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Outbreak of *Stenotrophomonas maltophilia* Bacteremia Among Patients Undergoing Bone Marrow Transplantation: Association With Faulty Replacement of Handwashing Soap

Jeffrey D. Klausner, MD, MPH; Carol Zukerman,
RN, CIC; Ajit P. Limaye, MD; Lawrence Corey, MD

ABSTRACT

Using molecular typing methods, we confirmed an outbreak of *Stenotrophomonas maltophilia* among bone marrow transplant patients. The likely source was a healthcare worker who may have washed with moisturizer instead of soap between patients. Hospital epidemiologists need to go beyond antibiograms when evaluating outbreaks and be vigilant about all aspects of hand washing (*Infect Control Hosp Epidemiol* 1999;20:756-758).

Stenotrophomonas maltophilia is an important cause of nosocomial infection among ventilated and immunocompromised patients and among patients receiving broad-spectrum antimicrobials.^{1,3} *S. maltophilia* is found widely in the water and soil and has been isolated frequently from hospital equipment, including disposable nebulizers, tracheal suction catheters, and respirator circuits.^{4,5} Because of the ubiquity of *S. maltophilia*, determination of the source of infection in patients is difficult.

Traditionally, the antibiogram has been useful in determining the relatedness of isolates and offering evidence of transmission. *S. maltophilia*, however, often is resistant to many antimicrobials, and antimicrobial-susceptibility patterns of clonally related isolates may differ, rendering the antibiogram less useful in epidemiological investigation.⁶ Recently, new methods using various gel electrophoresis techniques that define strain genotypes have been used to identify clonal isolates of bacteria and determine transmission in outbreak settings.^{2,7,8} In this report, we describe an outbreak of *S. maltophilia* bacteremia among mechanically ventilated patients undergoing bone marrow transplantation (BMT) and the role that similar-appearing hand lotion and handwashing soap may have played in the development of this outbreak.

METHODS

S. maltophilia was isolated from blood cultures and identified using the API 20 E System (bioMérieux Vitek, Inc, St Louis, MO). Antimicrobial susceptibilities were performed and interpreted using the Kirby-Bauer disc diffusion method according to National Committee for Clinical

Laboratory Standards guidelines. Pulsed-field gel electrophoresis (PFGE) was performed at the University of Washington Molecular Typing Laboratory, Seattle. *S. maltophilia* isolates from case-patients were analyzed in parallel with isolates from noncase-patients and isolates from stored specimens in two separate experiments by two different technicians.

We performed a case-control study evaluating the exposures of case- and control-patients to hospital personnel. A case was defined as *S. maltophilia* bacteremia during July or August 1997 in a patient hospitalized for BMT. The exposure period was defined as the 11 days beginning July 19 (3 days before obtaining the first sputum specimen that grew *S. maltophilia*) and ending July 29 (the date of the last such sputum specimen). Because all case-patients were mechanically ventilated and the number of noncase BMT patients who were mechanically ventilated during the exposure period was limited, two groups of control-patients were identified. Group 1 control-patients were BMT patients mechanically ventilated at least 4 of 10 days during the exposure period. Group 2 control-patients were non-BMT patients mechanically ventilated in hospital A for at least 4 of 10 days during the exposure period. We reviewed patient medical records to obtain demographic and clinical information, and we reviewed employee time sheets and billing data and interviewed staff to identify clinical personnel who came in contact with patients during the exposure period.

We collected cultures of case-patient room surfaces, sinks, and ventilator equipment. In addition, we inspected the soap dispensers and made note of handwashing supplies. A confidential, self-administered questionnaire was offered to healthcare workers who came in contact with case- or control-patients during the exposure period. We asked about soap and moisturizing-lotion knowledge and the use of different soap and moisturizing-lotion products for hand washing when taking care of mechanically ventilated patients. Categorical data were compared by using chi-square and Fisher's Exact tests.

