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Dialysis Central Venous Catheter–Associated Sepsis: Complimentary Role of Local Susceptibility Pattern

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Introduction: Effective treatment of central venous catheters infections could be very challenging, and may require catheter removal. Reinsertion could worsen the economic burden on patient, particularly those paying out of pocket.

Methods: Management was anchored on dialysis-based nitrogenous waste, antigen and cytokines clearance, in addition to antibiotic treatment that was based on sensitivity results and, local microbial susceptibility pattern, to minimize cost.

Results: He was febrile (38.4^0C), had a non-tunnelled jugular vein catheter with a dirty, wet dressing with a greenish tinge. He had tachycardia (110/min), fine crepitaions in the lung bases and ascites. Blood and central line samples grew Pseudomonas aeuriginosa sensitive to Imipenem ++ (both), Vancomycin + (blood) and Ciprofloxacin + (central line). He had 4 haemodialysis sessions through the infected catheter, a dose of Vancomycin but none of Imipenem (on account of cost). He had a full course of intravenous Ciprofloxacin and Ceftazidime which was introduced on the basis of local microbial susceptibility pattern as it had been very effective in managing infective conditions in our CKD patients (either in mono or in combination therapy), particularly in patients unable to afford culture and sensitivity test . He had a good clinical and, microbiological recovery as a repeat culture after seven days of antibiotics treatment showed no growth. The catheter was retained for use in further dialysis sessions.

Conclusion: Treatment of infected non-tunnelled dialysis catheters could be very challenging particularly in resource poor settings. The use of low cost antibiotics with positive local microbial susceptibility pattern could be very beneficial, additive and effective in treatment and in minimizing complications.

Keywords: Antibiotics; haemodialysis; central venous catheters; culture; susceptibility; infections.

1. INTRODUCTION

The use of tunnelled and non-tunnelled, non-femoral dialysis central venous catheters (CVCs), is becoming increasingly more common in resource poor settings (RPSs) [1]. Vancomycin is recommended for empirical treatment (effective against the common causative microbes including methicillin resistant staph aureus (MRSA) [2] Incident hemodialysis catheters for end stage renal disease (ESRD) is more common in the United States compared to other developed countries like Germany and Japan [3,4]. Medkouri et al in Casablanca found a 86.3% incidence of temporary CVC [5]. In Nigeria, despite the increasing use of permanent dialysis access, the prevalence of arterovenous fistula (AVF) was only 9% in 2021 [6] Infection and hospitalization rates are commoner with the CVCs than AVF, coupled with higher vascular stenosis rates in CVCs, particularly subclavian [7].

Treatment outcome for CVCs infections could be sub-optimal in RPSs, with consequences on health. Despite this, literature is still scare in RPSs. We report the management of a 55-year old indigent male who was successfully managed for CVC infections based on combined microbial sensitivity and, local microbial susceptibility pattern.

2. CASE REPORT

A 55 year old male, artisan, known diabetic and hypertensive, was referred from a peripheral dialysis facility with fever and vomiting of 2 weeks duration for which an assessment of end stage renal disease (ESRD) was made. He was commenced on maintenance haemodialysis (MHD) with a non-tunnelled internal jugular venous catheter (ntIJVC) 4 weeks prior to his presentation. He had fever (($T=37.7^0$C),) at his last dialysis visit at the referral center.

He was febrile ($T=39.4^0$C), pale and had pedal oedema. He had a ntIJVC in-situ with a dirty wet dressing stained with greenish discharge, and an immature AVF on the left forearm. He had tachycardia (PR-110/min), elevated blood pressure (148/96 mmHg) an enlarged heart and liver, a forth heart sound and fine chest crepitaions were heard. He had moderate ascites but no asterixis.

Diagnosis: Acute exacerbation of Chronic Kidney Disease (CKD) secondary to Diabetic nephropathy (DN) precipitated by sepsis from an infected ntIJVC.

Urinalysis showed: protein 2+. Renal biochemistry showed creatinine (726 µmol/L), bicarbonate (17 mmol/L) and potassium (6.0 mmol/L). While culture and sensitivity (C/S) results were being awaited he was commenced on antipyretics, IV Vancomycin 500mg twice weekly for 2 weeks, and Ceftazidime 1g daily based on local susceptibility pattern. Antibiotics were given after dialysis treatment which was delayed for a day as funds were unavailable. His Metformin was changed to Insulin at admission.

