Occupational Transmission of *Neisseria meningitidis* — California, 2009

Neisseria meningitidis is a leading cause of bacterial meningitis and sepsis (*1*). The case-fatality rate for meningococcal disease is 10%–14%; survivors can experience brain damage, hearing loss, limb loss, and learning disabilities (*1*). On December 11, 2009, the California Department of Public Health (CDPH) initiated an investigation of two secondary cases of meningococcal disease in a police officer and a respiratory therapist following occupational contact with an unconscious adult. This report describes the events surrounding occupational transmission of *N. meningitidis* and recommends measures to control and prevent secondary transmission of *N. meningitidis*. Breaches in infection control, notification delays, and lack of worker exposure assessment and postexposure chemoprophylaxis (PEP) likely contributed to secondary cases. Employers should provide adequate infection-control training to staff members, PEP to exposed workers, and report notifiable diseases promptly.

On December 3, 2009, the index patient, a man aged 36 years, was found unconscious at home by four police officers who had been asked by the patient's family to check on his welfare. The patient was supine on his bed, and his airway was partially obstructed by vomitus. Vomitus and feces were on the patient's body and clothing. While positioned near the patient's head, one of the police officers (PO1) turned the patient to the patient's side and adjusted the patient's head to aid breathing. Immediately afterward, PO1 left the patient's room, reentering only to check on the patient from a distance. After firefighters and paramedics arrived, PO1 left the scene. Firefighters measured the patient's blood pressure and heart rate, and paramedics placed an intravenous line, performed airway suctioning, placed an oropharyngeal airway, administered oxygen, and transported the patient by ambulance to hospital A at approximately 7:00 p.m. on December 3.

In the emergency department (ED) of hospital A, the patient's airway was suctioned, and an endotracheal tube was placed. Blood was drawn for culture in the ED and the patient was treated with ceftriaxone. The patient was transferred to the intensive-care unit (ICU), and the treating provider considered meningococcal disease, 2009 pandemic influenza A (H1N1), and community-acquired pneumonia as possible causes of his illness. In the ICU, cerebrospinal fluid (CSF) was collected for gram stain and culture and the patient was treated with piperacillin and tazobactam, levofloxacin, ceftriaxone, and vancomycin.

On December 4, gram-negative diplococci were identified in the patient's CSF at 9:30 a.m. and in his blood at 3:30 p.m. On December 6, *N. meningitidis* was isolated from blood and on December 7, *N. meningitidis* also was isolated from CSF. On December 7, hospital A reported this case of laboratory-confirmed meningococcal disease (*2*) to its local health authority, 3 days after a presumptive diagnosis of meningococcal meningitis was made and 1 day after the diagnosis was confirmed by blood culture. The index patient was hospitalized for 20 days and then discharged to a rehabilitation facility on December 23.

On December 5, PO1, a man aged 30 years, experienced onset of sore throat and nausea that progressed to muscle pain with fever and vomiting. On December 9, he was examined by his primary-care physician. While at the physician's office, PO1 received a phone call from a colleague who informed him of the index patient's diagnosis of meningococcal disease. The primary-care physician advised PO1 to go directly to the ED, and he was admitted to hospital B the same day. PO1 had blood and CSF collected for gram stain and culture and was treated empirically with ceftriaxone and vancomycin. On December 10, gram-negative diplococci were detected in blood from PO1, and hospital B reported the case of meningococcal disease to its local health authority and the local health authority of PO1's employer. The next day, blood and CSF from PO1 were culture positive for *N. meningitidis*. PO1 was hospitalized for 5 days, and then discharged to his home on December 14.

On December 8, a respiratory therapist (RT1), a man aged 47 years who had been present during airway suctioning and assisted with endotracheal tube placement in the ED at hospital A, began experiencing weakness, chills, and fatigue. On December 10, RT1 was transported by ambulance from his home to hospital C. RT1 was empirically treated with ceftriaxone, vancomycin, and meropenem and had blood

and CSF collected for gram stain and culture in the ED. On December 11, gram-negative diplococci were detected in blood and CSF from RT1. The next day, blood and CSF from RT1 were culture positive for *N. meningitidis*, and hospital C notified its local health authority. RT1 was hospitalized for 11 days and then discharged to his home on December 21.

On December 11, CDPH was notified of the three cases by the local health authority to which hospital B (and later hospital C) reported, and CDPH initiated an investigation. Because CDPH determined that contact tracing and postexposure follow-up of workers already had been initiated by the local health authorities and all employers, the objectives of the ensuing investigation were limited to characterizing the occupational exposure, identifying lapses in infection control, and confirming that appropriate employee health follow-up was conducted. CDPH also made recommendations on prevention and control measures. CDPH interviewed hospital A infection-control and employee health personnel and workers involved in the patient's care before his transfer to the ICU, including PO1 and RT1. Employers provided CDPH with a list of workers who participated in the emergency response. Workers were identified from employer logs and from documentation submitted by the ambulance service that describes the patient's prehospital care. Employers' records of their workers' postexposure assessment (n = 22), local health authority records, and the medical records of the patients were reviewed. Potentially exposed workers were defined as those persons reported being ≤3 feet from the patient while providing care, based on CDC guidelines (*3*). Additional information on personal protective equipment (PPE) use was collected during interviews and record reviews. *N. meningitidis* isolates from patients were typed by using multilocus sequence typing at CDPH and submitted to CDC for pulsed-field gel electrophoresis (*4,5*).

