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Duration of catheterisation and risk of bacteremia following temporary hemodialysis catheterisation

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Abstract
Introduction: Temporary haemodialysis catheters are the most common vascular access used in emergency and associated with significant complications especially bacteraemia.
Aim: To analyse the risk of infection after temporary haemodialysis catheter.
Material and Methods: From Jan 2016 to August 2017, all patients who underwent haemodialysis with temporary non cuffed veno-venous double lumen catheter were included. Baseline patient data was recorded at the time of insertion and were followed from the day of catheter insertion to the day of catheter removal. In case of a febrile illness suspected to be due to catheter, blood was sent for haemogram and culture and the catheter tip was sent for culture. Bacteremia and exit site infection was noted at follow up. Statistical analysis was done using Strata 6 software for windows and $P<0.05$ was considered statistically significant.
Results: 210 catheter insertions were done in 160 patients. Bacteremia occurred in 72 cases. For femoral catheters, bacteremia rate increased from 27% in first week to 73% by second week ($P<0.05$); for jugular catheter, it increased from 16% at two weeks to 72% by third week ($P<0.05$). Most common organism isolated was staphylococcus aureus (70%).The risk of bacteremia was significantly more in patients with diabetes ($P < 0.05$) and those admitted in intensive care unit ($P < 0.05$).
Conclusions:
1) Bacteremia is not an uncommon complication following temporary catheter insertion.
2) Femoral catheters, more than 1 week, jugular catheters more than 2 weeks, presence of diabetes and admission to ICCU are significant risk factors for bacteremia.

Keywords: Catheterization, Hemodialysis, bacteremia and catheter

Introduction
Temporary Hemodialysis catheters (HD) provide an effective vascular access for immediate hemodialysis. Although meant for temporary use, their use is often prolonged and especially in developing countries, they provide the only means of vascular access for HD in many centres thereby increasing the risk of infection and mechanical complications. KDOQI guidelines recommend femoral catheter to be used not more than 5 days and jugular and subclavian catheter not more than 21 days [1]. However there have been no studies to validate these guidelines from developing countries. The present study attempts to analyse the risk of bacteremia with the duration of catheterization.

Material and Methods
Patients who underwent Temporary Hemodialysis Catheter insertion with Non cuffed Non tunnelled Double lumen polyurethane catheters (Arrow @ Arrow International, Inc, PA. USA) at Department of Nephrology, Lions Hospitals, koparkhairne from Jan 2016 to Aug 2017 were prospectively analysed. Catheters were inserted by attending nephrologists at sites as of their preference and patient clinical profile. Catheters were inserted with strict aseptic precautions, sutured to the skin and dry dressing was applied. Correct position of the catheter was verified with a XR Chest view done post procedure.
Prior to each dialysis session, catheter site was examined and flow in the catheter was ascertained by flushing the catheter with 100ml of 0.9% saline or 100ml of 0.1 ml of unfractionated heparin dissolved in 500 ml of normal saline (1U/ml). Post dialysis the catheters were locked with unfractionated heparin equivalent to the volume of catheter lumen (As indicated by catheter company). Patients were followed from the time of catheter insertion till catheter removal.

On follow up, catheter insertion site was examined before each dialysis session. If purulent exudate or cellulitis was noted at the insertion site, pus swab was sent for culture and in case of a febrile illness, the catheter was removed and tip was sent for culture. In case of a febrile illness (>38.5 F), blood was sent for culture and if the source of fever was not apparent on clinical examination, it was assumed to be due to catheter related and catheter was removed and tip sent for culture. Bacteremia was defined as positive blood culture in a patient with signs of bacteremia.

Definite Catheter related Bacteremia (CRB): was defined as association of fever (>38.5 C) and the isolation of an identical micro-organism on cultures of blood and catheter tip in the absence of an alternative source.

Possible Catheter related Bacteremia: was defined when fever developed in the absence of an alternative source where microbiological criteria were insufficient to diagnose CRB.

Exit Site Infection was defined as purulent discharge from the exit site or when other signs of inflammation occurred (redness, pain and swelling) in conjunction with a positive culture from the catheter tip.

Outcome Assessment

Each individual catheter episode was analysed separately in those patients who had more than one catheter insertion during the study period.

Catheter exchanged over a guidewire because of mechanical complications were also treated as single episode.

Primary outcome was to determine the time interval from the day of catheter insertion to development of exit site infection or bacteremia.

Statistical Analysis

Data was entered in Microsoft Excel worksheet. Analysis was done using SPSS software version 7.0 for Windows. Students T test was used for discrete variable while Chi square test was used for categorical variables. $P < 0.05$ was considered to be statistically significant.

Results

A total of 210 catheters were inserted in 160 patients. There were 100 males and 60 females. The mean age was 41 years with an age range of 20-64 yrs. Diabetes mellitus was present in 73 (45%) patients and 76 (47%) were admitted in the Intensive care unit (ICU).

Site of catheterisation included Internal jugular in 86, Subclavian in 27 and Femoral in 97.The mean catheter survival was 13 days with jugular, 11 with subclavian and 6 with femoral. Table 1.

Incidence of bacteremia was highest at femoral site increasing from 27% in 1st week to 73% in the 2nd week. In case of jugular site, it increased from 16% in 2nd week to 74% in the 3rd week and in case of subclavian catheter it increased from 16% in 2nd week to 68% in 3rd week. Table 2.

