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# Clinical profile of hemodialysis catheter related bloodstream infections

**Short title:** ***Clinical profile of hemodialysis catheter infections***

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***Abstract***

***Introduction: Catheter-related bloodstream infection (CRBSI) is a critical problem in dialysis center.***

***Aim: To study the prevalence of central venous catheter related blood stream infections and to identify the microbiological profile of organisms causing CRBSI.***

***Materials and Methods: This prospective observational study carried out at Dialysis unit over a period of two years on 145 hemodialysis patients, who had cultures of catheter and blood samples were studied.***

***Results: A total of 557 haemodialysis catheters (tunnelled and non-tunnelled) were inserted during the study period, and among them, CRBSIs was seen in 145 cases.Mean duration of dialysis catheters in situ was 20.6days.99 (68.2%) patients were males, and 46 (31.7%) were females. Diabetes mellitus (76.5 %) was the most common premorbid illness associated with CRBSI. 81.3% patients found to be below 10 mg/dl of Hb, and 68.3%patients had leucocytosis. Among 145 of CRBSI, blood cultures were positive in 48 patients, and 97 patients were culture negative.45.8% isolates were gram-positive and 52.8% isolates were gram-negative bacteria, and one isolate was found to be fungal infection.Among gram positive, CONS were most isolated, followed by Enterococcus, MSSA and MRSA. Among gram negative isolates, Acinetobacter were isolated in 5, Pseudomonas in 4, Klebsiella in 4,Citrobacter in 4, E. Coli in 3, Burkhel dorrhoea in 3 and Serratia in 2 cases respectively.The most sensitive routine antibiotic for P.aerusinosa***

***isolated from CRBSI was piperacillin and ciprofloxacin(100%sensitive each). Among the reserved antibiotic, the most sensitive were cefepime (75%), cefoperazone-sulbactum, piperacillin-tazobactam and meropenem (100%) sensitive each. There was no routine antibiotic sensitive for E.coli isolated from CRBSI and three were ESBL producers and among reserved antibiotic meropenem was most sensitive.***

***Conclusion: The knowledge of incidence of CRBSI and the microbiological spectra will be useful in formulating bundles of care and effective programs to control hospital acquired infections.***

***Keywords: Catheter related blood stream infections, hemodialysis, Diabetes mellitus, Enterococcus.***

## 1. INTRODUCTION

Blood stream infections account for 14% of the hospital acquired infections and among them, Central venous catheters (CVCs) are the most common cause[1]. The incidence of Catheter related blood stream infections (CRBSI) varies between ICUs due to differences in type of catheter used, insertion and utilization techniques, frequency of catheter manipulations and the patient cohort.

A substantial percentage of patients resort to temporary as well as permanent central venous catheters for vascular access during initiation of hemodialysis in ESRDpatients[2].

The prevalence of CRBSI varies considerably by type of catheter, frequency ofcatheter manipulation, and patient-related factors (underlying comorbidities)[3,4].

There is compelling evidence that a significant effort is warranted to implement strategies to reduce the incidence of these infections, which must be multidisciplinary, involving healthcare professionals who insert and maintain intravascular catheters, health care workers who assign resources, and patients who are competent of assisting in the care of their catheters[5,6].

According to Parameswaran et al. (2011), the incidence of CRBSI was 8.75 per 1,000 catheterdays[7]. In general, uncuffed catheters have a higher rate of infection, 3.8 to 6.6 episodes/1,000 days, compared with cuffed catheters, which vary from 1.6 to 5.5 episodes/1,000 days. Among uncuffed short-term catheters, femoral catheters have the highest infection rate, averaging 7.6 episodes/1,000 days, with more than 10% being infected by one week[8-11]. According to international guidelines, delay in referral of patients in stage 4 of chronic kidney disease (pre-dialysis) to nephrologist and implantation of arteriovenous fistula or graft result in catheter insertion for urgent hemodialysis and increased risk of subsequent complications. Decreased mortality due to infection may be achieved by appropriate choice of antibiotics and avoiding catheter salvage attempts[12].

Sufficient data about microorganisms and their susceptibility to antibiotics in hemodialysis patients is necessary for handling of CRBSI; therefore, this study performed for better management of patients.

This study was aimed to analyse the clinical and microbiological profiles of patients developing hemodialysis catheter-related local and systemic infections, including their predisposing factors and the treatment provided.

## 2. MATERIALS AND METHOD

Study period: 2 years.