A total of 23 workers, including four police officers, three firefighters, two paramedics, and 14 health-care workers, were involved in the index patient's care. Among the 23 workers, 10 were reported to have been ≤3 feet from the patient (Table) while providing care. Among these, PO1 wore only gloves, two firefighters and two paramedics donned N95 respirators, and one of five hospital health-care workers wore a surgical mask. Lack of PPE availability in the field and lack of knowledge regarding where respirators and surgical masks were located in the ED were cited as two reasons why appropriate PPE was not worn by health-care workers.

In total, 16 workers were offered PEP by their employers 4–8 days postexposure. For the seven workers not offered PEP, two were already taking antibiotics for other medical reasons, two had no patient exposure, one was seen by his private physician and was not offered PEP, and two (PO1 and RT1) were not offered PEP by their employers.

The index patient and both secondary patients had culture-confirmed *N. meningitidis* serogroup C, ST-11 clonal complex; isolates were indistinguishable by pulsed-field gel electrophoresis. Neither secondary patient used N95 respirators or surgical masks; both did use gloves. PO1 reported no direct contact with respiratory secretions. However, PO1 reported that he heard hacking or gurgling sounds when he turned the index patient, but he could not remember feeling droplets on his skin or face. RT1 assisted with intubation and airway suctioning of the index patient. In both cases, unprotected exposure to respiratory aerosols or secretions might have resulted in transmission of *N. meningitidis*.

Reported by

B Materna, PhD, K Harriman, PhD, J Rosenberg, MD, D Shusterman, MD, G Windham, PhD, J Atwell, California Dept of Public Health. S Beckman, MPH, CDC/CSTE Applied Epidemiology Fellow; E Mortensen, MD, J Zipprich, PhD, EIS officers, CDC.

Editorial Note

Occupationally acquired meningococcal disease outside of the laboratory is rarely reported (*6–8*), perhaps in part because of rapid use of PEP. Transmission of *N. meningitidis* to health-care personnel has occurred after unprotected exposure to infected patients during endotracheal intubation, airway suctioning, and oxygen administration (*6–8*), but more than one occupationally acquired infection from the same index patient has not been reported. Findings from this investigation indicate that breaches in infection control and delays in notification to the local health authority, worker exposure assessment, and PEP administration likely contributed to secondary cases of meningococcal disease.

To decrease the risk for infectious disease transmission to health-care personnel, the Healthcare Infection Control Practices Advisory Committee recommends use of empiric infection-control precautions based

TABLE. Exposure and prophylaxis characteristics of workers who were reported to be ≤3 feet from index patient with *Neisseria meningitidis* while providing care* — California, 2009

Employer	Occupation	Exposure to patient	Type of mask/ respirator worn	Days from exposure to notification	Prophylaxis offered
City	Police officer†	Turned patient, near head	None	6§	No¶
	Firefighter	Took vital signs, assisted with patient transfer to ambulance, rode with patient in ambulance, administered oxygen	N95 respirator	6	Yes
	Firefighter	Took vital signs, assisted with patient transfer to ambulance	N95 respirator	5	No**
Private company	Paramedic	Placed intravenous line, suctioned patient, placed oropharyngeal airway, administered oxygen, rode with patient in ambulance	N95 respirator	4	Yes
	Paramedic	Performed full physical examination	N95 respirator	4	Yes
Hospital A	Respiratory therapist††	Assisted with intubation, present for suctioning	None	Not notified	No¶
	Physician	Suctioned patient, performed intubation	None	8	Yes
	Nurse	Checked pupils, pulse	None	8	Yes
	Respiratory therapist§§	Set up intubation tray, retrieved ventilator	Surgical mask (with face shield)	8	Yes
	Nurse	Injected intravenous medication	None	8	Yes

* Excludes persons who did not recall patient contact or for whom reliable data on patient contact was not available.
† Confirmed with meningococcal disease (PO1).
§ Notified by coworker.
¶ Not assessed.
** Exposure assessment was conducted by worker's private physician.
†† Confirmed with meningococcal disease (RT1).
§§ Not interviewed; information based on chart review and other employee interviews.

on the patient's apparent clinical syndrome when the diagnosis is unknown and recommends use of droplet precautions (surgical masks) for contact with patients with suspected or confirmed meningococcal disease (*3*). The California Division of Occupational Safety and Health aerosol-transmissible diseases (Cal/OSHA ATD) standard* requires droplet precautions for contact with patients with suspected or confirmed meningococcal disease and until November 2010 required N95 respirators for contact with suspected or confirmed 2009 pandemic influenza A (H1N1) patients. Given that the index patient's differential diagnosis included H1N1 infection, N95 respirators should have been used; however, among the 10 workers who had been ≤3 feet to the index patient, only four used a respirator. No health-care workers at hospital A wore respirators, and only one wore a surgical mask.

