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Original Article

Antibiotic Profile for Blood Stream Infections in Hemodialysis Patients

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Abstract

Background: Blood stream infections (BSIs) remain a significant factor influencing illness and death among patients receiving hemodialysis (HD). Monitoring trends in antibiotic use in dialysis units is important for improving patient safety and quality of care. This study aimed to facilitate the guidelines toward effective antibiotic therapy to the patients on HD with BSIs.

Materials and Methods: A total of 100 patients who undergone HD were enrolled in the study. Their blood cultures were performed according to automated robotic (BacT/Alert Three-dimensional, BioMérieux Inc.) blood culture system, to identify the organism cause BSIs.

Results: A total of 27 patients were confirmed to have HD BSIs based on our study criteria. 19 patients had Gram-positive (*Staphylococcus aureus*: 14, *Staphylococcus epidermidis*: 5) and 8 had Gram-negative infections (*Escherichia* coli: 4, *Pseudomonas aeruginosa*: 4). The most common Gram-positive organisms were sensitive to vancomycin and clindamycin. The *E. coli* has been sensitive to pazufloxacin and meropenem. The *P. aeruginosa* has been sensitive to imipenem with cilastatin.

Conclusion: Gram-positive organism *S. aureus* and *S. epidermidis* were highly sensitive to vancomycin and clindamycin once in week and 3 times per day through intravenous (IV), respectively, *E. coli* was sensitive to pazufloxacin and meropenem twice daily through IV for 2 weeks. *P. aeruginosa* was sensitive to imipenem with cilastatin once in 48 h for 2 weeks.

Key words: Antibiotic therapy, Blood stream infections, Gram-positive, Gram-negative, Hemodialysis

INTRODUCTION

Chronic kidney disease is a noteworthy public health burden.[1] End-stage renal disease is increasing exponentially across the world.[2] Comprehensively, dialysis is the foremost methodology for renal replacement therapy. Among dialysis patients, infection related results have an effect on hemodialysis (HD) patients lopsidedly as they have greater chances of blood stream infection (BSI) when put next with peritoneal dialysis patients.[3] HD catheter assumes a relevant phase within the treatment of patients requiring HD. It is moderately simple to be offered and may also be utilized immediately as a part of vast type of kidney failure patients. Unfortunately, HD catheter is just not without issues. Apart from thrombosis, infection is a standout among probably the most dreaded complexities. Disease of the HD catheter used to be suggestion to bring about an increase of >50% mortality in HD patients contrasted with patients on native fistulas in addition cause noteworthy morbidity in dialysis population.[4] The reason for HD BSIs is multifactorial starting from patient's elements (i.e., comorbidities and cleanliness) to catheter's variables (i.e., style of catheter and site of insertion).[5] Presently, the administration of HD BSIs depends on the kind of catheter integrated, variety of microorganism and the seriousness of the diseases. Antibiotics are the spine for the healing of HD BSIs. Occasionally, the HD catheters will have to be replaced in problematic instances. Cure have to be customized equipped as per the microbiology results.[6] The period of treatment is

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dependent on the organism cultured, as well as, whether or no longer the catheter was removed.[7] Nonetheless, there is a shortage of local data on this issue. This study meant to explore the viability of antibiotics for the treatment of BSI in patients receiving HD.

MATERIALS AND METHODS

A total of 100 patients who underwent HD were enrolled within this study. The selection of patients based on the following; mild fever, chills and/or hypotension, and semi quantitative laboratory confirmation, when blood from the catheter displays microbial progress not <2 h than progress is distinguished in blood culture while from a peripheral vein.[8] HD patients who presented other routes of infections had been rejected from the study. Consents were taken from the patients. Two arrangements of blood cultures have been taken from every patient. One set of blood culture (anaerobic and oxygen consuming) was taken from a peripheral vein and a different set from the catheter. The peripheral blood culture was taken from a vein in the middle cubital fossa or the flexor part of the lower arm. A sterile zone was then separated using hanging the territory with a sterile sheet. The sterile zone was once made by means of cleansing the zone with 70% alcohol took after by way of 10% povidone-iodine in a roundabout movement establishing from the within and moving outward, and the site was once left to dry. Blood was taken from the catheter in a comparative design. The catheter center was once then cleaned with 10% povidone-iodine and left to dry. An identical measure of blood was once drawn for catheter and peripheral cultures. All administrators wore plastic outfits, face covers, and sterile gloves to counteract infection of the blood culture.