Inclusion criteria are all patients with hemodialysis catheter in situ (Temporary orPermacath), and placement of hemodialysis catheter in situ for ≥48hrs.

Exclusion criteria are patients with bloodstream infections from other source prior to insertion of hemodialysis catheter (community/hospital-acquired infections).

**NKF KDOQI definitions:**

Definite**:**

The same organism from a semi-quantitative culture of the catheter tip (>15 colonies forming unit-CFU/catheter segment) and from blood culture (BC) in an asymptomatic patient with no other apparent source of infection.

Probable**:**

Defervescence of symptoms after antibiotic therapy with or without removal of the catheter, in the setting in which BC confirms infection, but catheter tip does not (or catheter tip does, but blood does not) in an asymptomatic patient with no other apparent source of infection.

Possible:

Defervescence of symptoms after antibiotic treatment or after removal of a catheter in the absence of laboratory confirmation of bloodstream infection in an asymptomatic patient with no other apparent source of infection.

Catheter tip processing: Extraluminal Maki's rollover plate method and endoluminal catheter flush culture were used forprocessing.

Extraluminal Maki's rollover platemethod: Using sterile forceps, the catheter tip is removed from the transport tube and kept on a blood agarplate. The tip is rolled back and forth across the surface of a blood agar plate using sterile forceps and exerting slight downward pressure.

Endoluminal catheter flush culture: Catheter lumen is flushed into a sterile vial with 1 ml of normal saline using a sterile syringe, of which 0.01 ml is streaked upon the culture media using a 4 mm inoculating loop.

The same volume of sample is also streaked upon blood agar and MacConkey agar and incubated at 37ºC in CO2 (performed only for quantification).

Identification of organisms: Colony morphology reading, gram staining, biochemical identification, and subculture of the organism isolated from the Maki’s roll plate were performed by routine laboratorytechniques.

Growth upon triple sugar iron agar and mannitol motility test agar and methyl red/Voges Proskauer, indole/H2S detection, citrate utilization, and urease tests were completed for identification of gram-negative bacteria. Catalase and coagulase tests were performed to identify gram-positive cocci.

Antibiotic sensitivity patterns were identified using the Kirby-Bauer disk diffusion method as recommended by the Clinical Laboratory Standards Institute (CLSI).

Screening for methicillin-resistant Staphylococcus aureus (MRSA) was performed using oxacillin (1 μg) disk on Mueller Hintonagar.

Screening for extended-spectrum beta-lactamases (ESBL) was by double disc approximation or double disk synergy using amoxicillin-clavulanic acid (20/10μg) and ceftriaxone (30 μg)

at a distance of 30 mm between the centres of the two disks. American type culture collections (ATCC) were used as controlstrains.

Multidrug resistance was defined as resistance to at least three of the four following groups: (1) Imipenem or Meropenem; (2) Cefepime or Ceftazidime; (3) Piperacillin, Piperacillin–tazobactam or Ticarcillin–clavulanic acid; and (4) Ciprofloxacin or levofloxacin.

Interpretation: Agar plates were examined at 24 hours, 48hours, and 72hours.

Significant growth was defined as ≥ 15 colony forming units (CFU) by Maki's roll plate method or ≥ 100 CFU/ml by the catheter flush method.

Salvageable catheters included those which were either retained or exchanged over a guidewire under strict asepticprecautions.

Catheters removed within three days of clinical recognition of bacteremia are considered to be removed, beyond which they are considered to have had attemptedsalvage. All CRBSI received empirical antibiotics covering both gram-positive and gram-negativeorganisms.Specific antibiotic therapy was continued later after obtaining culture reports.

Statistics: Data was tested using IBM SPSS statistical software version 22.0 for Windows (SPSS Incorporation, Chicago, Illinois, USA) with many continuous and categorical variables. The Mean value ± SD for the description of the continuous variables, Frequencies and Percentages for the description of the categorical variables were used. Chi-Square Test chisquare is used to test and compare the categorical variables.

## 3. Results

A total of 557 haemodialysis catheters (tunnelled and non-tunnelled) were inserted during the study period, and among them, CRBSIs was seen in 145 cases.Among cases, Definitive CRBSI were 14 cases, probable CRBSIs were 34 cases, and 97 cases were possible CRBSIs The average duration of dialysis catheters in situ was 20.6days.