Meningococcal disease is a nationally notifiable disease (*2*). California requires health-care providers to immediately report by telephone suspected cases of meningococcal disease to the local health authority.† Hospitals A and C were late in reporting suspected cases to their respective local health authorities. Additionally, under the Cal/OSHA ATD standard and the federal reauthorization of the Ryan White Act,§ hospital A was required to notify other employers of potentially exposed nonhospital employees, such as paramedics, fire fighters, and police. Had hospital A adhered to these reporting and notification requirements, postexposure follow-up of nonhospital employees might have been more timely. Hospital A also did not conduct an exposure assessment of its own employees until 8 days postexposure, after notification of RT1's hospitalization. PEP should be initiated as soon as possible, ideally <24 hours after index patient identification (*1*). However, all 16 workers were offered prophylaxis ≥4 days postexposure and ≥3 days after the index patient was suspected to have

* Aerosol Transmissible Diseases Standard, Title 8 C.C.R. Sect. 5199 (2009), April 15, 2010. Available at http://www.dir.ca.gov/title8/5199.html.

† Reportable Disease and Conditions, Title 17 C.C.R. Sect. 2500, April 15, 2010. Available at http://www.cdph.ca.gov/programs/documents/provider_reportable_diseases+conditions.pdf.

§ Ryan White HIV/AIDS Treatment Extension Act, S. 1793, 111 Cong. (2009), April 15, 2010. Available at http://www.govtrack.us/congress/bill.xpd?bill=s111-1793.

What is already known on this topic?

Occupational transmission of meningococcal disease has been reported, rarely, after unprotected exposure to infected patients. In California, a suspect case of meningococcal disease, defined as the detection of gram-negative diplococci from a normally sterile site, is reportable immediately, by telephone to the local health authority.

What is added by this report?

A multiemployer emergency response to a patient with meningococcal disease resulted in two secondary cases that might have been prevented if infection control recommendations, postexposure chemoprophylaxis (PEP), and notification requirements had been implemented in a timely manner.

What are the implications for public health practice?

Health-care facilities should review infection control and occupational health recommendations and disease reporting requirements; clinicians should carefully evaluate worker exposures to determine whether PEP is indicated.

meningococcal disease. Neither secondary patient was offered PEP.

CDC's Advisory Committee on Immunization Practices (ACIP) recommends PEP for close contacts of patients with meningococcal disease. ACIP defines close contacts for PEP as 1) household members, 2) child-care center personnel, and 3) persons directly exposed to the patient's oral secretions (e.g., by kissing, mouth-to-mouth resuscitation, endotracheal intubation, or endotracheal tube management) (*1*). Although the majority of workers were offered PEP, albeit late, whether PEP would have been recommended for PO1 is unclear and would depend on how strictly the evaluating clinician interpreted the ACIP recommendations. Other types of exposures not defined specifically in the ACIP recommendations might warrant PEP based on the clinician's judgment. However, because PO1 was experiencing symptoms as early as December 5, timely notification and assessment could have resulted in earlier diagnosis and treatment.

Health-care facilities should review their local health authority reporting procedures to ensure timely reporting of notifiable diseases, such as *N. meningitidis*, and employers should provide infection-control training and PPE to potentially exposed workers. Employers also should conduct timely and thorough investigations to identify and evaluate workers potentially exposed to a patient suspected to have meningococcal disease.

References

1. CDC. Prevention and control of meningococcal disease: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2005;54(No. RR-7).
2. Council of State and Territorial Epidemiologists. Public health reporting and national notification for meningococcal disease (09-ID-42). Atlanta, GA: Council of State and Territorial Epidemiologists; 2009. Available at http://www.cste.org/ps2009/09-id-42.pdf. Accessed November 10, 2010.
3. CDC. 2007 Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: US Department of Health and Human Services, CDC; 2007. Available at http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/isolation2007.pdf. Accessed November 10, 2010.
4. Popovic T, Schmink S, Rosenstein NA, et al. Evaluation of pulsed-field gel electrophoresis in epidemiological investigations of meningococcal disease outbreaks caused by *Neisseria meningitidis* serogroup C. J Clin Microbiol 2001;39:75–85.
5. Maiden MC, Bygraves JA, Feil E, et al. Multilocus sequence typing: a portable approach to the identification of clones within populations of pathogenic microorganisms. Proc Natl Acad Sci USA 1998;95:3140–5.
6. CDC. Nosocomial meningococcemia—Wisconsin. MMWR 1978;27:358–63.
7. Gehanno JF, Kohen-Couderc L, Lemeland JF, Leroy J. Nosocomial meningococcemia in a physician. Infect Control Hosp Epidemiol 1999;20:564–5.
8. Petsas A, Sharma A, Aghadiuno O, Abid M, Paranthaman K. A secondary case of meningococcal disease in an ambulance worker, Berkshire, November 2007. Euro Surveill 2008;13:1–2.