Outbreak of Burkholderia cepacia bacteraemia in a haemodialysis unit

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Abstract

Background: Burkholderia cepacia is a wide spread aerobic, motile, glucose non fermenting multi drug resistant Gram negative bacilli, which proliferate under the conditions of minimal nutrition and can survive in the presence of certain disinfectants . Haemodialysis fluids and equipment supports the growth of hydrophilic bacteria and contamination of them is directly related to the quality of water supply. Therefore regular monitoring of RO (Reverse osmosis) water quality in a haemodialysis setting is mandatory.

Aim and Objective: The aim of this study is to analyse the cause of bacteraemia in patients who are on haemodialysis in NU Hospital Bengaluru.

Material and Methods: Venous blood from the patients was cultured using BD blood culture bottles at first clinical symptoms.

Results: Bacterial pathogens were isolated and commonest isolate is Burkholderia cepacia followed by Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus.

Conclusion: Burkholderia cepacia has occurred in significant numbers in haemodialysis patients due to dysfunctional RO plant. So routine culture of RO water should be done to prevent nosocomial infections.

Key words: Burkholderia cepacia, haemodialysis, RO water.

Introduction

Burkholderia cepacia [B. cepacia] is a wide spread aerobic, motile, glucose- nonfermenting multi drug resistant Gram negative bacillus that proliferates under conditions of minimal nutrition and can survive in the presence of certain disinfectants. It is widely distributed in the natural environment and has been isolated from water, soil. Burkholderia cepacia has emerged as a serious human pathogen in the last two decades, causing fatal necrotizing pneumonia and bacteraemia and also associated with nosocomial infection[1]. This organism colonizes water supplies, filter membranes, and antiseptic solutions. Inadequate catheter care, defects in membrane integrity, and reprocessing of dialyzers has all been implicated in outbreak in haemodialysis unit. Patients receiving long term haemodialysis are at increased risk of blood stream infections due to repeated vascular access.

Advance in aseptic techniques have reduced the risk of infection, but outbreak continue to occur accounting 12to38% of mortality in patients with chronic renal disease[2,3]. Haemodialysis fluids and equipment support the growth of hydrophilic bacteria and contamination of them is directly related to the quality of water supply. Although the water supply for haemodialysis is not required to be sterile, the number of bacteria present must fall within specific standards to reduce the risk of blood stream infection[2]. Therefore monitoring of water quality in a haemodialysis setting is mandatory.

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Chronic kidney disease patients are treated by maintenance haemodialysis. In dialysis, patients are exposed to 360 to 600 litres per week of dialysate. Therefore all low molecular weight substance present in water has direct access through semi permeable membrane of the dialyzer to dialysis patients blood stream.

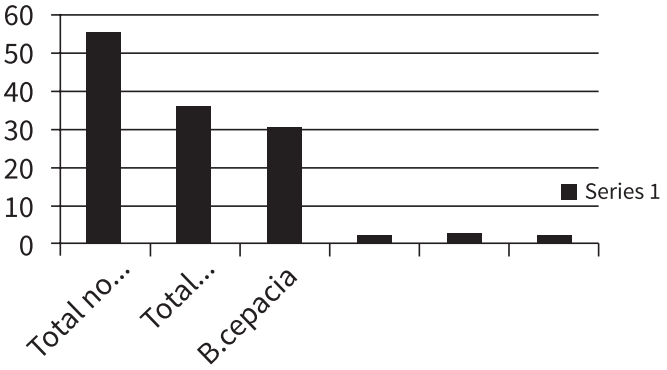
Inadequate catheter care, contamination of water supply, defects in membrane integrity, and reprocessed dialyzers have all been implicated in outbreaks in haemodialysis units. Haemodialysis fluids and equipment support the growth of hydrophilic bacteria and contamination of them is directly related to water supply. Although water supply for haemodialysis is not required to be sterile, the number of bacteria present must fall within specific standards to reduce the blood stream infections[2]. Therefore, monitoring of water quality in a haemodialysis setting is mandatory. B. cepacia isolates recovered from blood and water in haemodialysis setting unequivocally implicated the water supply as a source of infection.

Haemodialysis unit at NU Hospitals, Bangalore provides long term haemodialysis for approximately 38 patients/day using 12 stations. Vital signs and body temperature are always monitored during dialysis procedure. The dialysis machines are disinfected daily& dialyzer coils are reprocessed mechanically and reused, individually upto12 times. Chlorine treated water from reservoir 1 passes through sand filters, deionizers and reverse osmosis machines. Treated water is maintained in reservoir 2 from where it is distributed to dialysis machines. Water quality is assessed monthly by collecting 100ml samples from different points of both reservoirs, after each filter passage, after reverse osmosis, before dialysis machines and dialysates. Faecal coli forms, heterotrophic bacteria, amount of end toxins and chemical analysis of water are monitored. Epidemiological investigation was carried out on chronic renal patients being dialyzed three times a week. A case was defined as any long term haemodialysis patient with an episode of blood stream infection.

