FIGURE. Pulsed-field gel electrophoresis (PFGE) of *B. cepacia* strains. The λ denotes the lambda ladder PFGE weight marker (48.5 kbp concatemers). *Lane 1,* an epidemiologically unrelated strain recovered from a cystic fibrosis patient; *Lane 2,* strain retrieved from the catheter of patient 2; *Lanes 3-7,* strains isolated from the blood of patients 1, 2, 3, 4, and 5, respectively; *Lane 8,* strain recovered from a sample of the tap water of hemodialysis station 3; *Lanes 9* and *10,* strains recovered from 2 bottles of 2.5% chlorhexidine solution.

alysis units discontinue the use of diluted alcohol-free chlorhexidine solution. In fact, the manufacturer's instructions recommend adding alcohol when diluting the chlorhexidine for skin disinfection before catheter insertion and during follow-up care.

M. P. Romero-Gómez, MD; M. I. Quiles-Melero, MD;
P. Peña García, MD; A. Gutiérrez Altes, MD;
M. A. García de Miguel, MD; C. Jiménez, MD;
Sylvia Valdezate, PhD; J. A. Sáez Nieto, PhD

From the Departments of Microbiology and Parasitology (M.P.R.-G., M.I.Q.-M., P.P.G., A.G.A.) and Nephrology (M.A.G.M., C.J.), La Paz University Hospital, and the Servicio de Bacteriología, Centro Nacional de Microbiología, Instituto de Salud Carlos III, Majadahonda (S.V., J.A.S.N.), Madrid, Spain.

Address reprint requests to M. P. Romero-Gomez, Department of Microbiology and Parasitology, La Paz University Hospital, Paseo de la Castellana, 261, 28046 Madrid, Spain (maryfirm2000@msn.com).

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Outbreak of *Pseudomonas aeruginosa* Infections Associated With Contaminated Water in a University Hospital in Tunisia

To the Editor—*Pseudomonas aeruginosa* is a major pathogen that causes nosocomial infections, particularly in ventilated and/or immunocompromised patients. This organism is ubiquitous in moist environments and is frequently found in various hospital sites. Strains involved may be spread via the hands of healthcare workers or by an environmental source, such as contaminated water.[1-5] The installation of surveillance systems that detect outbreaks of nosocomial infection is important; sources of infection may be characterized and isolated, and modifications in procedures made to stop further infections from occurring. Infection is a frequent event in surgical wards, such as the urology ward, where endoscopy and surgical procedures are common.

We describe an outbreak of *P. aeruginosa* infection that occurred between July and September 2005 in the urology ward in the University Hospital Sahloul in Tunisia, a 548-bed hospital. An investigation of the environment was done to determine the potential source of infection and to implement control measures to stop the outbreak. The urology

ward is a 60-bed unit situated in the third floor of the hospital. Endoscopic procedures are performed using an ultraviolet water disinfection system; this technology has been in place since the hospital opened in 1990. Endoscopes were disinfected with a quaternary ammonium compound and gluteraldehyde and rinsed with water.

Twelve patients were diagnosed with *P. aeruginosa* urinary tract infection. Ten of those patients had undergone a ureteroscopic procedure 24 to 72 hours before diagnosis of infection. Isolates were recovered from urine specimens.

An environmental survey was done in order to determine potential reservoirs or sources of contamination. Water was sampled at 3 points related to the ureteroscopic equipment: the water outflow from the sterilizer, the water reservoir container, and the irrigation tube in contact with the patient. Samples of solutions used for disinfection of the equipment and swab samples of environmental surfaces, cystoscopes, ureteroscopes, and resectoscopes were cultured.

Strains recovered from patients and from environmental specimens were genotyped by macrorestriction of genome DNA with *Spe*I, followed by pulsed-field gel electrophoresis (PFGE).[6,7] Banding patterns obtained were analyzed by visual inspection according to criteria described by Tenover et al.[8]

The 10 strains recovered from patients who had undergone endoscopy showed the same PFGE banding pattern as isolates obtained from water outflow, reservoir, and irrigation specimens. The 2 strains recovered from patients who had not undergone endoscopy were different in antibiotype profile and in PFGE pattern (Figure).

This outbreak of *P. aeruginosa* infection was caused by the use of inadequately disinfected water used in ureteroscopic procedures. In our hospital, water for bladder irrigation is passed through an ultraviolet disinfection system. This system failed to disinfect the water and its use resulted in the outbreak. The use of commercial sources of sterile water was not feasible because of cost. An alternative system consisting of filtration with 3 filters (with pore sizes of 25 mm, 0.5 mm, and 0.2 mm) was recommended by the hygiene department and implemented. After the outbreak and the resulting implementation of the new water system, we performed routine and systematic surveillance for 3 months of the environment, equipment, water sources, and patients who had undergone ureteroscopy. We found no further episodes of patient infection with *P. aeruginosa* or other bacteria and no contamination of the environment with the epidemic strain.

