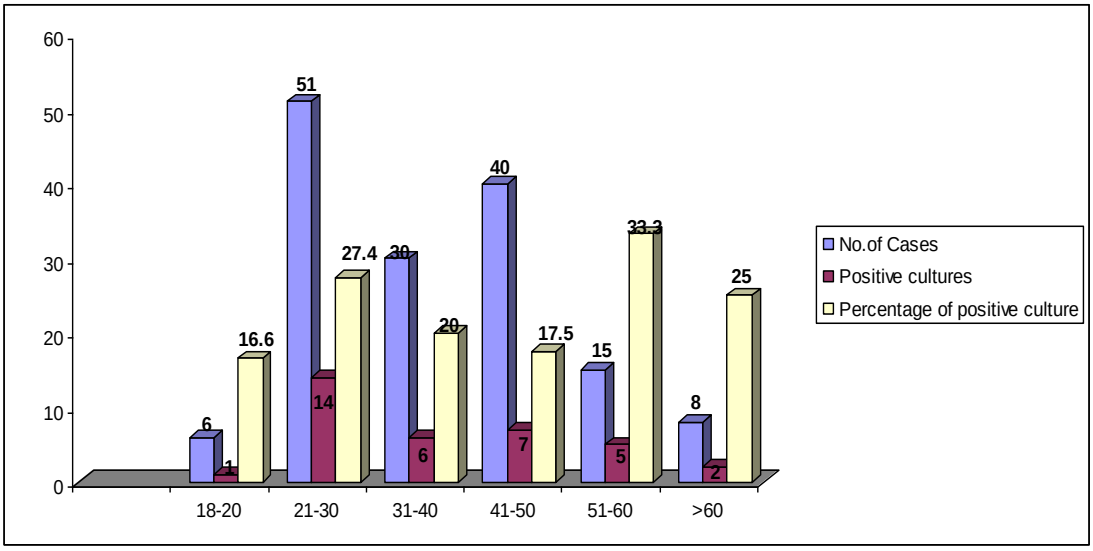
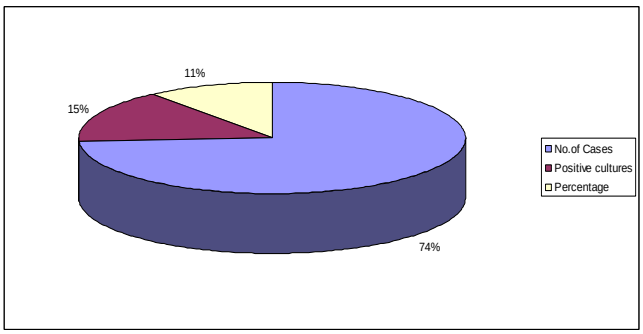


TABLE 2: ASSOCIATION BETWEEN SITE OF CATHETERIZATION AND CRBSI

Site	No.of Cases	Positive cultures	Percentage
Internal Jugular vein	144	30	20.8
Subclavian vein	3	2	6.6
Femoral vein	3	2	6.6



Double lumen catheter in situ

DOUBLE LUMEN CENTRAL VENOUS CATHETER

TABLE 3: ASSOCIATION BETWEEN DURATION OF CATHETERIZATION AND CRBSI

Duration of Catheterization	NO	Percentage
1-5 days	1	2.8
6-10 days	4	11.4
11-15 days	12	34.3
>15 days	18	51.4

