Original Article

Pattern of Causative Micro-organism in Catheter Related Blood Stream Infections in Patients Receiving Hemodialysis through Venous Catheter in Combined Military Hospital, Dhaka

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Abstract

Background: Catheter Related Blood Stream Infections (CRBSI) is an important frequently encountered abnormality in clinical medicine in patients receiving hemodialysis (HD) through venous catheter. It is the most prevalent vascular access device complication in both the hospital and home setting which is increasing markedly in patients undergoing HD through venous catheter, though the result varies from different institutions and centers.

Objective: To determine the incidence and isolate different types of micro-organism in individual receiving HD through venous catheter and to emphasize in putting a protocol to decrease CRBSI.

Methods: The study was an observational type of cross-sectional study that was conducted at the dialysis center of Nephrology department in Combined Military Hospital (CMH), for six months from June 2019 to November 2019. A total number of 100 suspected CRBSI patients of different age group receiving HD through venous catheter participated. The participants were informed about the nature and purpose of the study and written consent were given by patients themselves. After collecting samples with aseptic procedure, data was analyzed by the SPSS v23.0.

Results: Among 100 participants, age ranging from 40 to 90 years. Mean age was 64.86±25.1 years. Participants were both male and female. There were 41 distinct episodes of CRBSI. Gram-negative micro-organisms were 75.6% (n=31) and 24.4% (n=10) were due to gram-positive micro-organisms. Twenty cases were- Pseudomonas aeruginosa, S aureus 9. Klebsiella 6, Escherichia coli 2, Acinetobacter spp 2, Burkholderia cepacia complex 1 & MRSA 1. CRBSI was isolated mostly in males (n=29), diabetics (n=33), in age 40-74 years (n=30) and patients with temporary venous catheters.

Conclusion: Gram-negative micro-organisms were major causes of CRBSI in this study. Pseudomonas aeruginosa is the key among them, a finding not observed in other studies. Staph aureus is next micro-organism responsible for CRBSI, that is also a common fact in worldwide. Diabetes mellitus, old age, male gender, temporary & prolonged duration of venous catheter group was highly associated with CRBSI incidence.

Keywords: Micro-organism, Catheter related blood stream, Infections, Hemodialysis, Venous Catheter.

Introduction

Among different sites of vascular access, the venous catheter remains the key tools for HD. There is direct access to the circulation for instant management also.The survivability and the effectiveness of life of patients with ESRD on HD is often related with the appropriate dialysis via an optimally placed and perfectly functioning dialysis catheter with less complications and infection rates. CRBSI and related complications requiring hospitalization, account for nearly one third of the cost of ESRD management with reported mortality rates of 12–25.9%.[1-4]

CRBSI was identified as important reason to an increase of morbidity and >50% mortality in HD patients compared to new and mature fistulas.[5] The cause of CRBSI ranges from patient's clinical condition (i.e., comorbid factors, hygiene & previous bacteremia) to catheter's criteria (i.e., types of catheter, duration of catheter use and sites of insertion).[6-12]

Various causative organisms have been described including gram +ve micro-organism which is mostly the occurrence in the Indian and American studies and gram –ve micro-organism isolated predominantly in European studies.[13-19] Dialysis center should have a more study with preserved statistics of presumed and cultured cases CRBSI, which should include antibiotic sensitivity and therapeutic outcome also.[20]

The difference in the reported findings between different studies was explained by the heterogeneity of the study cases which founded the basis to find out the pattern of CRBSI in peoples of Bangladesh.

Materials and Methods

This observational type of cross-sectional study was conducted from June 2019 to November 2019 at Combined Military Hospital (CMH), Dhaka. A total number of 100 suspected CRBSI patients of different age group receiving HD through venous catheter participated in this study. The subjects were informed about the nature and purpose of the study and consent were taken from the patients themselves. Blood samples were collected from the subjects with all aseptic precautions. Sampling technique was purposive and collected data was analyzed by the SPSS 23.0.Ethical clearance was obtained from the ethical committee of Combined Military Hospital (CMH), Dhaka. All the information obtained from each study participant was kept confidential.

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Results

Total 100 patients of suspected CRBSI receiving HD through venous catheter were enrolled in the study. Among them, 59 were male and 41 were female patients. Mean age of 64.86±25.1 year and ranged between 40 to 90 years. Forty one patients were diagnosed as CRBSI by blood and catheter tip culture. Gram-negative micro-organisms were 75.6% (n=31) and 24.4% (n=10) were due to Gram-positive micro-organisms. Twenty events were due to Pseudomonas aeruginosa. Staphylococcus aureus accounted for 9 events. Klebsiella 6, Escherichia coli 2, Acinetobacter spp 2, Burkholderia cepacia Complex 1 & MRSA 1events.

Table-I: Pattern of causative micro-organism for CRBSI.

Organism Found	n	% among CRBSI	% in Total Study Population
Pseudmonas aeruginosa	20	48.8	20
Staph aureus	09	22	09
MRSA	01	2.4	1
Klebsiella Spp	06	14.6	6
Acinetobacter Spp	02	4.9	2
Burkholderia cepacia Complex	01	2.4	1
Escherichia coli	02	4.9	2

Majority of the patients (45%) were found in 60-74 years age group. CRBSI was predominant 16(39%) among 40-59 years of age. Sixty eight percent of the study population had history of diabetes mellitus. It is profoundly found among CRBSI patients 33(80.5%).

Table-II: Distribution of patients according to diabetes mellitus.