20 patients developed exit site infection. The incidence of CRB increased to 75% by day 7 of the presence of exit site infection. Table 3.

Definite CRB was present in 30 (41%) cases while 42 (59%) had possible CRB. Table 4. Staph aureus was the most common organism isolated in 70% followed by Klebsiella (20%), Pseudomonas (08%) and Burkholderia (02%). Table 5.

Presence of Diabetes Mellitus, Exit site infection and ICCU admission were associated with increased risk of bacteremia. Table 6.

Discussion

Temporary Hemodialysis catheters are essential component of dialysis. However it is associated with high rate of complications especially bacteremia leading to an increased risk of morbidity and even mortality.

In the present study, incidence of CRB was 34% which was much higher than that reported in developed countries [2, 3, 4, 5]. Increased number of femoral catheterisation, increased presence of comorbidities and delay in the diagnosis of CRB could be responsible for the increased incidence.

Incidence of bacteremia was similar in femoral and jugular catheters but much lower in subclavian catheters. Conflicting data have been reported in this regard with some studies reporting a higher incidence in IJV [5, 6, 7, 8], some in femoral [9], some have reported no difference in infection rate in subclavian or jugular catheter [4, 10] while some have reported similar frequency of infection in jugular and femoral catheters [11, 12]. Shorter subcutaneous tunnel, close proximity to nasal flora and inability to maintain a dry insertion site in case of jugular catheters and higher bacterial content of the groin region in case of femoral catheter may be responsible for increased risk of CRB [5]. Despite higher incidence of bacteremia in case of jugular catheter, it is preferred *in view* of higher incidence of subclavian vein stenosis with subclavian vein catheter.

Oliver *et al.* [13] in his analysis of 417 individual catheters noted that the incidence of bacteremia increased with duration of catheterisation with incidence of bacteremia being highest with the use of femoral catheters in each week as compared to jugular catheters. Similar findings have been noted in our study. However, the risk of bacteremia increases significantly after the second week in case of jugular catheters in our study as against third week as has been reported by Oliver *et al.* [13]. *In view* of the KDOQI guidelines which recommend removal of femoral catheter in 5 days in case of femoral and 21 days in case of jugular cathers [1], patients would be exposed to very high risk of bacteremia if catheters are kept for more than 2 weeks. This may have a tremendous bearing in nephrology practice in developing countries and hence removal of jugular catheters after 14 days may be much more prudent in the developing countries which may be contrary to that recommended by KDOQI guidelines. However this direct correlation of increased risk of bacteremia with prolonged duration of catheterisation is not supported by few studies [4, 5] who suggest that patients are exposed to a constant risk of bacteremia over time.

Risk of bacteremia also increases significantly in the presence of exit site infection and the risk increases with increased duration of catheterisation probably suggesting that presence of exit site infection predisposes the patient to CRB. Similar findings have been reported by Oliver *et al.* [13].

Diagnostic criteria required for definite CRB were satisfied in only 30/72 cases. 42 cases had insufficient microbiological criteria (but a strong clinical suspicion) for CRB. Prior antibiotic therapy (on clinical suspicion), timing

of sample collection and level of bacteremia may account for these false negative results.

Staphylococcos aureus is the most common organism isolated similar to other studies [3, 4, 5, 14]. High rate of colonisation of hemodialysis catheters with Staph aureus may be responsible for the same.

In summary, temporary hemodialysis catheters are associated with increased risk of bacteremia and the risk increases with prolonged duration of catheterisation and presence of exit site infection. Jugular may still be the preferred site for catheterisation. In the developing countries, it may be worthwhile considering removal of femoral catheters after 7 days and jugular catheters after 14 days contradictory to that recommended by KDOQI. Presence of exit site infection warrants removal of catheter. However, further large scale prospective, randomised studies are needed especially from developing countries to validate these findings as the KDOQI guidelines on this aspect are opinion based.

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Conflicts of interest: None

Disclosure: None

Table 1: Site and Duration of Catheter insertion

	Jugular	Subclavian	Femoral
Total no	86	27	97
Mean durn (Days)	13	11	6
CRB (%)	30 (34%)	06 (22%)	36 (37%)

Table 2: Duration of Catheterisation and Risk of Infection

Weeks	Jugular (N=30)	Subclavian (N=06)	Femoral (N= 36)
0-1wks	3(10%)	1(16%)	10(27%)
1-2wks	5(16%)	1(16%)	26(73%)
2-3wks	22(74%)	04 (68%)	

Table 3: Duration of Exit site infection and Risk of Bacteremia

Day of Exit Site infection (N = 20)	No of CRB (%)
D 0	0
D 7	15 (75%)

Table 4: CRB
Definite CRB – 30
Possible CRB –42
Positive blood culture – 5
Positive catheter tip – 19
Negative blood culture and catheter tip – 18.

Table 5: Organisms and CRB

Organisms	No (%)
Staphylococcus Aureus	70%
Klebsiella	20%
Pseudomonas	08%
Burkholderia Cepacias	02%

Table 6: Risk factors for CRB

Risk factor	No Bacteremia	Bacteremia	P value
Mean age (yrs)	41±24	42±22	NS
Sex(M:F)	1.6:1	1.4:1	NS
Diabetes Mellitus	34%	70%	<0.05
ICCU admission	38%	74%	<0.05
Exit Sit Infection	05(25%)	15(75%)	<0.05
Catheter exchange	1%	2%	NS

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