STUDY OF CENTRAL VENOUS CATHETER RELATED BLOOD STREAM INFECTIONS IN PATIENTS ON HAEMODIALYSIS

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ABSTRACT

BACKGROUND

Temporary and permanent central venous catheters are used in majority of patients of CKD when initiated on hemodialysis and mostly these catheters act as bridge before permanent AV fistula assess could be obtained. Blood stream infections related to these central venous catheters are an important cause of morbidity and mortality in these patients. Appropriate antiseptic precautions while inserting central venous catheter and early identification of catheter related blood stream infections (CRBSI) are of utmost importance for reducing hospital stay, cost of therapy and mortality.

MATERIALS AND METHODS

A total of 50 patients of CKD were included in the study who had central venous catheter in situ (internal jugular or subclavian) and developed symptoms related to blood stream infections. Blood cultures were obtained from the catheter lumen and a separate venous site 1 hour apart. All the culture sensitivity reports were obtained from department of microbiology of our institute.

Inclusion Criteria- Known case of CKD patients aged more than 18yrs on hemodialysis with symptoms and signs of catheter related blood stream infections were included in the study.

Exclusion Criteria- Patients with other associated comorbid infections like Koch's, urinary tract infection or others mimicking symptoms of CRBSI.

RESULTS

The cultures were found positive in 38 patients (76%) while in rest 24% cases positive cultures could not be obtained. Out of culture positive patients 52.63% cases were found to have gram positive infections while 44.74% had gram negative infections. In 2.63% patients, fungus was isolated to be the causative organism. Among the gram positive organisms 50% had CoNS, 30% had MSSA and 20% had MRSA infections. Among the gram negative group, 47.06% had klebsiella, 23.53% had acinetobacter, 17.65% had E.coli and 11.76% had pseudomonas as the causative organisms. Mortality was observed in 14% patients out of which 28.57% were culture negative and the rest culture positive. No mortality was observed in patients with gram positive cultures and E.Coli infections. Mortality in culture positive group was predominantly in klebsiella (40%), Acinetobacter (40%) and pseudomonas (20%)

CONCLUSION

CRBSI related bacteremia and sepsis pose a major cause of morbidity and mortality among CKD patients and also increase the cost of therapy and financial burden of healthcare. Simple handwashing techniques, proper handling of CVCs during dialysis, antiseptic and antibiotic locking of catheters remain gold standard to reduce CRBSIs. CRBSIs are certainly not inevitable completely but preventable to a significant extent.

KEYWORDS

Central Venous Catheter, Bacteremia, Infections, Hemodialysis, Cultures.

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BACKGROUND

Infection is probably the most important cause of morbidity and mortality in patients on haemodialysis. Haemodialysis patients with a catheter have 3-fold more risk of hospitalization for infection and death compared with patients with an arteriovenous fistula or graft.[1] Central venous catheters are an inevitable part of care of CKD patients on haemodialysis and the provide venous access till the patient gets a permanent AV fistula. Catheter-related bloodstream infections (CRBSIs), are common complications

related to haemodialysis central venous catheter use. Catheter-related bloodstream infections alone have a reported incidence of 1.1 to 5.5 episodes per 1000 catheter days and are associated with increased morbidity, hospitalization, and death.[2-5] The most common causative pathogens are gram positive bacteria, with Staphylococcus aureus and coagulase-negative staphylococci accounting for 40% to 80% of CRBSIs.[6] Gram-negative organisms cause 20% to 40% CRBSIs, whereas polymicrobial infections (10%-20%) and fungal infections (<5%) are less common. The elderly and diabetics are less likely to have functional native AV fistula at the time of initiation of haemodialysis which puts this high risk group more likely to have prolonged catheter usage.[6-8] The risk of bacteraemia increases exponentially with duration of the catheter use.[9] It is also reflected in the increase in mortality by upto 50%.[10] Proper aseptic and antiseptic precautions with insertion of central venous catheter along with proper care, dressing and antiseptic locking of catheters and proper hand washing before handling central venous catheters help increasing the life of catheters and reducing the incidence of CRBSIs. There have been significant efforts made over the past 25 years to reduce the number of bloodstream infections that are caused by use of haemodialysis central venous catheters (CVCs) in patients with end-stage renal disease. These efforts include the Centers for Medicare & Medicaid Services Fistula First initiative.[11] Centers for Disease Control and Prevention (CDC) guidelines including Scrub-the- Hub protocol.[12] education and training of health care personnel.[3] and using antimicrobial locks.[13-18] Despite these efforts, the use of CVCs for HD continues to be a leading contributor to higher rates of BSI, hospitalization, morbidity, and mortality, as well as increased health care costs.[19,20]

Aims and Objectives

1. To study the incidence, causative organisms and mortality of central venous catheter associated blood stream infections in patients of CKD on hemodialysis.
2. To study the incidence of central venous catheter associated blood stream infections among patients of CKD on HD.
3. To study the causative organisms of CRBSIs.
4. To study the mortality pattern among patients of CKD who develop CRBSIs.

