Original Research Article

Hemodialysis catheter related blood stream infections

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ABSTRACT

Background: Hemodialysis catheter related blood stream infection (CRBSI) is common cause for sepsis in hemodialysis patients with high morbidity and mortality. It has to be diagnosed promptly for early treatment to avoid serious complications including catheter removal. This prospective study was undertaken to study clinical features, to validate use of cultures drawn from different sites for diagnosis and management of hemodialysis catheter related blood stream infection (CRBSI). As there is paucity of data regarding CRBSI, hence the study was undertaken.

Methods: All hemodialysis patients with CRBSI between October 2016 to October 2017 were included. Variables like different catheter position, blood cultures collected from peripheral vein, both catheter hubs, catheter exit site swab, and catheter tip cultures were analyzed with respect to time to culture positivity, microbes and its management were analyzed.

Results: Mean duration of hemodialysis catheter inside patient was 24days, most common risk factor for CRBSI was diabetes mellitus (58%) followed by surgery (50%), previous dialysis catheterization within preceding 2months (33%). 30% patients had history of guide wire exchange of catheters previously, most had temporary catheter (88%), most common site of catheter was right internal jugular vein (58%). Cultures showed gram positive organisms in 63%. It was found that same monomicrobial growth was noted in most cultures stating less chances of contamination. Exit site, catheter tip samples and blood sample from catheter's venous hub yielded early result. It was found that same monomicrobial growth was noted in most cultures stating less chances of contamination. Among complications, 8% had endocarditis, 61% had catheter removal. Average hospital stay was 9days. Deferve scence was noted upon antibiotic therapy and catheter removal in most cases. Death was noted in 8% due to sepsis.

Conclusions: CRBSI are major cause of admissions, morbidity and mortality in hemodialysis patients on catheters. Gram positive organisms were commonest pathogens causing CRBSI. Exit site, catheter tip samples and blood sample from catheter's venous hub yielded early result. Peripheral blood sampling for culture diagnosing was unnecessary. Most requires 2-6weeks systemic antibiotics and catheter removal especially if persistent fever and systemic complications are present.

Keywords: Catheter, Culture, Hemodialysis, Peripheral

INTRODUCTION

Hemodialysis catheter related blood stream infection (CRBSI) is common cause for sepsis in hemodialysis patients with high morbidity and mortality.[1,2] It has to be diagnosed promptly for early treatment to avoid serious complications including catheter removal.[1,3] Various initial guidelines stressing on use of blood cultures from peripheral vein, but later, use of blood cultures from catheter hubs and hemodialysis circuit have been published.[1] Peripheral vein puncture may not be feasible always including aim to preserve for future access

creation. In addition, blood circulating in extracorporeal dialysis circuit may dilute microbial growth unless sample drawn prior to start of dialysis. As there is paucity of data regarding CRBSI, hence the study was undertaken.

METHODS

Study setting

This prospective study was done in Vydehi hospital which is a tertiary care hospital where about 500-600 hemodialysis are undertaken in a month. All hemodialysis patients on catheter were handled with aseptic measures. Universal precautions like wearing mask, caps, sterile gloves, sterile gowns were followed. Exit site was dressed in povidone-iodine. Heparin lock alone was used in temporary catheter. 7 patients had gentamycin antibiotic (1mg/ml) lock with heparin who had tunneled catheter. Catheters were not used for non-hemodialysis use except for blood sampling.

All hemodialysis patients with hemodialysis catheter and suspected CRBSI between October 2016 to October 2017 were included. Included patients had body temperature >380C, rigors, hypotension, catheter dysfunction after exclusion of infection from another source. Patients who had other source of infection were excluded. Under aseptic measures, 10ml blood samples for cultures were taken from peripheral vein, both catheter hubs and catheter tip, if catheter was removed and exit swab cultured wherever indicated. After bedside inoculation, growth was analyzed regularly according to flurescence changes in BACT/Alert machines. Colony count was not analyzed. In some patients, there was difficulty in drawing peripheral venous blood. Variables like different

catheter position, clinical features, risk factors, blood cultures collected from peripheral vein, both catheter hubs and catheter exit site swab, catheter tip cultures were analyzed with respect to time to culture positivity, microbes and its management were analyzed.

