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Short report

Outbreak of *Pseudomonas fluorescens* bloodstream infection in a coronary care unit☆

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SUMMARY

An outbreak of *Pseudomonas fluorescens* infection in six patients in a coronary care unit was associated with a source not previously reported, namely the ice bath used for cardiac output determinations. Outbreaks of pseudobacteraemia caused by *P. fluorescens* and occasional blood transfusion-associated bloodstream infection (BSI) have been described. However, during the last two decades, two outbreaks of *P. fluorescens* BSI have been described and this article reports a third. Isolation of *P. fluorescens* in blood cultures must alert clinicians to the possibility of contamination of infusate, lock solutions or catheter flush.

Introduction

Like other members of the genus *Pseudomonas*, *Pseudomonas fluorescens* is widespread in nature with a predilection for moist environments. Due to its low virulence, it is an infrequent cause of human infection and has been implicated mainly in outbreaks of pseudobacteraemia.[1–8] Nevertheless, true infections have also been described — several cases of blood transfusion-associated *P. fluorescens* bloodstream infection (BSI) did occur in the 1980s.[9–12] During the last two decades, two outbreaks of *P. fluorescens* BSI have been described.[14,15] The source of the first outbreak was not identified.[13] During the most recent outbreak, BSI occurred following exposure to contaminated heparinized saline flush.[14] The present article reports a new outbreak of *P. fluorescens* BSI that developed from December 2007 to April 2008. The objective of the present investigation was to identify and eradicate the source of *P. fluorescens* contamination.

Methods

The present outbreak occurred in the eight-bed coronary care unit of the Hospital de la Santa Creu i Sant Pau, a 600-bed university tertiary care hospital in Barcelona, Spain.

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Case patients were defined as those who had a positive blood culture and/or catheter tip positive for *P. fluorescens* from December 2007 to April 2008. Data were collected on demographic characteristics of the patients, symptoms, microbiology results, and outcomes. During the epidemiological investigation, types of intravascular devices, intravenous fluids, medications and blood products administered to patients were analysed as well as procedures for placing and maintaining catheters and for obtaining blood samples for culture, and any other manipulation of catheters in search of a potential source for the infection. A review of potential breaches in infection prevention and control practices was performed using interviews with healthcare personnel and observations of practices in the unit. Specifically, practices involving manipulation of intravascular catheters were directly observed. Cultures of potential point-source contaminants in the environment were performed.

Blood culture sets of two bottles were incubated in the semi-automated system BacT Alert (bioMérieux, Marcy l'Etoile, France). For the culture of intravascular catheter tips, the semiquantitative method in which the 5 cm distal portion of the catheter is rolled across a blood agar plate four times was used. Environmental samples were cultured on blood agar plates. Isolates were obtained from routine cultures and were identified using standard methods. The disc diffusion susceptibility test was performed according to Clinical Laboratory Standards Institute guidelines, using commercially available discs (Bio-Rad, Marnes La Coquette, France).

Clinical isolates were compared using pulsed-field gel electrophoresis (PFGE) following *Xba*I digestion (Roche) of chromosomal DNA. DNA bands were separated into 1% agarose gels (Seakem ME Agarose, Lonza) in 0.5 × Tris–borate–EDTA (TBE) buffer. Electrophoresis was performed at 14 °C in 0.5 × TBE buffer with a CHEF DRIII apparatus (BioRad) using the following conditions: 4 to 8 seconds for 8 hours; 10 to 15 seconds for 20 hours.

Results

We identified six patients with *P. fluorescens* recovered from blood cultures, intravenous catheter tip cultures, or both. This was the first time that *P. fluorescens* was isolated from human samples in our hospital. All patients were male, aged 15–75 years who had been admitted to the coronary care unit during the study period (Table I). Three of the six patients had a fever without apparent source of infection (with the exception of catheter), and *P. fluorescens* was recovered from cultures of blood samples drawn from a peripheral vein (Table I, patient nos. 1, 3 and 4); the same micro-organism was also grown from the culture of the tip of the explanted catheter in one patient (Table I, patient no. 4). These three patients had their catheters removed and two of them received treatment with intravenous antibiotics; all three eventually recovered. In another three patients, *P. fluorescens* was only isolated from catheter tips and was considered to represent catheter colonization (Table I, patient nos. 2, 5 and 6). All isolates had identical antibiotypes resistant to aztreonam and susceptible to piperacillin, ceftazidime, cefepime, ciprofloxacin, gentamicin, amikacin, tobramycin and trimethoprim-sulphamethoxazole. The minimum inhibitory concentration for imipenem and meropenem ranged from 2 to 8 mg/L.

The occurrence of six cases of bacteraemia or catheter colonization with an unusual bacterial species during a six-month period in the coronary care unit suggested a common source of infection. Epidemiological investigations revealed that all patients had pulmonary artery catheters, and frequent cardiac output determinations were performed in these patients. During the epidemic period, determination of cardiac output was performed in the coronary care unit using the cold thermodilution injection technique. This technique involved injecting cooled saline and cooling was accomplished through individual syringes of saline in ice baths. Thus, the saline used for injection was drawn into sterile 10 mL disposable plastic syringes, which were then closed with plastic caps and placed in a stainless steel bucket filled with ice. The injectate was dated as to when the solution was drawn and was discarded after 24 h, if not used. For each cardiac output measurement, approximately two to three syringes of solution were injected into the patient. It was suspected that the probable source for the *P. fluorescens* outbreak was contamination of the ice bath used to cool syringes for cardiac output determination.

Samples were obtained for culture from disinfectants (culture methods included neutralizing agents) and solutions used for catheter insertion and maintenance, including skin disinfectants and heparin solutions, cardiac output injectable solution from syringes, cardiac output ice bath, and ice from unopened packs. Additionally, cultures were performed from the sinks, soaps and lotions. After performing cultures from 20 samples, we isolated *P. fluorescens* only from the cardiac output ice bath. Isolates of *P. fluorescens* from five patients (patient nos. 2–6) were available for molecular typing. PFGE demonstrated that isolates obtained from patients and from the cardiac output ice bath were genetically indistinguishable (Figure 1). The outbreak was terminated when a new method of closed cardiac output estimation that involves injecting room-temperature saline was introduced. No further episodes of *P. fluorescens* infections have occurred at our hospital from May 2008 to March 2012.

Discussion

To the best of our knowledge, this outbreak of nosocomial BSI is the second reported cluster shown to be secondary to contaminated cardiac output injectate (and the first one supported by a genetic relatedness study). Moreover, this is the third outbreak of BSIs caused by *P. fluorescens* unrelated to blood transfusions.

Contaminated ice baths used for thermodilution cardiac output studies were demonstrated to be responsible for another previous outbreak of BSI involving four patients.[16] This outbreak was caused by *Ewingella americana*, a member of the Enterobacteriaceae family that is rarely reported as a human pathogen. Positive cultures for *E. americana* were obtained from the cardiac output ice bath and from the cardiac output injected solution from a syringe. Based on this and the current outbreak, we can postulate that syringes used to perform thermodilution cardiac output determination underwent bacterial contamination when cooled with ice and in turn colonized the pulmonary arterial catheters. Both outbreaks were terminated by the introduction of a closed cardiac output injectate delivery system. Other nosocomial infections have been occasionally traced to contaminated ice,