The blood has been cultured utilizing a robotic blood culture (BacT/Alert three-dimensional, BioMérieux Inc.) approach. The blood inoculated immediately into BacT/Alert FA plus aerobic blood culture bottles with 0.025% of sodium polyanethol sulfonate as anticoagulant. After assortment, these bottles had been right away incubated in BacT/Alert 3D (manufactured by means of BioMérieux) an absolutely automatic blood culture approach for identification of growth in culture. The negative results have been followed as much as 7 days and final report was issued. At the same time, in case of a positive progress, the BacT/Alert robotically offers an alert. The positive bottles had been then subcultured on MacConkey agar for identification of microorganisms with the aid of common microbiological ways.[9] The antibiotics have been given as per the international guidelines, sensitivity tests and observed the efficacy of the antibiotics. This study protocol has been approved via hospital ethics committee and we bought written and informed consent from the study patients before the study.

RESULTS

Out of 100 blood samples subjected for culture, 27% showed culture positive result. No anaerobic bacteria identified in this study. Among these positive cases, 19 patients had Gram-positive (*Staphylococcus aureus*: 14, *Staphylococcus epidermidis*: 5) and 8 had Gram-negative infections (*Escherichia coli:* 4, *Pseudomonas aeruginosa*: 4).

Among the Gram-positive infectious patients, the predominant causative organism was *S. aureus*. Out of 14 patients, 13 were susceptible for vancomycin 1 g once in a week by intravenous (IV) route for 2 weeks. Another 1 patient was susceptible for clindamycin 600 mg 3 times per day by IV route for 2 weeks. Similarly, out of five patients with *S. epidermidis,* four patients showed susceptible for vancomycin 1 g once in a week by IV route for 2 weeks and one patient was susceptible for clindamycin 600 mg 3 times per day by IV route for 2 weeks (Table 1).

Two Gram-negative organisms were observed with equal numbers in this study. *E. coli* showed susceptible for pazufloxacin (500 mg twice a day by IV for 2 weeks) in 2 patients and another two patients were susceptible for meropenem (500 mg twice a day by IV for 2 weeks). *P. aeruginosa* has showed susceptible for imipenem with cilastatin as a combinational therapy with 0.5 g once in 48 h through IV for maximum 14 days (Table 1).

In view of this significance, vancomycin showed 89% efficacy against *S. aureus* and *S. epidermidis.* 100% efficacy has been observed in pazufloxacin and meropenem against *E. coli.* and *P. aeruginosa* was susceptible 100% with imipenem with cilastatin.

DISCUSSION

In this study, 27% samples processed have been culture positive cases. No organism was detected from 74% blood samples processed until 1 week of incubation and these instances had been viewed as culture negative. Blood culture positivity was visible in 27 of 100 (27%) cases which is fairly scale down to different experiences of previous authors.[8,10,11] This may be when you consider that of majority of the patients suggested to us are referred with the aid of other experts or hospitals, and these patients have been given antibiotics somewhere else earlier than they reached our medical institution. Many patients developed infections after hospitalization or after surgical procedure

Table 1: Antibiotic profile for microorganisms caused BSIs

Microorganisms	Antibiotic	Dose	Route of administration	Response (how many days)
Staphylococcus aureus	1. Vancomycin	1 g	IV once in a week	2 weeks
	2. Clindamycin	600 mg 3 times a day	IV daily	1-2 weeks
Staphylococcus epidermidis	1. Vancomycin	1 g	IV once in a week	2 weeks
	2. Clindamycin	600 mg 3 times a day	IV daily	1-2 weeks
Escherichia coli	1. Pazufloxacin	500 mg twice daily	IV daily	1-2 weeks
	2. Meropenem	500 mg twice daily	IV daily	1-2 weeks
Pseudomonas aeruginosa	Imipenem with cilastatin	0.5 g	IV once in 48 h	7-14 days

BSIs: Blood stream infections

during which they already had been given antibiotics before sampling of blood for culture.