CRBSI per 1000 catheterdays:

For a total of cases (definitive &probable and possible):12.5

For cases of definitive CRBSI:1.21

For cases of probable CRBSIs: 2.95

For remaining cases of possible CRBSIs: 8.42

Demographics**:** 3 (2.06%) patients were in the age group of < 20years,5(3.44%) patients were in age21-30years,20(13.7%) patients were in the age group of 31-40years,47 (32.4%) patients were in the age group of 41-50years,45 (31.03%) patients were in the age group of 51 – 60 yearsand25(17.2%) patients were above 60years. Out of 145 patients tested positive, 99 (68.2%) patients were males, and 46 (31.7%) were females.

Symptomatology and pre-morbidillness: The most common symptoms observed in the study population were fever 116 (80 %), chills 71 (48.9 %), myalgia 31 (21.3%), vomiting 13 (8.9 %)& followed by erythema at exit site 10 (6.8 %). Premorbid illnesses found to be associated inpatients with CRBSI were, Diabetes Mellitus, Hypertension, CKD, Cardiac, cirrhosis &malignancy.

Out of these, Diabetes mellitus (n=111&76.5 %) was the most common premorbid illness associated with CRBSI. 12 patients were found to be cirrhosis&four patients had malignancy.

In our study, among the entire study population, 32(22 %) and 22 (15.1%) were smokers and alcoholics, respectively.

Laboratory data: Haemoglobin was found to be below 10 mg/dl in 118 (81.3 %) patients. Of these 118 patients, with a documented minimum haemoglobin of 4.2 mg/dl.

99 (68.3 %) patients had Leucocytosis. The maximum and minimum leucocyte count observed was 37000(worthwhile mentioning is that this patient had severe infection with sepsis) and 1900 respectively.Among the 17 patients with thrombocytopenia (< 150000), 8 patients had chronic liver disease. Among the entire study population, the minimum platelet count was found to be 46000, and this patient had CLD with HBSAg+ve.

Serum bilirubin was raised in 9 (6 %) patients with a maximum bilirubin value of 8.4 mg/dl.ALT and AST were elevated more than twice the normal limit in 6 (4.13%) patients, 5 (3.4 %) patients, respectively. The maximum AST was 174 IU/L. Maximum ALT was 169IU/L. The maximum ALP was 440 IU/L.

Hyponatremia was present in 11 (7.5%) patients, while hypernatremia was noted in 3 patients (2.06%).The majority of individuals (83%) had normal serum potassium levels.

Hypokalemia was evident in 16 (11%) of patients and hyperkalemia was there in 9 patients (6%).

Blood Culture: Among a total of 145 patients who had CRBSI, blood cultures were positive in 48 patients, and 97 patients were culture negative.

Table 1: Catheter Profile

| Variables | Catheters (Percentage) | Catheter days | Infection rate (per 1000 catheter-days) |
|---|---|---|---|
| Total | 557 | 11520 | nil |
| CRBSI cases:<br>Total Definitive<br>Probable<br>Possible | 145 (26.03%)<br>14 (2.5%)<br>34 (6.1%)<br>97 (17.4%) | 2998 | 12.5<br>1.21<br>2.95<br>8.42 |

Infection rate = Number of episodes / Total catheter days of all catheters (days between insertion and removal) x 1000.

77.2 % (n=112) of CRBSI cases have right IJV catheters, followed by 13.7 % left IJV & 8.9% femoral catheters.Among a total of 145 patients, 6 patient's had cuffed catheters and rest 139 had non- cuffed catheters.Out of a total of 145 patients, triple lumen catheter was used in 20 patients, and double-lumen catheter was used in 125 patients.Hemodialysis was carried twice weekly in 119 patients and thrice-weekly in 26 patients.

TYPE OFORGANISM:

45.8 %(n = 22) of the isolates were gram-positive bacteria and 52.8 %(n = 25) of the isolates were gram-negative bacteria.Only one isolate was found to be a fungal infection.

In gram positive, total of 48 patients had blood cultures positive. Gram-Positive organisms

were reported in 22 patients. Among which CONS were most isolated, followed by ENTEROCOCCUS, MSSA and MRSA.

In gram negative, total 48 patients had blood cultures positive. Gram-Negative organisms were reported in 25 patients.Among which, Acinetobacter were isolated in 5; Pseudomonas in 4; Klebsiella in 4; Citrobacter in 4; E Coli in 3; Burkhel dorrhoea in 3 and Serratia in 2.