All CRBSI received initial antibiotics covering both Gram positive and Gram-negative organisms. Specific antibiotics were continued later after obtaining culture reports. Duration of antibiotic requirement was 2-6weeks. Catheter removal was required in all patients.

The objective of the work was to study clinical features, risk factors, management of CRBSI and to study and analyze time to culture growth positivity of samples drawn from peripheral vein, both arterial, venous catheter hubs, catheter tip and exit swab.

RESULTS

Among the enrolled 60 patients, most of them (38.3%) were between 51-60years age, males (68%) were predominant in gender, mean duration of hemodialysis catheter inside patient was 24days, most common risk factor for CRBSI was diabetes mellitus (58%) followed by surgery (50%), previous dialysis catheterization within preceding 2months (33%), 30% patients had history of guide wire exchange of catheters previously (Table 1), most had temporary catheter (88%), most common site of catheter was right internal jugular vein (58%) followed by right femoral vein (38%), most common symptom was fever within 1hour of dialysis initiation (100%) followed by nausea, vomiting (66%) (Table 2). Among investigations, all had leukocytosis, 83% had hypoalbuminaemia. Cultures showed gram positive organisms in 63%, polymicrobial in 5%.

Table 1: Risk factors.

	No. of patients (n=60)	%
Diabetes mellitus	35	58.3
Previous hemodialysis catheterization within past 2 months	20	33.3
Previous hemodialysis catheterization 2months prior	10	16.7
Catheter used for other than dialysis	18	30.0
Staphylococcus aureus nasal carriage	5	8.3
Guide wire exchanged catheter	18	30.0
Recent surgery	30	50.0
Received pneumococcal vaccine	10	16.7
Catheter lock with antibiotics/citrate	7	11.7

Analysis showed mean time from dialysis initiation to blood culture collected was 103minutes, mean transit time from blood culture collected to start of cultivation was 159minutes. Time to culture positivity analysis showed mean time for culture positivity in peripheral vein blood was 837minutes, mean time for culture

positivity in blood from arterial hub of catheter was 761minutes, mean time for culture positivity in blood from venous hub was 745minutes, mean time for culture positivity in catheter tip was 694minutes, mean time for culture positivity in exit swab c/s was 658minutes. Differential time to culture positivity showed differential

time for positivity comparing peripheral vein to arterial hub of catheter was 60minutes, differential time for positivity comparing peripheral vein to venous hub of catheter was 100minutes, differential time for positivity comparing peripheral vein to catheter tip was 140minutes, differential time for positivity comparing peripheral vein to exit site swab culture was 165minutes (Table 3). Among complications, 8% had endocarditis.

Table 2: Clinical features.

Clinical features	No. of patients (n=60)	%
Fever prior to dialysis initiation	26	43.3
Fever after hemodialysis	8	13.3
Fever within 1hour of dialysis initiation	60	100.0
Fever after 1hour of dialysis initiation	10	16.7
Chills	45	75.0
Rigors	45	75.0
Exit site infection	8	13.3
Catheter dysfunction	25	41.7
Hypotension	37	61.7
Malaise	25	41.7
Breathlessness	20	33.3
Nausea, vomiting	40	66.7
Altered sensorium	10	16.7

Table 3: Descriptive statistics.

Variables	Min-max	Mean ± SD
Time from dialysis initiation to blood culture collected (min)	0.00-190.00	103.08±65.11
Transit time from blood culture collected to start of cultivation (min)	60.00-240.00	159.67±57.62
Time to positivity	-	-
Time for culture positivity (in min) in peripheral vein blood	755.00-865.00	837.42±29.42
Time for culture positivity (in min) in blood from arterial hub	735.00-795.00	761.67±23.51
Time for culture positivity (in min) in blood from venous hub	720.00-840.00	745.73±30.36
Time for culture positivity (in min) in catheter tip	640.00-795.00	694.88±39.86
Time for culture positivity (in min) in exit swab c/s	650.00-660.00	658.57±3.78
Differential time to positivity	-	-
Differential time for positivity comparing peripheral vein to arterial hub of catheter (in min)	45.00-65.00	60.00±7.56
Differential time for positivity comparing peripheral vein to venous hub of catheter (in min)	10.00-135.00	100.72±44.92
Differential time for positivity comparing peripheral vein to catheter tip (in min)	55.00-20.00	140.78±43.39
Differential time for positivity comparing peripheral vein to exit site swab culture (in min)	165.00-165.00	165.00±0.00