Vancomycin acts on Gram-positive bacteria by inhibiting its cellular wall synthesis. It must be given intravenously since it has high molecular weight and not easily absorbed from the intestine. Vancomycin dose has half-life approximately 6 h in subjects with normal kidney function.[12] The half-life is greatly increased in kidney failure (half-existence is up to 7.5 days in anephric patients, indicating minimal nonrenal clearance), and dosage regimen is carried according to the need of these patients.[13,14] Bisiwe *et al.,* (2015)[15] revealed that a vancomycin-resistant Gram-positive organism used to be not recognized of their study and their discovering helps the advice of utilizing vancomycin empirically to duvet Gram-positive organisms in these patients while waiting for blood culture outcome. The identical results were observed in our study additionally. Published vancomycin protocols[13,14] are also adopted to inspire nontoxic and effective administration. This study had been followed the same protocol.

Clindamycin is an antibiotic which stops the growth of microorganisms especially bacteria. It binds on 50 s ribosomal unit to inhibit protein synthesis. Its activity against to respiratory infection caused by *S. pneumoniae, S. pyogenes,* and MSSA, also an extensive variety of Gram-positive and Gram-negative anaerobes.[16] Clindamycin is basically bacteriostatic agent shows time-dependent endeavor at >4 times concentration than the MIC, and has a moderate *in vitro* postantibiotic influence against *S. aureus*.[17] As a result, this study has been used clindamycin for Gram-positive organisms which used to be now not respond with vancomycin.

Pazufloxacin is a potent large spectrum antibiotic against both Gram-positive and negative microorganisms including multidrug resistant strains.[18,19] It also showed that it has DNA antagonist efficiency.[20] The present has been utilized the pazufloxacin against *E. coli* and results have been incredibly commendable.

Meropenem is a carbapenem antibiotic. It kills bacteria by inhibiting cell wall synthesis. It has efficiency to kill most Gram-positive and negative microorganisms. Mostly, it is used to treat intra-abdominal infections for 7-14 days. In this study also followed the identical protocol.

Imipenem is a carbapenem antibiotic and cilastatin facilitates the imipenem works efficiently by inhibiting the breakdown in the kidney. Imipenem/cilastatin combination is an antibiotic useful for the treatment of a number of bacterial infections. It is a broad-spectrum beta-lactam containing equal quantities of imipenem and cilastatin. It is related to the penicillin/cephalosporin family of antibiotics, but is classified as belonging to the carbapenem class. It has activity against many aerobic and anaerobic Gram-positive and Gram-negative organisms, including *P. aeruginosa*. Based on the above fact, in this study, we used combinational therapy for *P. aeruginosa*.

In conclusion, Gram-positive organism was predominant to cause BSI. Vancomycin can be appropriate treatment option for Gram-positive organisms. If vancomycin fails, can use clindamycin as an alternate to vancomycin. In Gram-negative organisms especially *E. coli*, pazufloxacin and meropenem can be used based on the clinical condition and sensitivity patterns of patients. Imipenem with cilastatin may be served as a better combination for treating *P. aeruginosa* infections.