Table 2 : Antibiotic sensitivity pattern of gram-positive organisms

| Antibiotics | | MSCONS (N = 6) | MRCONS (N = 2) | MSSA (N =5) | MRSA (N = 2) | ENTEROCO CCUS (N=7) |
|---|---|---|---|---|---|---|
| Amoxicillin | Sensitive | 0 (0%) | 0 (0%) | 3 (60%) | 0 (0%) | 0 (0%) |
| | Resistant | 6 (100%) | 2 (100%) | 2 (40%) | 2 (100%) | 7 (100%) |
| Amoxicillin + Clavulanic Acid | Sensitive | 6 (100%) | 0 (0%) | 5 (100%) | 0 (0%) | 4 (57.14%) |
| | Resistant | 0 (0%) | 2 (100%) | 0 (0%) | 2 (100%) | 3 (42.85%) |
| Erythromycin | Sensitive | 6 (100%) | 0 (0%) | 5 (100%) | 0 (0%) | 1 (14.5%) |
| | Resistant | 0 (0%) | 2 (100%) | 0 (0%) | 2 (100%) | 6 (85.5%) |
| Oxacillin | Sensitive | 6 (100%) | 0 (0%) | 5 (100%) | 0 (0%) | 2 (28.57%) |
| | Resistant | 0 (0%) | 2 (100%) | 0 (0%) | 2 (100%) | 5 (71.42%) |
| Gentamicin | Sensitive | 2 (33.3%) | 1 (50%) | 2 (40%) | 1 (50%) | 1 (14.5%) |
| | Resistant | 4 (66.6%) | 1 (50%) | 3 (60%) | 1 (50%) | 6 (85.5%) |
| Ciprofloxacin | Sensitive | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (14.5%) |
| | Resistant | 6 (100%) | 2 (100%) | 5 (100%) | 2 (100%) | 6 (85.5%) |
| Doxycycline | Sensitive | 6 (100%) | 1 (50%) | 5 (100%) | 0 (0%) | 6 (85.5%) |
| | Resistant | 0 (0%) | 1 (50%) | 0 (0%) | 2 (100%) | 1 (14.5%) |
| Cotrimoxazole | Sensitive | 6 (100%) | 2 (100%) | 5 (100%) | 2 (100%) | 5 (71.4%) |
| | Resistant | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (28.5%) |
| Chloramphenicol | Sensitive | 6 (100%) | 2 (100%) | 5 (100%) | 2 (100%) | 5 (71.4%) |
| | Resistant | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (28.5%) |
| Amikacin | Sensitive | 6 (100%) | 1 (50%) | 2 (40%) | 1 (50%) | 1 (14.5%) |
| | Resistant | 0 (0%) | 1 (50%) | 3 (60%) | 1 (50%) | 6 (85.5%) |
| Clindamycin | Sensitive | 6 (100%) | 1 (50%) | 5 (100%) | 1 (50%) | 4 (57.14%) |
| | Resistant | 0 (0%) | 1 (50%) | 0 (0%) | 1 (50%) | 3 (42.85%) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Linezolid | Sensitive | 6 (100%) | 2 (100%) | 5 (100%) | 2 (100%) | 6 (85.5%) |
| | Resistant | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (14.5%) |
| Vancomycin | Sensitive | 6 (100%) | 2 (100%) | 5 (100%) | 2 (100%) | 7 (100%) |
| | Resistant | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Teicoplanin | Sensitive | 6 (100%) | 2 (100%) | 5 (100%) | 2 (100%) | 7 (100%) |
| | Resistant | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |

All resistant staphylococcus (MRSA) isolated from CRBSI were 100 % sensitive to co-trimoxazole, chloramphenicol, vancomycin, teicoplanin and linezolid. All sensitive staphylococcus (MSSA and MSCONS) were 100 % resistant to ciprofloxacin.