MATERIALS AND METHODS

A total of 50 cases of CKD on HD were included in this study who were undergoing routine haemodialysis in Rama Medical college hospital in past three years and developed symptoms and signs of central venous catheter related blood stream infections at some point of time. The symptoms varied from development of chills and rigors during dialysis, sudden onset on high spikes of fever, rising TLC count ranging upto developing hypotension, septicaemic shock and rapidly deteriorating renal functions. All the patients with any other identifiable cause of sepsis or fever like urinary tract infections, respiratory tract infections etc were excluded from study. Blood culture samples were taken from the catheter lumen and peripheral venous site and sent to department of microbiology of this institute. Patients who had same organism grown from both the sites were considered culture positive CRBSI. Patients were classified according to sex, age, time from the day of insertion of CVC, causative organisms and mortality. Data was entered on a excel spread sheet and statistical analysis was done by Microsoft excel.

Inclusion Criteria

1. Cases of CKD(>18 yrs) on HD with central venous catheter in situ.
2. Patients with evidence of catheter related infection of blood stream with no other identifiable cause.

Exclusion Criteria

1. Patients with evidence of infection at some other site like urinary tract, respiratory tract etc.
2. Patients who succumbed to sepsis before the culture reports were back.

Observations

Age	Number of Patients
18-40 years	16
41-60 years	25
61-80 years	9

Table 1. Age Distribution of Total Number of Cases

Sex	Number of Patients
Female	26
Male	24

Table 2. Sex distribution of total number of cases

Culture report	Number of Patients
Culture positive	38
Culture negative	12

Table 3. Distribution of Cases According to Culture Positivity

	Number of Patients
Gram positive cocci	20
Gram negative bacilli	17
Fungal	1

Table 4. Classification of Cases According to Causative Organism

	No. of Patients
Coagulase negative staphylococcus	10
MSSA	6
MRSA	4

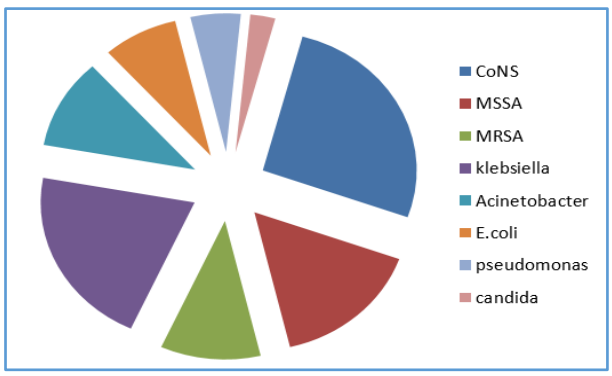
Table 5. Distribution of Gram Positive Infections

	Number of Patients
Klebsiella	8
Acinetobacter	4
E.coli	3
Pseudomonas	2

Table 6. Distribution of Gram Negative Infections

	Number of Patients
Carbapenem resistant	5
Carbapenem sensitive	12

Table 7. Classification of Gram Negative Infections according to Sensitivity



Graph 1. Graphical Representation of Causative Organisms of CRBSIS

Outcome	Number of Patients
Patients improved	43
Patients died	7

Table 8. Classification according to Outcome

Culture Report	Number of Patients
Culture negative	2
Klebsiella	2
Acinetobacter	2
Pseudomonas	1
Gram positive cocci	None

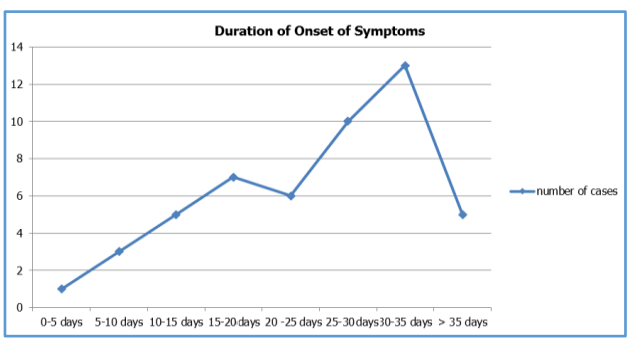
Table 9. Classification of Mortality according to Cause

	Number of Patients
MRSA	None
Carbapenem sensitive	1
Carbapenem resistant	4

Table 10. Classification of Mortality According to Drug Resistance Pattern

Days from Insertion of CVC	Number of Patients
0-5	1
6-10	3
11-15	5
16-20	7
21-25	6
25-30	10
31-35	13
>35	5

Table 11. Patients Developing Symptoms of CRBSI from the day of CVC Insertion



Graph 2. Graphical Representation of day of onset of Symptoms of CRBSI

RESULTS

Fifty patients of chronic kidney disease on haemodialysis were included in the study who had central venous catheter in situ and developed symptoms and signs of catheter related blood stream infection at some point of time. All the central lines were used for venous access for haemodialysis acting as a bridge upto the construction and usage of permanent AV fistula Around 198 patients were inserted central venous catheter during this three year interval which gives around 25.2% incidence of CRBSIs in our centre. The mean age of the patients enrolled in the study was 47.2 yrs. The incidence of CRBSI was observed to increase with time of catheter usage however there was a steady decrease after 35 days. However it is a routine practice in our centre to remove/change CVCs after 6 weeks of usage. 46% of CRBSI was observed between 25-35 days of CVC insertion. 26% cases alone were observed between 30-35 days of CVC insertion. No significant difference in incidence of CRBSI was observed as per sex.

