

CENTRAL VENOUS CATHETER RELATED INFECTIONS IN HAEMODIALYSIS PATIENTS

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ABSTRACT

Objective: Infections represent a serious complication among the haemodialysis patients. More than two - thirds of these infections in haemodialysis patients were related to intravascular catheterizations. We prospectively evaluated catheter related infections in the haemodialysis patients with this study.

Patients-Methods: Eighty-seven central venous catheter tips were collected from 77 haemodialysis patients during a one year period. Catheters were cultured by the semiquantitative method described by Maki et al.

Results: Local catheter related infection was diagnosed in 20 (23%) cases, catheter related bacteremia was diagnosed in 13 (15.6%) cases, catheter related sepsis was diagnosed in 5 (5.7%) cases according to the clinical findings and semiquantitative catheter culture method results. None of the patients was diagnosed as catheter related endocarditis or as catheter related metastatic infections. The Coagulase Negative Staphylococci were the most frequently isolated pathogen (25.7%), followed by Staphylococcus aureus (24.3%) and Gram negative bacteria (34%). The prolonged

catheterization is a significant risk factor for catheter related infection.

Conclusion: It is concluded from the study that, the goal of the physician is to prevent catheter related infections, many of which are potentially preventable. Treatment must be individualized for each patient on the basis of the clinical presentation and the causative agent.

Key Words: Haemodialysis, Central venous catheter, Infection.

INTRODUCTION

Intravascular catheters are the most frequently used indwelling medical devices in clinical practice. The intravascular catheter related infections are quite common in hospitalized patients and account for significant morbidity and mortality. Multiple causative factors are encountered (1,2).

Infection is an extremely important complication in haemodialysis patients because of their sensitivity. The increased susceptibility to infections is related to the decreased immune response that is believed to be caused by

impaired renal function. More than two - thirds of the infections in these patients were related to intravascular catheters (3,4).

Strictly obeying infection prevention measures and catheter care are very important. Once fever develops in a patient who has an intravascular catheter, catheter related infections must be considered. If there is a suspicion of infection, appropriate antibiotic therapy should be considered according to the probable causative agents and their antimicrobial resistance patterns based on surveillance studies. Therefore we studied temporarily used central venous catheters in hemodialysis patients in the internal medicine clinics of our hospital. We assessed frequency, types, predisposing factors of central venous catheter related infections with causative agents in a prospective manner.

PATIENTS - MATERIAL - METHOD

Patients: Eighty-seven central venous catheter tips were collected from 77 haemodialysis patients during a one year period. The central venous catheter related data included the catheter application site, dates of insertion and removal of catheter, the catheter application site inspection. Patients data were collected concomitantly and included age, gender use of antibiotic and / or chemotherapeutic drugs and underlying medical problems. All data were collected on a standardized form.

Method: Catheters were removed if there was a suspicion of catheter related infection or when a central line was no longer necessary. The catheter was removed aseptically with a sterile forceps by pulling the catheter away from the skin surface after local disinfection of the insertion site. A blood sample was drawn from another peripheral vein at the time of catheter removal. After removal, the distal 5 to 6 cm of catheter tip was cut off and placed into a sterile container for culturing. Inoculation of catheter tips were done onto blood agar plates and incubation was performed according to the semiquantitative technique described by Maki et al. Cultures yielding 15 or more colonies were recorded as positive (5). All isolates were identified by the routine laboratory methods (6).

Definitions: The catheter related infections were diagnosed by semiquantitative catheter culture and / or simultaneous quantitative blood cultures explained below. No catheter infection: When the catheter culture is negative and no clinical evidence of infection is fully explained by a known source this is called no catheter infection. Catheter colonization: Catheter colonization was defined as colony formation greater and equal than 15 cfu (≥ 15 colony forming units) per plate. Catheter contamination: Catheter contamination was defined as colony formation less than (<15) cfu per plate.

Local catheter related infection: Local catheter related infection was defined as colony formation greater and equal than 15 (≥ 15) cfu per plate with the local signs of infection such as presence of fever, leucocytosis, signs of infection at the catheter application site (erythema, tenderness, swelling, purulent discharge etc), no clinical evidence of another source of infection.