Table 3. Antibiotic sensitivity pattern of gram-negative organisms (Oxidase Positive)

| Antibiotics | | PSEUDOMONAS AERUGINOSA (N = 4) |
|---|---|---|
| Ceftazidime | Sensitive | 3 (75%) |
| | Resistant | 1 (25%) |
| Piperacillin | Sensitive | 4 (100%) |
| | Resistant | 0 (0%) |
| Gentamycin | Sensitive | 2 (50%) |
| | Resistant | 2 (50%) |
| Netilmycin | Sensitive | 1 (25%) |
| | Resistant | 3 (75%) |
| Tobramycin | Sensitive | 2 (50%) |
| | Resistant | 2 (50%) |
| Amikacin | Sensitive | 2 (50%) |
| | Resistant | 2 (50%) |
| Ciprofloxacin | Sensitive | 4 (100%) |
| | Resistant | 0 (0%) |
| Aztreonam | Sensitive | 3 (75%) |
| | Resistant | 1 (25%) |
| Cefepime | Sensitive | 3 (75%) |
| | Resistant | 1 (25%) |
| Cefperzone - Sulbactum | Sensitive | 4 (100%) |
| | Resistant | 0 (0%) |
| Piperacillin - Tazobactam | Sensitive | 4 (100%) |
| | Resistant | 0 (0%) |
| Meropenam | Sensitive | 4 (100%) |
| | Resistant | 0 (0%) |
| Colistin | Sensitive | 4 (100%) |
| | Resistant | 0 (0%) |

| | | |
|---|---|---|
| Tigecyclin | Sensitive<br>Resistant | 4 (100%)<br>0 (0%) |

The most sensitive routine antibiotic for P.aerusinosa isolated from CRBSI was piperacillin and ciprofloxacin (100%sensitiveeach). Among the reserved antibiotic, the most sensitive were cefepime (75%), cefoperazone-sulbactum, piperacillin– tazobactam and meropenem (100 %)sensitive each.

**Table 4: Antibiotic sensitivity pattern of Gram Negative Bacteriae (Oxidase Negative)**

| Antibiotics | | Klebsiella (n =4) | E.coli (n=3) | Acineto bacter (n=5) | Citrob acter (n=4) | Burkhe ldorrhoea (n=3) | Serratia (n=2) |
|---|---|---|---|---|---|---|---|
| Amoxicillin | Sensitive | 0(0%) | 0 (0%) | 0(0%) | 0(0%) | 0 (0%) | 0 (0%) |
| | Resistant | 4(100%) | 3 (100%) | 6(100%) | 4(100%) | 3 (100%) | 2(100%) |
| Amoxicillin + clavulanic Acid | Sensitive resistant | 0(0%) | 0 (0%) | 0(0%) | 0(0%) | 0 (0%) | 0 (0%) |
| | | 4(100%) | 3 (100%) | 6(100%) | 4(100%) | 3 (100%) | 2(100%) |
| Ceftaz Olin | Sensitive | 0(0%) | 0 (0%) | 1(16.6%) | 0(0%) | 0 (0%) | 0 (0%) |
| | Resistant | 4(100%) | 3 (100%) | 5(83.3%) | 4(100%) | 3 (100%) | 2(100%) |
| Cefur Oxime | Sensitive | 0(0%) | 0 (0%) | 1(16.6%) | 0(0%) | 0 (0%) | 0 (0%) |
| | Resistant | 4(100%) | 3 (100%) | 5(84.4%) | 4(100%) | 3 (100%) | 2(100%) |
| Ceftri | Sensitive | 0(0%) | 0 (0%) | 2(33.3%) | 0(0%) | 0 (0%) | 0 (0%) |
| Axone | Resistant | 4(100%) | 3 (100%) | 4(66.6%) | 4(100%) | 3 (100%) | 2(100%) |
| Genta | Sensitive | 4(100%) | 0 (0%) | 2(33.3%) | 4(100%) | 0 (0%) | 1(50%) |
| Micin | Resistant | 0(0%) | 3 (100%) | 4(66.6%) | 0(0%) | 3 (100%) | 1(50%) |
| Netilmi Cin | Sensitive | 4(100%) | 0 (0%) | 2(33.3%) | 4(100%) | 0 (0%) | 0 (0%) |
| | Resistant | 0(0%) | 3 (100%) | 4(66.6%) | 0(0%) | 3 (100%) | 2(100%) |
| Amikac In | Sensitive | 4(100%) | 0 (0%) | 3(50%) | 4(100%) | 0 (0%) | 1(50%) |
| | Resistant | 0(0%) | 3 (100%) | 3(50%) | 0(0%) | 3 (100%) | 1(50%) |
| Ciprof loxaci n | Sensitive | 0(0%) | 0(0%) | 2(33.3%) | 0(0%) | 0 (0%) | 0 (0%) |
| | Resistant | 4(100%) | 3(100%) | 4(66.6%) | 4(100%) | 3 (100%) | 2(100%) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cotrim oxazole | Sensitive | 2(50%) | 0 (0%) | 2(33.3%) | 3 (75%) | 0 (0%) | 1(50%) |
| | Resistant | 2(50%) | 3 (100%) | 4(66.6%) | 1 (25%) | 3 (100%) | 1(50%) |
| Aztre Onam | Sensitive | 0(0%) | 0 (0%) | 1(16.6%) | 0(0%) | 0 (0%) | 0 (0%) |
| | Resistant | 4(100%) | 3 (100%) | 5(84.4%) | 4(100%) | 3 (100%) | 2(100%) |
| Cefepi Me | Sensitive | 0(0%) | 0 (0%) | 2(33.3%) | 0(0%) | 0 (0%) | 1(50%) |
| | Resistant | 4(100%) | 3 (100%) | 4(66.6%) | 4(100%) | 3 (100%) | 1(50%) |
| Cefpe razon | Sensitive | 2 (50%) | 2(66.6%) | 2(33.3%) | 2 (50%) | 3 (100%) | 1(50%) |
| E - Salbactum | Resistant | 2 (50%) | 1(33.3%) | 4(66.6%) | 2 (50%) | 0 (0%) | 1(50%) |
| Piperacillin +tazoba Ctum | Sensitive | 2 (50%) | 2(66.6%) | 2(33.3%) | 3 (75%) | 2(66.6%) | 1(50%) |
| | resistant | 2 (50%) | 1(33.3%) | 4(66.6%) | 1 (25%) | 1(33.3%) | 1(50%) |
| Merop Enam | Sensitive | 4 (100%) | 3(100%) | 4(66.6%) | 4 (100%) | 3(100%) | 2(100%) |
| | Resistant | 0 (0%) | 0(0%) | 2(33.3%) | 0 (0%) | 0(0%) | 0 (0%) |
| Colisti N | Sensitive | 4 (100%) | 3 (100%) | 5(83.3%) | 4 (100%) | 3(100%) | 2(100%) |
| | Resistant | 0 (0%) | 0 ( 0%) | 1(16.6%) | 0 (0%) | 0(0%) | 0 (0%) |
| Tigecy Clin | Sensitive | 4 (100%) | 3 (100%) | 5(83.3%) | 4 (100%) | 3(100%) | 2(100%) |
| | Resistant | 0 (0%) | 0 ( 0%) | 1(16.6%) | 0 (0%) | 0(0%) | 0 (0%) |