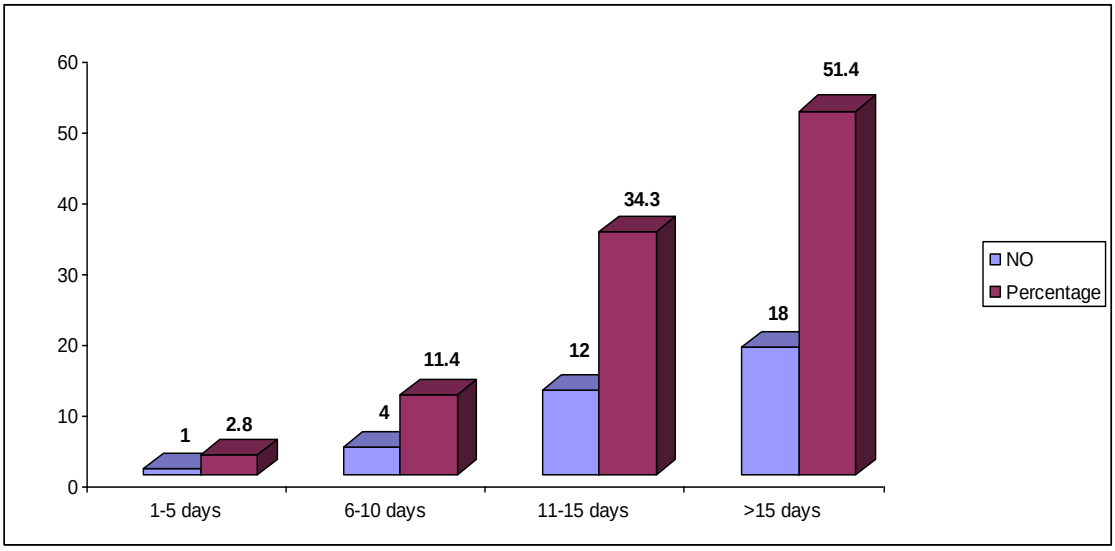


TABLE 4: RISK FACTORS FOR CRBSI

Diagnosis	No of cases	Percentage
History of infection in previous dialysis	28	80.0
Anaemia	32	91.4
Diabetes Mellitus	33	94.2
Hypertension	11	31.4

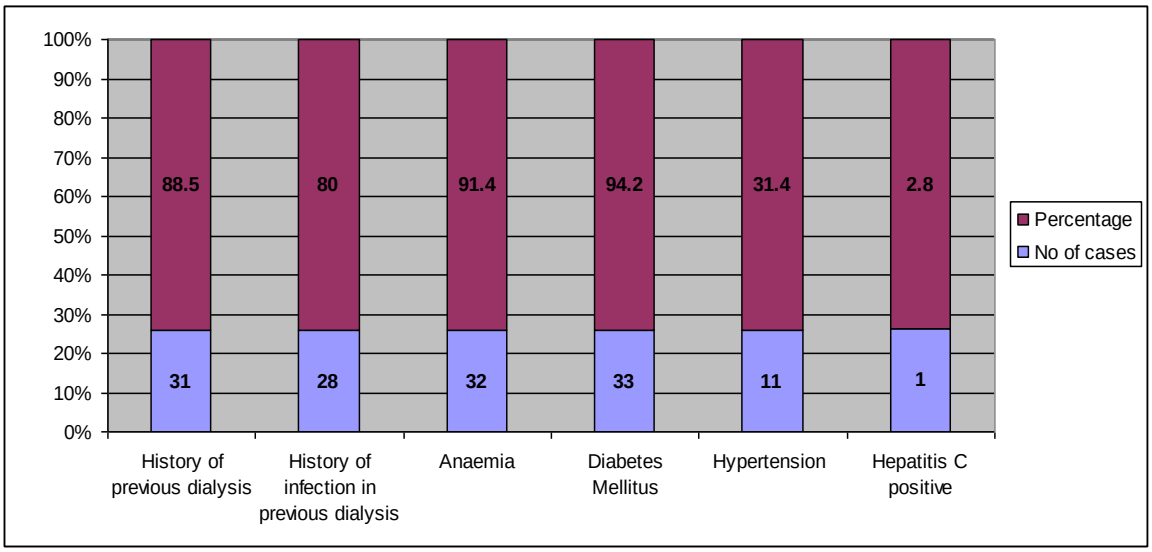


TABLE 5 : CORRELATION OF CRBSI AND DEVELOPMENT OF COMPLICATIONS

Complication	No.of Cases	Percentage
Hypotension	4	11.4%
Septic Thrombophlebitis	2	5.7 %
Death	1	2.8 %

TABLE 6: TYPE OF POLY MICROBIAL INFECTION IN CRBSI (n=35)

Mixed Growth	Catheter
Staphylococcus aureus + Candida albicans	4 (11.4%)
Staphylococcus aureus + Klebsiella oxytoca	2 (5.7%)

Conclusion:

The diagnosis of CRBSI is often suspected clinically in a patient using a CVC who presents with fever or chills, unexplained hypotension, and no other localizing sign.[14,16] Risk of Catheter Related Blood Stream Infection can be greatly reduced by strict aseptic technique. Routine hand washing should be practiced. Changing of catheters with sterile precaution is mandatory. Health education and periodic training of health care

workers regarding CRBSI to be done. Appropriate antibiotic therapy to prevent drug resistance is one of the important therapeutic approach in prevention of CRBSI. Institution level continuous quality improvement programs, education, and training of health care workers, and adherence to standardized protocols for insertion and maintenance of intravascular catheters will significantly reduced the incidence of catheter-related infections and represent the most important preventive measures.

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