RESULTS

During a 3-week period in July and August 1997, three cases of *S. maltophilia* bacteremia occurred in mechanically ventilated patients undergoing BMT. All three case-patients were in separate private rooms, in two of three nursing units. All three case-patients had a sputum culture negative for *S. maltophilia* on admission and became sputum-culture-positive for *S. maltophilia* during the exposure period. All three case-patients had undergone BMT within the past month for hematological malignancy and

TABLE
ANTIBIOTIC SUSCEPTIBILITY* PATTERNS OF *STENOTROPHOMONAS MALTOPHILIA* CASE ISOLATES, JULY 1997

Antibiotic	Case-Patient Isolate 1 (Zone Size mm)	Case-Patient Isolate 2 (Zone Size mm)	Case-Patient Isolate 3 (Zone Size mm)
Amikacin	R (6)	R (6)	R (6)
Aztreonam	R (6)	R (6)	R (6)
Cefixime	R (6)	R (6)	R (6)
Ceftazidime	S (23)	R (6)	R (6)
Ceftriaxone	R (6)	S (21)	S (31)
Ciprofloxacin	R (13)	R (6)	R (6)
Gentamicin	R (6)	S (24)	S (24)
Imipenem	R (6)	R (6)	R (11)
Piperacillin	R (6)	R (6)	R (6)
Ticarcillin-clavulanate	I (17)	R (6)	R (16)
Tobramycin	R (6)	R (13)	S (33)
Trimethoprim-sulfamethoxazole	R (6)	R (6)	I (13)
	S (17)	S (24)	S (24)

Abbreviations: I, intermediate; R, resistant; S, sensitive.

* As defined by the National Committee for Clinical Laboratory Standards guidelines.

had a mean age of 37 years; two were female. The mean duration of mechanical ventilation before the first episode of *S maltophilia* bacteremia was 23 days. The median number of different antimicrobials during the week prior to the first positive sputum culture for each case-patient was three: all were on a carbapenem. During the remainder of July and August 1997, there were two additional *S maltophilia* isolates from BMT patients; none were invasive. All three case-patients died from sepsis within 2 weeks of the onset of bacteremia.

The Table shows the antibiograms of the *S maltophilia* isolates from the case-patients. Isolates differed from each other by susceptibility to at least two different antimicrobials, but all had identical PFGE patterns. In contrast, five *S maltophilia* isolates from epidemiologically unrelated patients showed different PFGE patterns. We identified two group 1 control-patients and six group 2 control-patients. There were no physicians associated with care of case-patients when using group 1 patients as controls. Using group 2 control-patients to evaluate exposure among other healthcare workers, there was one healthcare worker (a respiratory-care technician) who took care of all case-patients and none of 6 control-patients (odds ratio, undefined; $P=.012$).

Of the 16 environmental cultures from case-patient rooms, 2 cultures (from the ventilator tubing reservoir and from the overflow bucket from one case's room) were positive for *S maltophilia*. Upon inspection of the handwashing equipment and supplies, we noted that each patient room had two soap dispensers: one hand-activated dispenser containing liquid hand soap and one foot-activated dispenser containing chlorhexidine gluconate 2% antimicrobial foam soap. Next to the soap dispensers was a third hand-activated dispenser containing foam moisturizing lotion. Both the antimicrobial soap and moisturizing lotion were a white foam product and were packaged in inter-



FIGURE. Photograph of antimicrobial foam soap and moisturizing foam lotion containers and labels.

changeable disposable containers with similar labels (Figure). It was determined by questioning staff that, for at least 1 day during the exposure period, the antimicrobial soap dispenser in one case-patient's room (case 2) actually contained foam moisturizing lotion.

Forty-seven (98%) of 48 respondents to the handwashing survey knew that there were two kinds of soap (liquid hand soap and antimicrobial foam soap) and one kind of moisturizing lotion in each patient room on the BMT units. More persons reported using the antimicrobial foam soap than the liquid hand soap (most of the time or always, 55% vs 42%; $P=.19$). The foam moisturizing lotion was infrequently used (most of the time or always, 8%). The healthcare worker identified as the probable source of transmission reported using antimicrobial foam soap most of the time and foam moisturizing lotion sometimes.