There was no routine antibiotic sensitive for E.coli isolated from CRBSI and three were ESBL producers and among reserved antibiotic meropenem was most sensitive.

The most sensitive routine antibiotic for k pneumoniae isolated from CRBSI was gentamicin, netilmicin, amikacin (all 100% sensitive) and meropenem among reserved antibiotic (100% sensitive).

The only one strain of A.baumanni isolated from CRBSI was resistant to all routine and reserved drugs (multidrug-resistant),which was only sensitive to colistin and tigecycline.

## 4. DISCUSSION

The present study analysed the incidence density, clinical & microbiological profile of CRBSI in hemodialysis patients admitted to Narayana medical college & hospital, between December 2018 and February 2020.

Patients with dialysis catheter in situ were prospectively followed up for any evidence of catheter-related bloodstream infections (as per standard NKF KDOQI definition)

In 1961, Shaldon, Chiandussi, and Higgs first introduced temporary hemodialysis catheters, and these catheters continue to be the primary means of achieving acute hemodialysis access[13].

Hemodialysis catheters are the most frequently used indwelling medical devices and have become necessary tools for successful management of patients with ESRD patients. Placement of these catheters, however, has an associated risk of morbidity and mortality. In most cases, this risk is outweighed, especially when there is a long- term need to access the

central venous system.

Extensive experience with this technique has led to the recognition of infectious complications that may result from its use and factors affecting infection rate. Thus, the definitive diagnosis of CRBSI can be made only by using a combination of clinical signs and symptoms together with the culture of the catheter. A prominent problem indetecting infection of hemodialysis catheters is the difficulty in distinguishing infection from contamination.

A total of 145 cases proven as CRBSI, admitted between January 2018 and January 2020 were analyzed. During the study period over 1.5 years, a total of 567 catheters were inserted for hemodialysis and out of which 145 were diagnosed with CRBSI (NKF KDOQI guidelines). Out of which definitive &probable CRBSI (NKF KDOQI guidelines) were 14 cases and 34 cases respectively, and the remaining 97 cases were possible CBRSI. This prospective study found an infection rate of 4.16 per 1000 catheter days (definitive &probable CRBSI), which is similar to other prospective studies (western and Indian studies) of temporary catheters that vary over a wide range from 3.5 to 12.8 per 1000 catheter days. However, the incidence of infection and risk of infection over time vary significantly according to the site of insertion.