MATERIAL AND METHODS- 8-10ml of venous blood is collected after disinfecting the venous port with sterillium and iodine and inoculated into BD Bactec plus Aerobic/F culture vial for processing with the Bactec 9050 culture system. Biochemical tests and identification of isolates was performed with BD phoenix TM NMIC/ID-129. Water quality monitoring was done by collecting the water sample from different sites like reservoirs and outlet environmental samples, health care workers hands were cultured in haemodialysis unit.

Results

Out of 55 blood samples received from dialysis unit from patients with clinical symptoms during the study period, 36 [65.4%] showed growth of bacterial pathogens. The most frequent organism isolated was B. cepacia 30 [83.3%] followed by Escherichia coli 2 [5.55%], Pseudomonas aeruginosa 3 [8.33%] and Staphylococcus aureus 2[5.55%] (Graph1, Table 1).



Graph 1. Epidemiological bar of bacteraemia outbreak in a haemodialysis unit

Table 1. Various environmental samples analysed in haemodialysis unit

Sl.	Water Culture	Organisms
1	Entry point	Burkholderia cepacia
2	Exit point	Burkholderia cepacia
3	RO Plant UV filter	Satisfactory
4	RO tank	Burkholderia cepacia
5	NG3 inlet fluid	Burkholderia cepacia
6	Washing area	Unsatisfactory
7	Membrane	Unsatisfactory
8	Sump	Burkholderia cepacia
9	Reprocess area	Burkholderia cepacia
10	Dialysate NG machine	Burkholderia cepacia
11	Tap water	Burkholderia cepacia
12	Bicarbonate solution preparation	Satisfactory
13	Sink and Wash basin	Satisfactory

14	Back water port	Burkholderia cepacia
15	Sterillium	Satisfactory
16	Iodine solution	Satisfactory
17	Health care worker hand swab	Satisfactory
18	Post osmosis water	Burkholderia cepacia

Discussion

B. cepacia has been recognized as an emerging opportunistic pathogen, usually related to respiratory infection of cystic fibrosis patients[4]. An outbreak among chronic renal failure patients in Thailand was traced to diluted chlorhexidine cetrimide solution contaminated with the same strain as was isolated from blood stream[5]. Contaminated reverse osmosis membranes were also responsible for a polyclonal B. cepacia complex bacteraemia in chronic renal patients in another outbreak in Brazil[6]. The present report describes the investigation of blood stream infection of patients undergoing dialysis. B. cepacia was the most frequently isolated microorganism. The results are consistent with bacterial diversity found in environmental samples[7,8]. The epidemiological investigation linked the bacteraemia episodes to water contamination, the probable source of contamination was inadequate cleaning procedure, environmental biofilim forming bacteria or micro-organisms present in the old pipe lines would have entered the water system through the tubing.

During the outbreak faecal coliform were not detected. B. cepacia was initially isolated from two outlet lines from the RO tank and from entry and exit points of dialysis room. Subsequently samples from the RO water tank also grew the organism. Cultures from the point immediately distal to the RO plant, environment, bicarbonate solution, heparin and hand wash did not yield the organism. Biofilim in the pipelines and RO water tank were thought to be the source and they were all changed but the outbreak did not subside. Though the chemical analysis of RO water was good and the point immediately distal to the RO plant where UV filter was located did not grow the organism, there was a strong suspicion of dysfunction of the RO membrane as raw water also grew the organism subsequently. New RO membranes were installed and fumigation and surface cleaning with high level disinfection of dialysis room were performed. The haemodialysis procedure, including equipment disinfection, and whole water system were reviewed. No further episodes of fever with chills and rigors were seen in patients undergoing dialysis.

Conclusion

Burkholderia cepacia bacteraemia occurred in a significant number of haemodialysis patients due to contaminated water and dysfunctional RO plant which became evident after detailed sampling at various ports. The studies also highlights that it is better to do a fluid broth enrichment to isolate the organism. High index of suspicion of dysfunctional RO membrane and biofilm formation in the old pipelines is required when an outbreak of infection occurs in a haemodialysis unit apart from surveillance of practices inside the unit and of the environmental factors.

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