Catheter related bacteremia / septicemia: When semiquantitative catheter cultures and blood cultures positive for the same species; clinical and microbiological data disclosed no other apparent source for the bacteremia / septicemia this is called catheter related bacteremia / sepsis (7,8).

Statistics: All data were collected on standardized form and statistical analysis of proportions were performed by using the chisquare test.

RESULTS

A total of 87 central vein catheters inserted in 77 haemodialysis patients were included in this study. 45 (51.7%) males and 32 (48.3%) females, with a mean age of 49 (range, 16 - 75 years) data of the patient and catheter information was shown in Table I. According to the results of semiquantitative catheter culture method, 66 microorganisms were isolated from 53 central vein catheters (CVC). Only one agent was isolated from 42 CVC and two different kinds of agents were isolated from 9 CVC. Three different kinds of agents were isolated from 2 CVC. 17 of all isolates were identified as

Coagulase Negative staphylococci (CNS), 16 isolates were identified as *Staphylococcus aureus* (S.aureus) and 23 isolates were identified as Gram negative bacteria. Oxacillin resistance of S.aureus and CNS was found 41.2%, 37.5% respectively. Distribution of those isolates was shown in Table II.

Local catheter related infection was diagnosed in 20 (23 %) cases, catheter related bacteremia was diagnosed in 13 (15.6%) cases and catheter related sepsis was diagnosed in 5 (5.7%) cases according to the clinical findings and semiquantitative catheter culture method results. None of the patients were diagnosed as catheter related endocarditis or as catheter related metastatic infection. 3 of 5 patients who were diagnosed catheter related sepsis died. One patient died due to Group A β - Hemolytic *Streptococcus* catheter related sepsis and two patients died due to S.aureus catheter related sepsis. Two other patients diagnosed as catheter related sepsis were treated with III. generation cephalosporin and quinolone respectively. Local catheter related infections were mostly caused by CNS. Catheter related bacteremia / sepsis were mostly caused by S. aureus. These results were shown in Table III.

Four central venous catheters were inserted into the jugular vein, 24 central venous catheters were inserted into the subclavian vein and 59 central venous catheters were inserted into the femoral vein. Two (50%) of 4 jugular venous catheters were culture positive. One case was diagnosed as local catheter related infection, another case was diagnosed as catheter related bacteremia / sepsis. Fifteen (62%) of 24 subclavian venous catheters were culture positive, 8 (52.3%) of them were diagnosed as local catheter related infection, 5 (33.3%) of them were diagnosed as catheter related bacteremia / sepsis. 36 (61%) of 59 femoral catheters were culture positive, 11 (30.5%) of them were diagnosed as local catheter related infection and 2 (33%) of them were diagnosed as catheter related bacteremia / sepsis. According to our results, there was no significant relation between catheter inserted vein and positive cultures of central venous catheters ($p=0.32$, $p>0.05$). These results were shown in Table IV.

Table I. Data from 77 patients with 87 central venous catheters (CVCs)

No. of men (%)	45 (51.7)
No. of women (%)	32 (48.3)
Mean age in years (range)	49 (16-75)
No. of CVCs inserted per patient (%)	
1	67 (83%)
2	10 (17%)
Site of CVC insertion no (%)	
Subclavian	24
Jugular	4
Femoral	59
Mean inserted catheter duration time	
Infection (+)	18 / day
Infection (-)	12 / day

Table II. Distribution of microorganisms which were isolated from central venous catheters

Microorganisms	n	(%)
CNS	17	(25.7)
- Oxacillin Resistant	7	(41.2)
- Oxacillin Susceptible	10	(62.5)
S. aureus	16	(24.3)
- Oxacillin Resistant	6	(37.5)
- Oxacillin Susceptible	10	(58.8)
Micrococcus spp.	5	(7.8)
Streptococcus spp.	2	(3.0)
Enterococcus spp.	1	(1.5)
Corynebacterium spp.	1	(1.5)
Enterobacter spp.	7	(10.6)
Klebsiella spp.	6	(9.1)
Acinetobacter spp.	2	(3.0)
P. aeruginosa	2	(3.0)
E.coli	2	(3.0)
Flavobacterium spp.	2	(3.0)
Serratia spp.	1	(1.5)
Pseudomonas spp.	1	(1.5)
Candida spp.	1	(1.5)
Total	66	(100.0)

Table III. Distribution of agents which were isolated from intravascular catheter related infections.