In our study, the majority of the patients, 92 (63.4%) were in the age group of 40-60 years.In the majority of the studies, CRBSIs were most common in patients above 60 years. But in our study, CRBSI were more common in the age group of 40-60 when compared to those above 60 years, this is because, in our institute, the patients who belonged to the age group of 40-60years with ESRD were more in number when compared to age above 60years with ESRD.

Elderly age group (>60 years) was a prominent risk factor associated with blood culture positive (definitive &probable) CRBSI.This complements various studies done by Murea M et al., Tao et al. and Daniel et al[14-16]. wherein patients aged 60 years and older on dialysis have approximately 50-60 % higher incidence of CRBSI and the possible explanation given is because of immunosenescence, atypical symptoms/presentation in elderly and delayed diagnosis[17].The most common clinical manifestations were fever (80%) with chills (48.9%) followed by myalgia & vomiting in the presentstudy.

In our study, a total 145 cases were analysed, of which, 111 had Diabetes Mellitus, 98had Hypertension, 16had ischemic heart disease, 6 had acute kidney injury, 12 had cirrhosis, and 139 had ESRD end-stage renal disease.

The high incidence of CRBSI in ESRD patients similar to studies conducted by Jaber et al. and Powe et al. who have explained mechanisms for such high frequency of CRBSI in ESRD patients which are:Impaired host immunity in end-stage renal disease, caused by neutrophil dysfunction; Ironoverload, Hyperparathyroidism; Retention of uremic solutes; Hemodialysis procedure might have a role in increasing the risk of bacteremia via contamination of dialysate or equipment, inadequate water treatment, or dialyzer reuse[18,19].

The higher incidence of CRBSI in patients with diabetes patients is similar to studies by Nassar et al., and Allon et al., who have shown that hyperglycemia maintains a state of immunosuppression and thus these patients are always prone for a higher incidence of

infections[20,21].The mechanisms of this poor immune functions are: impaired functioning of neutrophils such as phagocytosis, chemotaxis and decreased cytokine production as well as reduced Th1 dependentimmunity.

In this study among 145 cases, leucocytosis (>11,000 cells/cu mm) was seen in 99 (68.3%) cases and leucopenia (< 4000 cells/cu mm) was seen in 21 (14.5%) cases.

In our study out of 145 cases, thrombocytopenia was seen in 17(11.7%) cases. This data is similar to the study by Francois B et al. which revealed that Gram-negative bacteria were more likely than the positive ones to cause thrombocytopenia and also to an extent leucopenia which may be due to more endotoxin produced by the gram- negative bacteria which inhibits platelet production by inhibiting the bone marrow megakaryocytes in patients[22]. Pseudomonas aeruginosa, Acinetobacter baumannii, and *Klebsiella pneumonia* were more likely to cause thrombocytopenia; thus in the future management of CRBSI, we should be particularly cautious about the thrombocytopenia possibly caused by the infections of these bacteria.

Overall liver dysfunction was present in 9 (6%) patients.ALT was elevated more than twice the normal limit in 5 (3.4%)patients, and AST was elevated more than twice the normal limit in 6 (4.13 %)patients. Bilirubin was elevated in 9 (6%) patients and the maximum bilirubin was 8.4mg /dl. These parameters indicative of Liver dysfunction canbe explained by the production of pro-inflammatory cytokines in CRBSI that leads to changes in hepatic metabolism and enzymatic activities.

Blood culture positivity was found in 48 cases out of total 145 cases (33%) of CRBSI which is slightly higher when compared to various other studies where blood culture positivity varies between 15-25% and the reason being enhanced recognition and reporting of these organisms as valid bloodstream pathogens (as opposed to contaminants) and the use of broad-spectrum antibiotics (selection pressure)[23].

The duration of dialysis catheter in situ was an important contributory factor that determined the development of catheter-related infections. Studies by Heard et al., Moro et al. and Gil et al.[24-26] have shown that venous catheters in situ for longer than seven to fourteen days was associated with a higher risk of CRBSIs which is similar to our study where the mean duration of dialysis catheter in situ was 20.6 days.