DISCUSSION

Our study documents the nosocomial acquisition and transmission of *S maltophilia* among mechanically ventilated, severely immunocompromised patients receiving multiple antimicrobials, three risk factors that previously have been shown to increase the risk of *S maltophilia* infection.^{1,3} Pulsed-field gel electrophoresis patterns of the three case isolates were identical, whereas the antibiograms were distinctly different. We found a strong epidemiological association between one healthcare worker and case-patients. In addition, there was a lapse in environmental infection control during the outbreak period, when an antimicrobial foam soap dispenser in a case-patient's room contained foam moisturizing lotion.

A previous outbreak of *S maltophilia* found antibiograms useful in identifying the outbreak isolate and describing the source of the outbreak.⁹ More recently, however, molecular typing methods, and particularly PFGE, have been found to be the most discriminatory and accurate method for typing *S maltophilia*. The limitations of antibiograms to discriminate between isolates have been documented.⁷ In the present study, using antibiogram data alone would have led to the incorrect conclusion that the isolates from case-patients were unrelated.

The strong association in our study between a healthcare worker and cases of *S maltophilia* bacteremia is consistent with studies that have isolated *S maltophilia* from the hands of a nurse and demonstrated the high prevalence of gram-negative bacteria on the hands of hospital personnel.^{6,10} The healthcare worker implicated in this study took care of all three case-patients and none of the control-patients. We selected control-patients with the same opportunity of exposure to pertinent healthcare workers as case-patients. It is unlikely that this association occurred by chance, and there were no apparent confounders that might explain why controls were not exposed to the implicated healthcare worker.

We suggest that the implicated healthcare worker, after taking care of case 2 on July 26-27, washed his or her hands with what the healthcare worker thought was antimicrobial foam soap and then tended to respiratory care of case 3 and transmitted the clonal isolate. During this time period, because of the similarity between the antimicrobial foam soap and foam moisturizing-lotion containers and labels, the antimicrobial foam soap dispenser had been filled with foam moisturizing lotion. That the antimicrobial soap and moisturizing lotion were both white foam made it unlikely that the healthcare worker was aware that he or she washed his or her hands with moisturizing lotion. The results of the handwashing survey suggest that hospital staff were aware of the various available soaps and lotions and preferred to use soap in its foam form when caring for mechanically ventilated patients. The soap and moisturizing-lotion manufacturer was contacted, and the labels were changed to reduce future improper replacement of the dispensing containers and possible mistakes in hand washing.

From the Departments of Medicine and Laboratory Medicine (Drs. Klausner, Limaye, Corey), University of Washington and the

Department of Epidemiology (Ms. Zukerman), Swedish Medical Center, Seattle, Washington.

Address reprint requests to Jeffrey D. Klausner, MD, MPH, Director, STD Control and Prevention Services, San Francisco Department of Public Health, 1360 Mission Ave, Suite 401, San Francisco, CA 94103.

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Usefulness of Pulsed-Field Gel Electrophoresis in Assessing Nosocomial Transmission of Pertussis

Michèle Nouvellon, MD; Jean-François Gehanno, MD; Martine Pestel-Caron, PhD; Christian Weber; Jean-François Lemeland, PhD; Nicole Guiso, PhD

ABSTRACT

During a 2-week period, three infants with a cough lasting at least 8 days with whoops, were admitted to the pediatric unit; *Bordetella pertussis* was isolated from nasopharyngeal aspirates collected from the three infants. Approximately 1 week later, a nurse working on the same unit developed influenza-like symptoms followed by whooping cough; *B pertussis* was isolated. Isolates from the nurse and from one of the infants were shown to be indistinguishable by pulsed-field gel electrophoresis. These data demonstrate that *B pertussis* transmission to healthcare workers is possible and emphasize the need to use respiratory protection devices (Droplet Precautions) for healthcare workers having close contact with infected children (*Infect Control Hosp Epidemiol* 1999;20:758-760).