In conclusion, we found that the source of *P. aeruginosa* that caused the outbreak was the water used for bladder irrigation during endoscopic procedures. Molecular typing systems were important in the detection of the outbreak and confirmation of the environmental source. The water disinfection system was changed and rigorous surveillance confirmed that further infections with the epidemic strain were prevented.
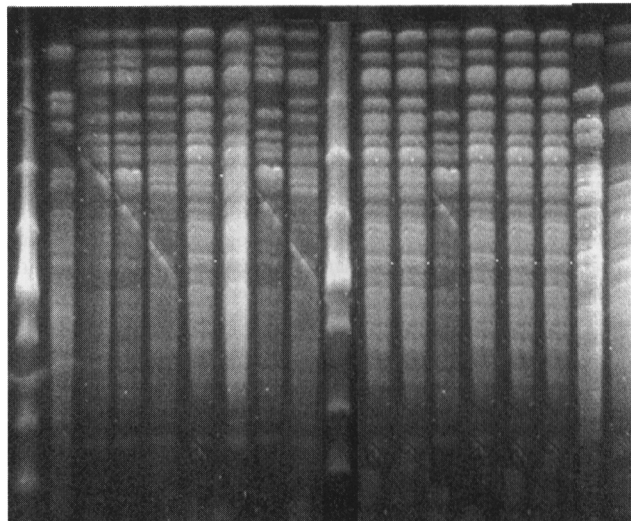

FIGURE. Pulsed-field gel electrophoresis banding patterns of chromosomal DNA of 15 *Pseudomonas aeruginosa* isolates from patients and from samples of water used in ureteroscopy. *Lane M*, molecular size marker; *lane LMG*, reference strain *P. aeruginosa* LMG*5827*; *lanes A, B,* and *C,* environmental isolates; *lanes 1 to 10,* isolates from patients who had undergone ureteroscopy; *lanes 11* and *12,* isolates from 2 other patients in the urology ward during the outbreak.

Wejdene Mansour, PhD; Olfa Bouallegue;
Houyem Said, MD; Safia Dahmen, PhD;
Noureddine Boujaafar

From the Unité des Infections à Bactéries Multirésistantes aux Antibiotiques, Laboratoire de Microbiologie (W.M., O.B., S.D., N.B.), and the Service d'Hygiène Hospitalière (H.S.), CHU Sahloul, Sousse, Tunisia.

Address reprint requests to Wejdene Mansour, Unité des Infections à Bactéries Multirésistantes aux Antibiotiques, UR/29/04, Laboratoire de Microbiologie, CHU Sahloul, 4054 Sousse, Tunisie (wejmbr@yahoo.fr).

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Modified Measles in a Healthcare Worker After Return From Travel

To the Editor—Measles is a highly communicable but vaccine-preventable infectious disease. It has been reported that modified measles, usually presenting with mild symptoms or even no symptoms, could occur in measles-vaccinated individuals during a measles outbreak.[1] Because of the protean clinical presentations of modified measles, it is difficult to raise clinical suspicion and/or make a rapid diagnosis without knowing the history of exposure. Early detection of modified measles would be a great advance in the interruption of disease transmission.

During a measles epidemic, healthcare settings can become a high-risk environment for measles transmission. Infected healthcare personnel can shed the measles virus particles during the prodromal period before clinical characteristics appear[2] and thus transmit the measles virus to susceptible coworkers, patients, and family members.[3] Moreover, susceptible patients in hospitals are often vulnerable individuals who will suffer severe complications of measles.[4] We describe a case of modified measles in a healthcare worker who had returned from travel to another country.

A 26-year-old male doctor, an intern, visited Tokyo, Japan, from May 19 to May 25, 2007, where a measles outbreak had occurred.[5] On June 2, after his return to Taiwan, he presented with fever and arthralgia, followed by a progressive pustule-like skin rash, which initially appeared on his trunk and face on the third day of illness and then extended to the extremities. He was hospitalized the next day. Isolation precautions for airborne pathogen were implemented during medical care. The diagnosis of modified measles was made on the basis of the following findings: (1) the absence of classic manifestations of measles, such as cough, conjunctivitis, coryza, or Koplik's spot; (2) travel to an area where measles is endemic; (3) a self-report of 2-dose measles vaccination in childhood; and (4) the presence of measles IgG in serum obtained at the acute stage of infection and of IgM in serum obtained at the convalescent stage. He was discharged without sequelae after 7 days' hospitalization.

During the prodromal phase of the patient's disease, 2 ambulatory patients and 25 medical personnel had close contact with the patient. The majority of these medical personnel (23 [92%]) recalled prior measles vaccination. Serological tests were performed on 32 staff members who cared for the patient, and 28 (87.5%) had detectable measles IgG in serum. No subsequent case of measles was identified.

Measles is still a major health problem because of its worldwide prevalence and its changing epidemiologic pattern in countries where measles vaccine is widely used.[2] Despite high levels of vaccine coverage, measles outbreaks still occur because of the accumulation of susceptible, unvaccinated persons and/or of persons without an adequate immunological response to measles vaccine. The diagnosis of measles during the present vaccine era has been complicated by the change in the age incidence of measles, the alteration of disease manifestations resulting from previous immunization, and the apparently sporadic occurrence of measles cases.[6] Cases of modified measles, which is characterized by an atypical or mild clinical presentation in a vaccinated patient, have been observed during a sustained outbreak.[1] The transmission of measles to patients exposed to sick healthcare workers has also been documented.[7] The highly contagious nature of the measles virus also underscores the need for appropriate infection control measures to reduce the risk of nosocomial transmission. In the investigation we describe, the delay in diagnosis and confirmation of the index case was problematic, as it resulted in a delay in contact tracing and follow-up.[8]

Acquisition of communicable diseases by healthcare personnel during travel poses a potential threat of nosocomial outbreak. At the present time, there are few rational recommendations for preventing travel-associated illness among healthcare personnel.[9] We suggest that healthcare workers be screened for measles IgG antibodies during their occupational health assessment, and nonimmune and uninfected individuals should be vaccinated. In our institution, studies are ongoing to assess the level of measles immunity in healthcare workers to determine strategies for measles screening and vaccination. To obtain adequate documentation of previous measles vaccination or immunity to measles for a large number of hospital employees when an acute case of measles occurs may be impractical.[7] Thus, vaccination of all employees under these circumstances seems appropriate.[7,10] In particular, measles vaccination status should be confirmed or updated at the time of employment. Moreover, information regarding healthcare personnel's travel to areas where measles is endemic should be regularly documented to allow evidence-based decisions about infection control policy to be made.