In the study, the commonest site for CRBSI was internal jugular vein followed by femoral vein (It is also worthwhile to mention here that in our institute, we follow a practice,where all ESRD patients who are stable,the choice of catheter placement is Internal jugular vein) without any statistically significant difference.The anatomic site chosen for catheter placement influencing the subsequent risk for catheter-associated infection remains controversial.

Merrer et al. and Goetz et al. studies have proved that the femoral venous site catheter has a higher incidence of infection-related complications in comparison with subclavian catheters[27,28]. The probable reason being that femoral access is often used in emergency situations during which adequate sterile precautions may not be taken, and presence of a higher density of local skin flora in the groin area is also postulated to be a reason for more infections at the femoral site. However, in our practice, subclavian catheters are usually avoided or the last option for vascular access if possible due to the high risk of central

venousstenosis.

Richet et al. explained that higher incidence of infection with jugular catheters could be related contamination of the site with oropharyngeal secretions, the catheter insertion technique or that the jugular-site dressings are often not too tight and Sadoyama et al. suggested that jugular venous catheters were associated with longer ICU stays, hospitalization, and higher mortality[29,30].

Multi-lumen lines have been associated with a higher incidence of CVC – BSI. In our study, no significant difference with CRBSI between triple & double lumen catheter insertion (In our study less number of patients were on triple lumen catheters) .McCarthy et al[31]. also had similar observations in his study wherein hecompared CRBSIs were higher in triple lumen versus single lumen catheters (12.8% vs 0%) for administering parenteral nutrition.The possible explanation in this study is due to the lower number of triple lumen dialysis, which was analysed. Higher rates of infection in triple lumen catheters is attributed to frequent handling, higher infusaterate and the possibility ofcontamination.

In the study, there was a total of 48 blood culture-positive cases of CRBSI (14 definitive and 34 probable CRBSI) was seen. The commonest isolate in our study were gram- negative organisms (25 cases) which caused the majority of the CRBSI followed by gram-positive organisms (22 cases) and least common being fungi(only one case ). But in the overall study Coagulase, negative staphylococcus aureus (CONS) was the commonest pathogen isolated (8 cases) followed by Enterococcus (7 cases) & acinetobacter (5 cases) were the commonest organisms.

This is in accordance with the study done by Wisplinghoff et al. which showed that the commonest isolates in CRBSIs were CONS (31%) and S. aureus (20%) followed by gram-negative aetiology. Another study by Subba Rao et al. also showed that the commonest aetiology of CRBSI being CONS (32.4%) followed by gram-negative rods. The reason for the common occurrence of CONS and S. aureus is mainly because these organisms usually originate from the skin surface and track along the external surface of the catheter whereas gram-negative organisms are often introduced by the hands of health-care providers during manipulation of dialysis catheters or due to intravenous tubing[32,33].

In our study, Candida species were isolated from only one case (2.08 %) in the study population which is in contrast with studies done by Pawar et al. and Sahni et al.which have shown that about 11.4% and 20% respectively of CRBSIs was caused by Candidal species[34,35].

Antibiotic sensitivity patterns showed 25 % and 28.5 % of CONS & S.aureus, causing CRBSI were methicillin-resistant. Pawar et al. observed that 11.7% of all the S.aureus causing catheter-related infections were MRSA.

The mortality rate in CRBSIs in our study was 4.13% which is lesser when compared to studies by other studies such as Maki DG et al.[1]which showed a mortality rate between 12-25%and Olaechea PM et al.[36], which showed an attributable mortality rate of 9.4%. The lesser mortality rate is because of less number of cases which were analysed in our study when compared to other publishedstudies.

**Conclusion**

CRBSI is a significant cause of admissions, morbidity and mortality in hemodialysis patients on catheters. CRBSI incidence rate 1.21 per 1000 catheter days for Definitive CRBSI, 2.95per 1000 catheter days for probable CRBSI and 8.42 per 1000 catheter days for possible CRBSI. Prevention with aseptic measures, restriction of usage of catheters for dialysis purpose and early arteriovenous access construction isimportant.Gram-Negative organisms were the commonest causative agent for culture- positive CRBSIs with the majority by Acinetobacter organism, but the overall commonest organism was staphylococcus aureus. However, the best way to prevent catheter infection is earlier diagnosis and referral pre-dialysis patients to a nephrologist for insertion of arteriovenous access (fistula or graft) or transplantation.

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