Update on Emerging Infections: News From the Centers for Disease Control and Prevention

Commentators

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Editor's note: *This article is part of a regular series on emerging infection from the Centers for Disease Control and Prevention (CDC) and the EMERGEncy ID NET, an emergency department–based and CDC-collaborative surveillance network. Important infectious disease public health information with relevance to emergency physicians is reported. The goal of this series is to advance knowledge about communicable diseases in emergency medicine and foster cooperation between the front line of clinical medicine and public health agencies.*

Wound Botulism Outbreak Among Persons Who Use Black Tar Heroin—San Diego County, California, 2017-2018.

[Centers for Disease Control and Prevention. Wound botulism outbreak among persons who use black tar heroin—San Diego County, California, 2017-2018. *MMWR Morb Mortal Wkly Rep.* 2019;67:1415-1418.]

During September 29 to October 6, 2017, the County of San Diego Public Health Services (COSD) was notified of 2 patients with suspected wound botulism and a history of using black tar heroin. On October 9, COSD, which had reported an average of one wound botulism case per year during 2001 to 2016, sent a health alert through the California Health Alert Network, notifying Southern California providers of these 2 patients, including their signs and symptoms and black tar heroin exposure. In collaboration with the California Department of Public Health, COSD conducted an investigation to identify additional cases, determine risk factors for illness, estimate cost of medical care, and develop recommendations to prevent further illness. By April 18, 2018, 9 patients (8 confirmed and 1 probable) with wound botulism were identified, all of whom were hospitalized; 1 of the 9 died. All 9 were persons who injected drugs; 7 specifically reported using black tar heroin and 6 practiced subcutaneous injection known as skin popping. Clinically compatible signs and symptoms included muscle weakness, difficulty swallowing, blurred vision, drooping eyelids, slurred speech, difficulty breathing, loss of facial expression, and descending paralysis. All patients were treated with heptavalent botulinum antitoxin (BAT). Wound botulism is likely underrecognized because of its rarity and the overlapping signs and symptoms with opioid intoxication, overdose, and other neurologic syndromes, including Guillain-Barré's syndrome, the Miller Fisher's variant of Guillain-Barré's syndrome, and myasthenia gravis. Prompt diagnosis, administration of BAT, and provision of supportive care can help stop the progression of paralysis and be lifesaving.

A confirmed case was defined as illness in a resident of San Diego County who had clinically compatible signs or symptoms of botulism during September 2017 to May 2018, laboratory detection of botulinum neurotoxin (BoNT) in serum, a history of injection drug use during the 2 weeks before illness onset, and no suspected exposure to contaminated food. A probable case was defined similarly, but without laboratory confirmation. All wound botulism patients reported to COSD were asked about potential exposures by investigators using a standardized questionnaire. Self-reported history of injection drug use was recorded for each patient, with drug use corroborated by toxicology results when possible. Serum collected from each patient was tested for BoNT by mouse bioassay at the California Department of Public Health's Microbial Diseases Laboratory; serum specimens with indeterminate results were tested by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry at the Centers for Disease Control and Prevention (CDC). Direct hospital charges for the outbreak-associated patients were estimated according to hospital charges for wound botulism cases reported to COSD during 2005 to 2016 from the California Office of Statewide Health Planning and Development database.

Among 9 total cases, 8 patients were men; median age was 40 years (range 25 to 67 years). Symptom onset dates ranged from September 26, 2017, (epidemiologic week 39) to April 12, 2018 (epidemiologic week 15). The most frequently reported symptoms were muscle weakness, difficulty swallowing, and blurred vision. Abscesses were observed for 5 patients. Symptoms of wound botulism were initially attributed to drug intoxication for 4 patients. One patient was admitted for 7 days before receiving BAT and

died 9 days later at a long-term care facility. One patient had received the opioid overdose reversal medication naloxone without improvement in symptoms, and 1 patient had received 2 doses of naloxone on admission after at least 1 previous emergency department (ED) visit associated with wound botulism. A fourth patient, who was evaluated for symptoms of wound botulism and a history of close contact with a person known to have wound botulism, was discharged from the hospital before later being readmitted. All 9 patients required admission to the ICU; 6 required intubation and mechanical ventilation, 1 of whom died. Median duration of hospitalization was 15 days (range 9 to 67 days) until discharge to long-term care facilities (8, including the patient who died) or departure against medical advice (1). All patients reported a history of injecting heroin; 7 reported using black tar heroin, 6 injected heroin by skin popping, and 1 patient did not report injection method. Toxicology tests performed for 6 patients were all positive for opioids. Two patients reported close contact with each other that included sharing drugs and needles.

In coordination with COSD, the California Department of Public Health authorized BAT, which was released for 9 patients by CDC quarantine stations in Los Angeles (8) and San Francisco (1). Median interval from symptom onset to BAT administration was 6.5 days (range 2.7 to 10.5 days). Pre-BAT serum specimens from 9 patients were collected for testing; BoNT type A was confirmed for 6 patients by mouse bioassay and 2 patients by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry. BoNT was not detected for one patient; however, that serum sample was frozen and hemolyzed and therefore not in optimal condition for confirmatory testing. During the 2017 to 2018 outbreak, all 9 patients were enrolled in public health care programs, including Medi-Cal (7), Medicare (1), and the Veterans Health Administration (1). The total direct hospital costs for this outbreak were estimated at $2.3 million, for 203 total inpatient days charged at the historical median daily rate of $11,506 per day, based on data available for 9 patients hospitalized with wound botulism in San Diego County during 2005 to 2016 (COSD, unpublished data; 2018).