Blood Culture grew Pseudomonas aeuriginosa sensitive to Vancomycin +, Ciprofloxacin +, Imipenem ++. Culture of catheter sample grew Pseudomonas aeuriginosa sensitive to ciprofloxacin +, imipenem ++. He had only a dose of Vancomycin on account of cost. With C/S results, He was commenced on IV Ciprofloxacin 200mg daily for 2 weeks while Ceftazidime was continued, as index patient could not afford imipenem. He made progressive improvement clinically and in hemodynamics, and repeat blood culture after 14 and 8 days of Ceftazidime and Ciprofloxacin respectively, showed no growth.

He had four dialysis sessions via the ntIJVC, got 4 units of blood and oral Sodium bicarbonate 600mg twice daily. His ntIJVC was maintained by locking with Ceftriaxone after each dialysis session, He was discharged on a twice monthly visit, twice weekly dialysis and erythropoietin treatment and the Insulin was replaced with oral Diamicron 30mg daily The IJVC was removed when his AVF became functional.

3. DISCUSSION

Infections of CVCs are not uncommon particularly with non-tunnelled catheters, and with non-adherence to infection control measures [8]. The index patient had a ntIJVC and the skin surrounding the access site was disinfected with methylated spirit and Savlon (Cetrimide 0.5% and Chlorhexidine digluconate 0.1%) solution during the weekly dialysis session at the referral centre. Despite the fever at the last visit, no laboratory investigation was conducted and he neither had a broad spectrum antibiotics cover nor an antibiotic ointment or cream such as Mupirocin around the catheter exit site (as is routinely done in most settings in our clime), this could have heighten the risk of catheter infection and dissemination [4,8].

It is reported that 7.6% of a dialysis population had a CVC, 32% of the hospitalizations from vascular access infection (VAI) were attributed to CVC [9]. The risk of infection from CVCs is

Table 1. Serum biochemistry ad haematology

Date	Sodim	Potassim	SBC	Cl^-	$PO4^{2-}$	CCa^{2+}	Urea	Cr	Alb
	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L	umol/L	mg/dL
8/11/20	136	6.0	17	98	6.3	2.10	19.8	726	28
10/11/20 Predialysis	136	5.0	13	101			15.7	848	
Post dialysis 10/11/20	140	3.6	18	103			10.1	426	
13/11/20 Predialysis	149	4.7	16	99			31.6	1125	
Post dialysis	137	3.3	18	101			11.2	574	
17/11/20	130	3.1	21	97			31.0	920	
20/11/20	137	3.9	21	102			27.0	738	
23/11/20	134	3.9	20	98			25.8	684	
28/11/20	132	3.7	18	95			26.2	546	
01/12/20 Discharge	132	4.1	20	96	1.5	2.21	10.5	196	31

	Haematoloy					
	HCT	WBC	Neut	Lymph	ESR	Plateles
	%	10^3/µL	%	%	mm/hr	10^3/µL
8/11/20	22	14.6	82	18	34	210
13/11/20	23	15.3				
23/11/20	24	9.1				
Discharge	27	7.3	65	33	16	234

SBC-serum bicarbonate concentration, CL-chloride, PO4-phosphate, CCa-corrected calcium, Cr-creatinine, Alb-albumin, HCT-hematocrit, WBC-white cell count, ESR-erythrocyte sedimentation rate

estimated to be 10 times higher than the AVFs, buttressing the need to classify CVCs as temporary dialysis accesses while awaiting placement of permanent accesses [10]. The ntIJVC in the current case are fixed at insertion sites with the catheter and attachments protruding directly while tunnelled catheters are passed under the skin from the insertion site to a separate exit site, where the catheter and its attachments emerge from underneath the skin thereby preventing infections and providing stability [8-10]. Catheter infection in the index case most likely resulted from the ntIJVC, reflecting the lack of a cuff that acts as a barrier against inoculation from the exit site into the systemic circulation.