REFERENCES

1. Schieppati A, Remuzzi G. Chronic renal diseases as a public health problem: Epidemiology, social, and economic implications. Kidney Int Suppl 2005;S7-10.
2. Abdul Gafor AH, Cheong Ping P, Zainal Abidin AF, Saruddin MZ, Kah Yan N, Adam SQ, *et al*. Antibiogram for haemodialysis catheter-related bloodstream infections. Int J Nephrol 2014;2014:629459.
3. Abbott KC, Agodoa LY. Etiology of bacterial septicemia in chronic dialysis patients in the United States. Clin Nephrol 2001;56:124-31.
4. Vanholder R, Canaud B, Fluck R, Jadoul M, Labriola L, Marti-Monros A, *et al*. Diagnosis, prevention and treatment of haemodialysis catheter-related bloodstream infections (CRBSI): A position statement of European Renal Best Practice (ERBP). NDT Plus 2010;3:234-46.
5. Mermel LA, Allon M, Bouza E, Craven DE, Flynn P, O'Grady NP, *et al*. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 Update by the Infectious Diseases Society of America. Clin Infect Dis 2009;49:1-45.
6. Bouza E, Alvarado N, Alcalá L, Pérez MJ, Rincón C, Muñoz P.

A randomized and prospective study of 3 procedures for the diagnosis of catheter-related bloodstream infection without catheter withdrawal. Clin Infect Dis 2007;44:820-6.
7. Xu Y, Moser C, Al-Soud WA, Sørensen S, Høiby N, Nielsen PH, *et al.* Culture-dependent and -independent investigations of microbial diversity on urinary catheters. J Clin Microbiol 2012;50:3901-8.
8. Kamga H, Njunda A, Nde P, Assob J, Nsagha D, Weledji P. Prevalence of septicaemia and antibiotic sensitivity pattern of bacterial isolates at the University Teaching Hospital, Yaoundé, Cameroon. Afr J Clin Exp Microbiol 2011;12:2-8.
9. Kirn TJ, Weinstein MP. Update on blood cultures: How to obtain, process, report, and interpret. Clin Microbiol Infect 2013;19:513-20.
10. Prabhu K, Bhat S, Rao S. Bacteriologic profile and antibiogram of blood culture isolates in a pediatric care unit. J Lab Physicians 2010;2:85-8.
11. Roy I, Jain A, Kumar M, Agarwal SK. Bacteriology of neonatal septicaemia in a tertiary care hospital of northern India. Indian J Med Microbiol 2002;20:156-9.
12. Panais R, Hirsch DJ, Dipchand C, Storsley L, Finkle SN. A protocolized approach to vancomycin dosing in conventional hemodialysis. J Nephrol 2010;23:569-74.
13. Mason NA, Neudeck BL, Welage LS, Patel JA, Swartz RD. Comparison of 3 vancomycin dosage regimens during hemodialysis with cellulose triacetate dialyzers: Post-dialysis versus intradialytic administration. Clin Nephrol 2003;60:96-104.
14. Moellering RC Jr. Pharmacokinetics of vancomycin. J Antimicrob Chemother 1984;14 Suppl D:43-52.
15. Bisiwe F, van Rensburg B, Barrett C, van Rooyen C, van Vuuren C. Haemodialysis catheter-related bloodstream infections at Universitas Academic Hospital, Bloemfontein: Should we change our empiric antibiotics? South Afr J Infect Dis 2015;30:29-33.
16. Falagas ME, Gorbach SL. Clindamycin and metronidazole. Med Clin North Am 1995;79:845-67.
17. Xue IB, Davey PG, Phillips G. Variation in postantibiotic effect of clindamycin against clinical isolates of *Staphylococcus aureus* and implications for dosing of patients with osteomyelitis. Antimicrob Agents Chemother 1996;40:1403-7.
18. Zhanel GG, Ennis K, Vercaigne L, Walkty A, Gin AS, Embil J, *et al.* A critical review of the fluoroquinolones: Focus on respiratory infections. Drugs 2002;62:13-59.
19. Zhanel GG, Fontaine S, Adam H, Schurek K, Mayer M, Noreddin AM, *et al.* A Review of new fluoroquinolones: Focus on their use in respiratory tract infections. Treat Respir Med 2006;5:437-65.
20. Andersson MI, MacGowan AP. Development of the quinolones. J Antimicrob Chemother 2003;51 Suppl 1:1-11.

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