The cultures were found positive in 38 patients (76%) while in rest 24% cases positive cultures could not be obtained. Out of culture positive patients 52.63% cases were found to have gram positive infections while 44.74% had gram negative infections. In 2.63% patients, fungus was isolated to be the causative organism. Among the gram positive organisms 50% had CoNS, 30% had MSSA and 20% had MRSA infections. Among the gram negative group, 47.06% had klebsiella, 23.53% had acinetobacter, 17.65% had E.coli and 11.76% had pseudomonas as the causative organisms.

Mortality was observed in 14% patients out of which 28.57% were culture negative and the rest culture positive. No mortality was observed in patients with gram positive cultures and E.coli infections. Mortality in culture positive group was predominantly in klebsiella (40%), Acinetobacter (40%) and pseudomonas (20%). Out of 14% mortality which was observed, 80% patients were found to be having gram negative organism resistant to carbapenems while the rest 20% were sensitive to carbapenems. Mortality was found to be higher in aged and immunosuppressed individuals. The mean age of the patients who died was 65.28yrs compared to 47.20 yrs. There was no significant difference observed in mortality according to sex.

DISCUSSION

Central venous catheters remain an inevitable part of care of CKD on HD waiting for a permanent AV fistula. Infections of the blood stream leading to bacteremia and sepsis remains an important cause of morbidity and mortality in this subset of patients. Our study reveals around 25.2 % incidence of CRBSI which is slightly higher than other related studies.[21,22]

Gram positive organisms remain the most common organisms causing CRBSIs in our study (52.63%) out of which 50% were CoNS. These finding are in accordance with the findings of similar studies done in past in different demographic locations. The incidence of CoNS which is a normal skin commensal again underlines the importance of

proper hand washing techniques before handling central venous catheters and requirement of proper scrubbing antiseptic precautions in preventing CRBSI. Nasal carriers of *S.* aureus are predisposed to CRBSI as it gets disseminated to catheter site though hands.[23-25] The rate of nasal carriage of S.aureus varies from 11-60%.

Gram negative organisms follow next followed by fungal infections which account for less than 5% of all infections. These findings are also in accordance with other studies.[26-30] Klebsiella remains the most gram negative infection causing CRBSI in our study followed by acinetobacter and pseudomonas being least common. Increasing incidence of gram negative infections are being reported from different studies which might be because of increased patient exposure to antibiotics, infected infuscate and immunosuppressed state of patients.[31-35]

Duration of usage of central venous catheters also play a key role in incidence of CRBSIs. Prolonged usage of catheters predispose to increased chances of infections. Earlier CRBSIs occurring within a week of insertion of CVC indicate inappropriate antiseptic precautions and mishandling of CVCs at the time of insertion which accounted for less than 5% of all CRBSIs in our study. The maximum incidence was observed between 25-35 days of insertion of line accounting for around 50% of all cases. However surprisingly there was a decrease in incidence between 35 to 42 days period without any significant explanation. Proper handling of CVCs, proper hand washing and antiseptic locking of cannulas remain critical in increasing the life of CVCs and thus reducing the cost of healthcare.

While analyzing mortality, gram positive infections were not found to cause any mortality. All the mortalities were observed in gram negative infections with 40% cases due to klebsiella and 40% due to acinetobacter while 20% due to pseudomonas. However if different etiological agents are taken separately, cases with klebsiella had 25% mortality and with acinetobacter had 50% mortality. Klebsiella seems to be the most common and acinetobacter the most lethal gram negative infection. Higher age, immunosuppression and carbapenem resistance also seem to be significant factors involved with increased mortality. Inadvertent use of antibiotics leading to increased multi drug resistance and rise ESBL and carbapenemases pose a great threat to future of health care.

CONCLUSION

With no evident alternative to central venous catheters at present, we don't have much choice but to depend on temporary and permanent CVCs for initiating and maintaining hemodialysis in patients of CKD. But at the same time they become a constant source of infection leading to bacteremia and sepsis which pose a major cause of morbidity and mortality among CKD patients and also increase the cost of therapy and financial burden of healthcare. Simple hand washing techniques, proper handling of CVCs during dialysis, antiseptic and antibiotic locking of catheters remain gold standard to reduce CRBSIs. CRBSIs are certainly not inevitable completely but preventable to a significant extent.

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