

Pseudomonas aeruginosa outbreak linked to sink drainage design

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Abstract. *Background:* This paper describes an outbreak of *Pseudomonas aeruginosa* (PAE) that occurred in a haematology ward between 8 January and 24 March 2009. Four patients had healthcare-associated infections due to PAE which was recovered in the groin, blood and perianal tissue.

Aim: This report highlights the risks associated with the use of sinks and outlines the approach used to manage the outbreak.

Methods: Subsequent investigations showed that a contaminated sink drainage system represented the possible source of spread. Of a total of 21 environmental samples taken, two samples from the sink drainage system showed a similar susceptibility pattern as the patients involved in the outbreak. Four cycles of disinfection of the sink drainage systems were attempted with various modalities.

Findings: PAE contamination of the sink drains at the multiple grooves in the drains proved difficult to disinfect adequately, despite using several cleaning protocols. The outbreak was finally terminated following a change in the sink drainage system to one without grooves, hence preventing any further PAE colonisation.

Conclusion: Our experience demonstrated that the design of the sink drainage system may be a potential source of PAE contamination for an immunocompromised patient.

Received 4 April 2013, accepted 17 June 2013, published online 9 July 2013

Introduction

Pseudomonas aeruginosa (PAE) outbreaks have been described to be associated with environmental contamination in different healthcare settings.^{1–3} We describe a PAE outbreak in a haematology ward at a 1700-bed acute tertiary-care general hospital in Singapore in 2009. This report highlights the risks associated with the use of sinks and outlines the approach used to manage the outbreak.

Methods

Outbreak overview

The outbreak occurred from 8 January to 24 March 2009 at a 25-bed haematology ward (nine single rooms and four 4-bed cubicles). It involved four patients with PAE susceptible to Polymyxin B only, isolated from groin, blood and perianal tissue. Possible outbreak cases were defined as patients admitted to the affected area during the outbreak period who were colonised or infected with PAE isolates that matched the antibiogram of the outbreak strain. An epidemiologic investigation was carried out to search for potential case–case links or case–common environmental-source links. Patient demographic and clinical information about the outbreak cases were collected by means of a retrospective review of the medical records and the laboratory information system.

Environmental studies

Environmental screening was done after the third case was identified. Environmental samples for culture and susceptibility testing were taken from sink surfaces, sink drainage systems, douching spray heads, shower heads, tap outlets and air conditioners. Sterile swabs moistened with sterile saline were used to swab the areas or equipment except when the areas were already moist before swabbing.

Microbiologic investigations

Antimicrobial susceptibility was determined for the following antimicrobial agents: piperacillin+tazobactam, aztreonam, ceftazidime, cefepime, meropenem, imipenem, gentamicin, amikacin, ciprofloxacin, and polymyxin with the disk diffusion method (Kirby–Bauer). Isolates were classified as susceptible, intermediate or resistant, according to the standard criteria. Minimum inhibitory concentrations (MICs) of piperacillin+tazobactam, cefepime, imipenem, meropenem, amikacin, and ciprofloxacin were determined by the E-test method (AB Biodisk, Solna, Sweden).

Molecular studies

Macrorestriction analysis resolved by pulsed-field gel electrophoresis (PFGE) was performed on a run time of 20 h

Implications

- Infection control should play a significant role in reviewing design of healthcare facilities.
- The design of sink drainage systems in clinical areas housing immunocompromised patients should be evaluated.
- Sink drainage systems that allow easy cleaning and maintenance by Environmental Services should be chosen.

and switch times of 5.35 s (Bio-Rad CHEF Mapper; Bio-Rad) with SpeI. The PFGE band patterns were analysed with Bionumerics (Applied Maths NV, Sint-Martens-Latem, Belgium), and all strains with more than 85% similarity were considered to belong to the same clone, using the criteria previously developed by Tenover *et al.*⁴

Outbreak control measures

Immediate actions were taken following the identification of the second case. Ward staff were informed to be vigilant and to step up hand hygiene practices besides practicing contact precautions on the outbreak cases, who were nursed in single rooms. Several methods of cleaning the sinks were attempted to remove PAE colonisation.

Results

Patient characteristics

Four patients were isolated with *Pseudomonas aeruginosa* susceptible to Polymyxin B only (Table 1). The mean age was 44 years (range 17 to 59 years); three patients were female and one was male. The main underlying diseases were acute myelogenous leukemia (AML) and myelodysplastic syndromes (MDS). The sites of isolation were: 50% blood ($n = 2$), 25% ($n = 1$) from perianal tissue, and 25% ($n = 1$) from the groin. The mean duration of hospitalisation before the first

Table 1. Patients with *Pseudomonas aeruginosa* involved in outbreak

Case	Sex	Age (years)	Service	Diagnosis	Culture site
Case 1	Female	47	Haematology	Myelodysplastic syndromes (MDS)	Groin
Case 2	Female	53	Haematology	Acute myelogenous leukemia (AML)	Blood
Case 3	Male	59	Haematology	Acute myelogenous leukemia (AML)	Perianal tissue
Case 4	Female	18	Haematology	Acute myelogenous leukemia (AML)	Blood

Table 2. Environmental cultures results

Number	Location	Specimen	Date tested	Results
1	Preparation room	Tap outlet	28 Jan. 2009	Negative
2	Preparation room	Sink drainage	28 Jan. 2009	Negative
3	Room 1	Douching spray head	28 Jan. 2009	Negative
4	Room 1	Tap outlet	28 Jan. 2009	Negative
5	Room 1	Sink drainage	28 Jan. 2009	<i>Pseudomonas aeruginosa</i> sensitive to PB only
6	Room 1	Shower head	28 Jan. 2009	Negative
7	Room 15	Air-conditioner	28 Jan. 2009	Negative
8	Room 15	Tap outlet	28 Jan. 2009	Negative
9	Room 15	Sink drainage	28 Jan. 2009	<i>Pseudomonas aeruginosa</i> sensitive to all antibiotics tested
10	Room 15	Shower head	28 Jan. 2009	Negative
11	Room 6	Air-conditioner	28 Jan. 2009	Negative
12	Room 6	Tap outlet	28 Jan. 2009	Negative
13	Room 6	Sink drainage	28 Jan. 2009	<i>Pseudomonas aeruginosa</i> sensitive to PB only
14	Room 6	Shower head	28 Jan. 2009	Negative
15	Room 1	Sink surface	2 Feb. 2009	<i>Pseudomonas aeruginosa</i> sensitive to all antibiotics tested
16	Room 10	Tap outlet	2 Feb. 2009	Negative
17	Room 10	Sink drainage	2 Feb. 2009	Negative
18	Room 10	Shower head	2 Feb. 2009	Negative
19	Room 10	Sink surface	2 Feb. 2009	Negative
20	Room 15	Sink surface	2 Feb. 2009	Negative
21	Room 6	Sink surface	2 Feb. 2009	Negative
22	Room 15	Sink surface	18 Feb. 2009	<i>Pseudomonas aeruginosa</i> sensitive to PB only

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