	Variables	Culture n (%)		% Population
		Positive (n = 41)	Negative (n = 59)	
Diabetes Mellitus	Yes	33 (80.5%)	35 (59.3%)	68 (66%)
	No	8 (19.5%)	24 (40.7%)	32 (32%)

Organism found, 34(82.9%) in blood culture and 7(17.1%) in catheter tip culture.

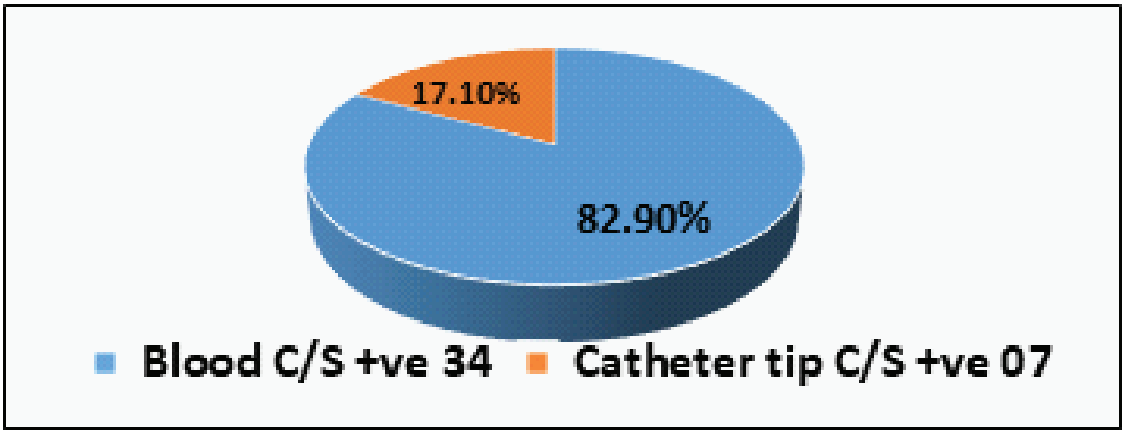

Figure-1: Distribution of Positive culture sample in CRBSI cases (n=41)

Twenty nine (70.7%) CRBSI cases were mostly found where venous catheter duration was more than 21 days.

Table-III: Distribution of venous catheter duration in study population.

Variables		Culture n (%)		% in Total
		Positive (n=41)	Negative (n=59)	
Venous catheter Duration (days)	≤ 14	2 (4.9 %)	5 (8.5 %)	7 (7 %)
	15-21	10 (24.4 %)	28(47.5 %)	38 (38 %)
	> 21	29 (70.7 %)	26 (44.1 %)	55 (53 %)

Frequency of CRBSI was mostly observed in patients with temporary HD catheter and it was 30(73.2%), among which 21(51.2%) was femoral catheters and 9(22%) was internal jugular catheters. Tunneled cuffed catheter comprises 11(26.8%).

Discussion

The etiological micro-organisms in CRBSI in patients receiving HD through venous catheter considering age, sex and predisposing diseases in the study was evaluated to categorize the differences. Gram-negative micro-organisms accounted for 75.6% (n=41). Among these Pseudomonas aeruginosa was identified in highest percentage (n=20) 48.8%, Staph aureus (n=9) 22%, Klebsiella (n=6) 14.6% of cases, Acinetobacter was observed in 4.9% (n=2) events. Escherichia coli (n=2), MRSA (n=1) and Burkholderia cepacia Complex (n=1) were also observed in our study. This study result varies from similar study conducted in other places.

In the study of King Fahd Hospital, Hofuf-Kingdom of Saudi Arabia, Gram-negative bacteria accounted in significant rate where Enterobacter was the key causative agent (n=28).[21] MRSA and Burkholderia cepacia were not observed as found in this study.

The study of Almuneef et al showed the similar result as maximum cases caused by Gram-negative bacilli. Klebsiella pneumonia (16%) was the main organism as differ from this study.[22] In western studies and other studies in US.[23–27], the bacterial pattern also varies from this study. The study of Ramanathan Parameswaran et al, displayed a remarkable variation as gram-positive organism was in highest percentage and S. aureus was found 40%.[28] This was significantly different from our findings but consistent with E. coli 4.9%, Klebsiella pneumoniae 14.6%, and Acinetobacter baumanii 4.9% of this study.

CRBSI was mostly observed in patients with temporary HD catheter 30(73.2%), which concedes with other studies. Acinetobacter accounted for 2 events with predisposition to DM. Among them, 1 in middle aged & 1 in ambulatory patient. This concedes with other studies.[22–28] where it was maximum in aged, bed ridden patients with diabetes, hypertension etc. Burkholderia cepacia (n=1) micro-organism revealed a significant difference with the available data worldwide.

Diabetes was evaluated as important factor predispose to CRBSI. Thirty three (80.5%) cases were found as diabetic coherent with other studies worldwide.[22-28] The mean age in this our study was 64.86±25.1 years which was balanced with study by Zahid N et al[29] Ramanathan Parameswaran et al[23] and other studies.[22–26] All the events were reported in patients receiving HD with both temporary and permanent HD venous catheters.

Conclusion

The pattern of micro-organism in our centre causing CRBSI is significantly different from other regions and countries. Gram-negative micro-organisms were more prevalent than Gram-positive micro-organisms. Pseudomonas aeruginosa was the leading cause of CRBSI in our patients, a finding which is significant but uncommon in dialysis patients with CRBSI in other regions and countries. Staph aureus was the second most common microorganism responsible for CRBSI, which is significant and common in dialysis patients with CRBSI in other regions and countries. Short duration single center study with small sample size was the important limitation.Further larger multicenter study within the region to compare this finding with other regions so that we can study our spectrum of micro-organism in a better way and the use of AVF/ permanent tunneled catheters for HD is recommended.

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