Health alerts issued by COSD on October 9, 2017, and April 10, 2018, reminded health care providers to educate persons who inject drugs about the risks and symptoms of wound botulism, thoroughly search for wounds, consider a wound botulism diagnosis for patients with injection drug use history and cranial nerve abnormalities or descending paralysis, and consult promptly with local health departments to request BAT.[1,2] Within 1 day of the April 2018 health alert, local clinicians reported suspected clinical wound botulism for 2 currently hospitalized patients. Additional public health communications included presentations to the local infectious diseases medical society, the local chapter of the American College of Surgeons, and the local antiopioid misuse coalition, and distribution of informational flyers at substance abuse, needle exchange, and methadone clinics. The California Department of Public Health issued a communicable disease brief to local health departments throughout California.

Botulism, a nationally notifiable condition, is a rare but serious illness of descending paralysis most commonly caused by the neurotoxin produced by the anaerobic, Gram-positive bacteria *Clostridium botulinum;* wound botulism in particular results from germination of *C botulinum* spores in a wound or other necrotic tissue.[3,4] The 2017 to 2018 outbreak of wound botulism among persons who inject drugs in San Diego County was associated with black tar heroin use, possibly through contamination of one or more batches. Black tar heroin use poses a heightened risk for wound botulism attributable to its production, preparation, and practice. It is a dark, gummy drug primarily produced in Mexico and often contains adulterants to increase bulk or contaminants introduced during illicit transport to the United States, such as inside car tires or other unsanitary locations where the drug might be exposed to soil containing *C botulinum* spores.[3] Preparation of black tar heroin for injection through cooking does not destroy *C botulinum* spores, which can survive high heat and later germinate to produce BoNT.[5] Skin popping can create an anaerobic environment of necrotic tissue in which BoNT can be readily formed and released.[6]

With recent increases in opioid misuse nationwide,[7] there is an increasing need for awareness of the risks and symptoms of wound botulism among persons who inject drugs. During 2001 to 2016, in the United States, 353 wound botulism cases were reported to CDC[8]; 291 (82%) were from California, including 15 from San Diego County. Although rarely reported outside California, wound botulism likely is underdiagnosed in the United States.[5] Diagnosing wound botulism can be challenging because of the complex testing required and symptoms that can overlap with other neurologic syndromes or opioid intoxication and overdose.[5,6] In addition, law enforcement authorities throughout the western United States and increasingly in the northeast have confiscated black tar heroin,[9] providing evidence of potential exposure to this primary risk factor for wound botulism.[3]

Prompt BAT administration can help stop progression of paralysis.[10] The median interval between symptom onset and BAT administration in this outbreak (6.5 days)

primarily comprised the time from symptom onset to hospital admission (2.0 days) and a suspicion of botulism that prompted a BAT request (2.5 days). Consistent with a previous report,[5] costs of inpatient medical care were high and paid at public or hospital expense because the patients lacked private medical insurance. Efforts to improve botulism prevention, identification, and prompt treatment can improve morbidity and mortality outcomes, as well as likely decrease the monetary burden to the public and health care system.[5] Persons who have symptoms of wound botulism should promptly seek medical care and communicate their specific drug practices to aid diagnosis and accelerate BAT administration. Persons who inject drugs should be aware that, although safe injection practices can reduce the risk for some bloodborne infections (eg, HIV and hepatitis), wound botulism remains a risk when black tar heroin is ingested through injecting or skin popping. Clinicians caring for persons who inject drugs or persons who fail to respond to naloxone need to perform thorough searches for wounds, be alert for wound botulism, and inform patients of this potentially lethal consequence of injection drug use. Health departments can deliver these health messages and emphasize the importance of opioid overdose education and referral of persons who inject drugs to medication-assisted treatment for opioid use disorder, and implement timely surveillance and notification of injection drug users when wound botulism clusters are detected.

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COMMENTARY

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The overwhelming epidemic in opioid abuse in the United States has come to national attention in recent years, with the number of opioid overdose deaths being 5 times higher in 2016 compared with 1999.[1] Much of the burden of treating the acute complications of opiate abuse falls on emergency physicians, who routinely manage overdose, withdrawal, skin infections, and other comorbidities. It is important for the emergency physician to recognize and treat not only the common sequelae of opiate abuse, such as overdose, but also potentially fatal complications, such as wound botulism from black tar heroin use described in this report.

Wound botulism is a paralytic disease caused by the BoNT produced by the anaerobic *C botulinum,* which germinates from spores inoculated in a wound or necrotic tissue. Usually found in soil, the spores in this case cluster contaminated one or more batches of black tar heroin likely produced in Mexico, leading to cases of wound botulism in its users. These spores are resistant to the high temperatures associated with the "cooking" or preparation of black tar heroin for injection. The practice of skin popping, or subcutaneous infiltration of black tar heroin, may promote a suitable environment for the toxin to be formed and released.[2] Black tar heroin is a less expensive form of heroin often produced in Mexico and traditionally found in the western United States. It has a dark, tarry consistency and because of its crude method of production contains many contaminants and adulterants.[3]