Short Report

An outbreak investigation of bacteraemia due to *Burkholderia cepacia* complex at the National Hospital of Sri Lanka

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Abstract

Burkholderia cepacia complex (BCC) is an opportunistic pathogen in immunocompromised patients and well distributed in the natural environment. Nosocomial outbreaks of BCC are due to contaminated solutions and medical devices. However, in Sri Lanka, there have been no nosocomial outbreaks of BCC reported in the past. We report here an outbreak investigation of bacteraemia due to BCC in the wards and ICUs of the National Hospital of Sri Lanka (NHSL) during the period of August 14th 2017 to September 13th 2017 which an extensive investigation traced to a contaminated nebulizer solution of a particular brand of ipratropium bromide. The blood culture isolates from the patients with bacteraemia and from the particular nebulizer solution were found to be identical and confirmed as BCC. There had been outbreaks in other hospitals with the same organism in the recent past but they were not able to find the common source for the outbreak. The incident was reported officially to the relevant authorities and other hospitals, and an alternative agent for the use of nebulization was strongly recommended to prevent further cases immediately.

Keywords: outbreak, investigation, bacteraemia, Burkholderia cepacia complex, National Hospital of Sri Lanka

Introduction

Burkholderia cepacia complex (BCC) is a Gram negative aerobic bacillus distributed in the soil and various aquatic environments.[1] It plays a role in the commercial industry related to biocontrol, bioremediation and plant growth promotion which can also create an environment to be a reservoir of this bacterium.[1]

There are 17 closely related species found to be in the complex. *B. cepacia* complex can cause blood stream infection, pneumonia, surgical wound infection and genitourinary tract infection especially in immunocompromised hosts such as patients with chronic granulomatous disease (CGD) and cystic fibrosis.[1] A high level of intrinsic resistance in this organism to different groups of antibiotics makes treatment options very difficult.

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Nosocomial outbreaks associated with BCC are known to be due to contaminated disinfectants, nebulizer solutions, mouth wash, medical devices and intravenous solutions.[1] It can be also due to contaminated fresh frozen plasma (FFP) and cryoprecipitate due to thawing in water baths.[2]

Three outbreaks in other government hospitals had occured in July and August 2017 without identification of the source (Personal communication). At that time, our rate of isolation of BCC from the blood cultures had not reached an outbreak situation and remained static as it was in the past. Later, during the period between 14th August and 13th September 2017, we observed a steep increase in the isolation of BCC from blood cultures of patients from several intensive care units (ICU) and wards of the hospital with isolates having the same antibiotic susceptibility profile. This unprecedented finding led to a detailed investigation for a possible common source, as finding the source was essential to control the outbreak.

Methods and materials

There were 27 positive blood cultures of BCC from patients in different ICUs and wards of NHSL from 14th August to 13th September 2017. The isolates had the same antibiogram. Two of these patients died because of possible sepsis following BCC infection. Others were treated with appropriate antibiotic therapy and improved clinically. This increase in isolation of BCC in blood cultures initiated an outbreak investigation to find the possible common source which caused the outbreak.

Medical devices and solutions were tested for bacterial contamination to identify the possible source. The devices tested were different sizes of syringes, IV cannulae and burette sets. Other solutions tested were opened and unopened 15 ml ipratropium bromide nebulizer solutions (two brands), salbutamol nebulizer solutions (one brand), working and stock solutions of disinfectants, 5% dextrose solutions and normal saline solutions.

Sterile water was aspirated under aseptic conditions into sterile syringes, cannulae and burette sets, decanted into sterile tubes and centrifuged. The deposit was used for culture. Five ml of all liquid samples were directly inoculated onto the culture media. Blood agar, chocolate agar and MacConkey agar were inoculated and incubated overnight at 37 ºC. Samples were also inoculated into Brain Heart Infusion broth which was subcultured after overnight incubation at 37 ºC.

The identification and antibiotic susceptibility testing (AST) of the isolates were done by the BD Phoenix™ automated identification and susceptibility testing system.