Emergency presentation, cost and ease of insertion of non-tunnelled CVCs contributes to their high prevalence in dialysis treatment for acute kidney injury (AKI) and for incident MHD sessions. Ideally, tunnelled catheters should play temporary role while grafts and AVFs are maturing, usually 4 weeks and 6-8 weeks respectively. They are also used in patients undergoing continuous ambulatory peritoneal dialysis (CAPD) while their catheter heals or during episodes of peritonitis. Despite new approaches to the prevention and treatment of infection, up to two-thirds of infected catheters needed to be removed as catheter infection may be life-threatening [4].

Femoral vein catheterization is associated with higher infection rates and lower degree of ambulation while the subclavian access site is commonly discouraged on account of stenosis and compromised vascular flow. The index patient incident session was with a femoral access, before been replaced with the ntIJVC. Catheter insertion should be performed under strict aseptic conditions, this may not be very likely, in the index case. Though catheters could be colonized after insertion, its removal is still debatable as it relates to positive cultures of central line samples in aymptomatic cases.[9] There is growing evidence that antimicrobial locks applied within the catheter lumen are effective in preventing catheter-related bloodstream infections, with Vancomycin, teicoplanin, gentamicin, amikacin, minocycline, ampicillin, alternating ampicillin and gentamicin, cefotaxime, ceftazidime, ceftriaxone and ciprofloxacin, reported to have been used [10]. For the index patient, ceftriaxone was used in locking the catheter according to the unit policy. Although the use of permanent catheters in MHD is being discouraged, the proportion of patients treated with them is still growing, and they could be life-saving in a substantial proportion of the current MHD population who have challenges with native vascular accesses [8,11]. Reasons adduced for the high prevalence of permanent catheters in the developed nations are older dialysis population, higher prevalence of cardiovascular disease and diabetes mellitus, conditions in which creation or repair of an autogenous fistula or graft may appear technically challenging, risky or impossible [3].

Systemic antibiotic treatment has remained a mainstay in managing catheter infection as was the case in the index case. According to the ERBP recommendations, in treating CVCs associated sepsis, preference should be given to antibiotics with a pharmacokinetic profile allowing administration after each dialysis session only, such as for vancomycin, teicoplanin, cefazolin, ceftazidime and daptomycin, with vancomycin or teicoplanin as the first choice for empirical therapy of gram positives in settings where methicillin resistant staphyloccocus aureus (MRSA) is highly prevalent [12]. On dialysis days, antibiotics were administered after dialysis sessions to ensure adequate coverage for gram negative organisms including Pseudomonas [13]. Though the index patient couldn't afford Imipenem (culture sensitive) and received just a single dose of vancomycin, the empirical use of Ceftazidime based on reported positive responses [10] low cost and local microbial susceptibility pattern gave a good treatment outcome. Considering the good treatment outcome despite the low microbial sensitivity to Ciprofloxacin from culture results, we infer that Ceftazidime (though not listed in the sensitivity pattern), most likely played a significant role in microbial clearance. Catheter removal is the first therapeutic option in cases of severe complications and metastatic infections with *S. aureus*, *P. aeruginosa*, multiresistant organisms and fungi, and infected tunnelled accesses with fever [13]. This should however be balanced against the cost and risk associated with re-insertion. Catheter removal might not be appropriate, if an alternative insertion site is not available or if re-insertion of a catheter is associated with higher risk [7,13].

If a catheter is not removed, blood cultures should be checked a week after completion of antibiotic treatment, and if those cultures remain positive, the catheter should be removed [13]. In the index case, culture results after a week of

antibiotics yielded no growth. Complications associated with delayed catheter removal such as osteomyelitis, infective endocarditis with septic embolization, and intracranial abscesses were fortunately not seen in index patient, both at discharge, and on subsequent follow up visits.

4. CONCLUSION

Non-tunnelled dialysis catheters carry an increased risk of infections that could lead to several complications. This is coupled with the fact that antibiotic treatment could be very challenging, particularly in resource poor settings as most payment are out-of-pocket. Vascular accesses with CVCs are on the increase contrary to recommendations. Antibiotics selection based on local susceptibility pattern may be beneficial in resource poor settings where antibiotics with higher sensitivity index (from culture and sensitivity results) may be too expensive for indigent patient to procure. This could improve the chances of effective treatment outcome, without negative sequelae.

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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