61% had catheter removal, most 13% patients had received antibiotic prior to sample culture collection, most patients received antibiotics covering both gram positive, gram negative organisms like vancomycin and cephalosporins. Once culture was received, specific antibiotic was given. Death was noted in 8% due to sepsis.

It was found that same monomicrobial growth was noted in most cultures stating less chances of contamination. Cultures of exit swab, catheter tip, blood sample from venous hub of catheter showed early positivity. Contamination was avoided due to aseptic measures undertaken. Average hospital stay was 9days. Defervescence was noted upon antibiotic therapy and catheter removal in most cases. Death was noted in 8% due to sepsis.

DISCUSSION

In our study CRBSI was diagnosed based on diagnostic criteria, clinical features, and defervescence upon catheter removal like in earlier studies.[4] In our study, heparin lock alone was used in temporary catheter. 7 (11%) patients

had gentamycin antibiotic (1mg/ml) lock with heparin who had tunneled catheter. This practice has been done as per European Best Practices Report considering avoiding antibiotic resistance.[5,6] This is supported by the fact that CRBSI rates were <1 per 1000 catheter-days in previous studies.[5,7] Here we attempted to see at any advantage of blood culture from exit site, catheter hub, catheter tip culture versus peripheral vein blood culture.

Fever and chills were most common feature in CRBSI like in earlier studies.[4,8] In this study, monomicrobial growth was found in a patient in general. Early culture positivity, accuracy was highest in culture from exit site sample, catheter tip sample, blood sample from venous hub of catheter like in other studies.[1] Cultures from peripheral vein was found unnecessary as it may be painful, can lead to scarring of veins, keeping the aim of preservation of veins for future access creation, avoiding damage to veins leading to inability to form arterio-venous access.

Infact, cultures from peripheral vein showed late culture growth compared to other sites even though same microbe is grown. Infact, chances of contamination are higher in peripheral vein samples like mentioned earlier studies.[1]

We found commonest organisms were Gram positive organisms as expected like in earlier study.[4] Central venous catheter is at 15-fold higher risk compared to arterio-venous access in causing CRBSI.[9] 10-20% CRBSI have metastatic complications like septic arthritis, endocarditis and physical loss due to catheter removal.[5]

CRBSI rates can be decreased by strict aseptic handling measures of catheter by trained personnel, restricting catheter for dialysis usage alone, and early diagnosis of CRBSI to avoid complications including catheter removal which can lead to increased financial burden, morbidity and mortality. The risk of sepsis in catheter dependant dialysis patients is 50% at 6months with financial burden. Hence, if catheter dependency dialysis is reduced, it will reduce financial burden including infective complications like CRBSI.[10] A multidisciplinary approach is required to reduce CRBSI and improve clinical outcome.[11]

CONCLUSION

CRBSI are major cause of admissions, morbidity and mortality in hemodialysis patients on catheters. Prevention with aseptic measures, restriction of usage of catheter for dialysis purpose and early arterio-venous access construction is important. Gram positive organisms are most pathogens causing CRBSI.

Exit site, catheter tip samples and blood sample from catheter's venous hub yielded early result. Peripheral blood sampling for culture diagnosing is unnecessary. Most requires 2-6weeks systemic antibiotics and catheter removal, especially if persistent fever and systemic complications are present.

Limitation of our study had less number of patients may be due to better care of dialysis catheter. Blood cultures were not analyzed from samples of extracorporeal circuit. Quantitative blood cultures were not done

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