Results

Total isolates of BCC from blood culture were 27 during the period of 14th August to 13th September 2017. All the blood culture isolates were identified as *Burkholderia cepacia* complex and AST were the same.

Table 1 BCC isolates of blood cultures from different units of the institute

Units	Number of isolates
Intensive Coronary Care Unit (ICCU)	7
Coronary Care Unit (CCU)	2
Neurotrauma Intensive Care Unit (NTICU)	6
Medical Intensive Care Unit (MICU)	5
Neurosurgical Intensive Care Unit (NSICU)	2
Surgical Intensive Care Unit (SICU) - Recovery Unit	2
Wards	3
Total	27

All of the opened and unopened 15ml ipratropium bromide nebulizer solutions of one of the two brands tested were found to be positive for the same organism with an identical morphological pattern. Cultures from other solutions and devices were negative.

The colonies of the isolates were opaque, glistening and non pigmented on blood agar and on MacConkey agar, they were non lactose fermenting. They were catalase and oxidase positive. The isolates were confirmed by BD Phoenix^{TM} automated identification and susceptibility testing system as BCC. All the isolates had the same antibiotic susceptibility pattern.

All the available stocks of different batches of 15 ml ipratropium bromide nebulizer solutions of the particular brand in the hospital were then tested and became positive for BCC with the same antibiogram.

Ultimately we found that the BCC isolates from the blood cultures and the isolates from the ipratropium bromide nebulizer solutions were identical in their antibiotic susceptibility profile. This suggested that the 15 ml ipratropium bromide nebulizer solution of one particular brand was the common source for the outbreak.

Discussion

The observation of a rise in isolation of *B. cepacia* complex with the same AST pattern from blood cultures during the period of 14th August to 13th September 2017 necessitated the search for a possible common source of the outbreak.

The outbreak investigation was started immediately to find the possible source to control the outbreak and it was initiated in the ICUs as there were several blood cultures positive for BCC from the ICUs.

According to the results of the extensive investigation, 15 ml ipratropium bromide nebulizer solutions of a particular brand were the possible common source for the outbreak since the BCC isolates of blood cultures and the solution were identical in their antibiotic susceptibility. The patients who had positive blood cultures for BCC had been nebulized with the particular nebulizer solution during their stay in the hospital before their blood cultures became positive.

This particular brand of nebulizer solution had not been in use for nebulization before August 2017.

The nosocomial outbreaks of BCC reported worldwide revealed that sources for outbreaks were contaminated disinfectants, nebulizer solutions, mouth wash, medical devices and intravenous solutions.[1] A study carried out in Saudi Arabia in 2006 found that the outbreak of BCC bacteraemia was due to contaminated salbutamol nebulizer solution[3]. Studies done elsewhere have implicated contaminated nasal spray[4], contaminated rubber stopper of sealed multidose amikacin vials[5], contamination of the gel applied to the ultrasound probe used to guide the insertion of a central venous catheter[6] and intravenous fentanyl.[7]

Actions taken

Identifying the possible source of the outbreak enabled the outbreak from spreading further by informing the relevant authorities, i.e Chairman and CEO of National Medicines Regulatory Authority (NMRA), Deputy Director General and the Director of Medical Supplies Division (MSD) and the Deputy Director General of NHSL with the recommendation for an alternative ipratropium nebulizer solution. A set of samples from four different batches of unopened nebulizer solution of the particular brand was sent to NMQAL for quality testing.

Consultant Microbiologists of other hospitals were alerted and advised to test the available ipratropium bromide nebulizer solutions of the particular brand in their hospitals. The solutions found in other hospitals too grew the same organism with the same AST. Finally, it was found that around 15 batches of the particular brand of nebulizer solutions were contaminated with the same strain of BCC.

Recommendations

We suggested to the hospital authorities to use an alternative solution for nebulization as there was evidence of bacterial contamination in the particular nebulizer solution.

Prevention of future outbreaks

Relevant standards should be maintained and monitored strictly and regularly regarding production of medical devices and solutions in Sri Lanka. Pre and post marketing surveillance of these products also have to be ensured for the safety of patients.

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Conflicts of interest

There are no conflicts of interests.

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