Organism	Local infection	Bacteremia	Sepsis	Total (n)
CNS	11	2	-	13
S.aureus	4	6	2	12
Group A β hemolytic streptococcus	-	-	1	1
Group B β hemolytic streptococcus	1	-	-	1
Enterococcus spp.	-	1	-	1
Enterobacter spp.	3	1	-	4
Klebsiella spp.	3	1	1	5
Acinetobacter spp.	1	-	1	2
E. coli	1	1	-	2
Flavobacterium spp.	2	-	-	2
Pseudomonas aeruginosa	1	-	-	1
Serratia spp.	-	1	-	1
Pseudomonas spp.	1	-	-	1
Total (n)	28	13	5	46

Table IV. The distribution of intravascular catheter related infections according to catheter application site.

	Colonise		Local catheter related infection		Catheter related bacteremia/sepsis		Negative culture		Total	
	n	%	n	%	n	%	n	%	n	%
Jugular vein	-	0	1	1.15	1	1.15	2	2.3	4	4.6
Subclavian vein	2	2.3	8	9	5	6	9	10.3	24	27.6
Femoral vein	13	15	11	12.6	12	13.8	23	26.4	59	67.8
	15	17.3	20	22.75	18	20.95	34	39.0	87	100.0

DISCUSSION

Infection is one of the leading complications of intravascular catheters and intravascular catheters are a common source of nosocomial infections (9, 10). Central venous catheters particularly multiple lumens catheters or haemodialysis catheters are associated with a higher risk of infection than peripheral venous catheters (11). The incidence of central venous catheter related infections is reported about 3 to 7%. Catheter related infection was reported 20% and catheter related bacteremia / sepsis was reported 10% in hemodialysis patients (12, 3). Local catheter related infection was diagnosed in 20 (23%) cases, catheter related bacteremia was diagnosed in 13 cases (15%), catheter related sepsis was diagnosed in 5 cases (5.7%) according to our results.

As found in previous studies, staphylococci were the most common isolated agents from catheter related infections in haemodialysis patients (13, 14). Staphylococci were the most commonly isolated organism in our study too. Oxacillin resistant *S. aureus* and CNS was found 41.2%, 37.5% respectively. Enteric Gram negative bacteria rarely cause catheter related infections and these isolates tend to have high level III. generation cephalosporin resistance and they are usually nosocomial pathogens. In addition the outbreak of Gram negative bacteremia could be encountered in haemodialysis centers (15-17). According to our results, 23 (34.8%) of all isolates were identified as Gram negative bacteria and five of Gram negative bacteria were caused by catheter related bacteremia / sepsis. Due to these results Gram negative bacteria are usually important pathogens of nosocomial infections in our hospital.

The predisposing factors to infections are prolonged catheterization, multiple catheter manipulation, improper aseptic insertion and maintenance techniques. Prolonged catheterization is one of the major risk factors for infection associated with venous and arterial catheters. Changing of central venous catheters at intervals of 48 - 72 hours is not offered practically because mechanical complications may increase in this way. There is a significant relation between catheter related infection and catheter using time (18, 19). According to our results, average catheter using time was found to be 18 days among catheter culture positives.

Finally, haemodialysis patients are frequently confronted by intravascular applications and consequently intravascular catheter related infections. The aim of the physician should be to prevent intravascular catheter related infections and if intravascular catheter related infections occur, the physician must treat the infection according to each patient on the basis of the clinical presentation and resistance pattern of probable causative agents based on surveillance studies.

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