

## Public Health

### Anthrax: of bison and bioterrorism

#### Epidemiology

Anthrax develops when endospores of *Bacillus anthracis* enter the body through ingestion, inhalation or skin abrasion. The spores are long lasting and resistant, favouring moist, alkaline soil with high organic content. Anthrax is primarily a disease of herbivores, which are exposed to the spores while grazing. Outbreaks tend to occur after heavy rainfall followed by drought. "Anthrax zones" in Canada include the western Prairies, northern Alberta and the Northwest Territories.<sup>1</sup> Since the implementation of livestock vaccination programs in Canada, animal outbreaks have been rare. Anthrax continues to be endemic in West Africa, Spain, Greece, Turkey, Albania, Romania and Central Asia, where veterinary control programs are inadequate.<sup>2</sup>

Anthrax in humans most often results from agricultural or industrial contact with contaminated animals or animal products. Cases in North America have been virtually eliminated thanks to animal vaccination and industrial sanitary programs, the restriction of imported wool, hides and other products and the proper disposal of infected animals. Anthrax is not a notifiable disease in Canada; a literature search found only 1 case report, of cutaneous anthrax in British Columbia in 1991.<sup>3</sup> In the United States, only 3 cases were reported between 1984 and 1993.<sup>4</sup> Despite its low incidence, anthrax has received attention because of its potential use in biological warfare.<sup>5</sup> In 1997 the American Department of Defense announced the mandatory vaccination of all service personnel; Canada issued a similar requirement for personnel serving in the Persian Gulf.

#### Clinical management

*B. anthracis* endospores germinate at the primary site of infection, causing local edema and necrosis. When phagocytosed by macrophages they migrate to lymph nodes and cause regional hemorrhagic

lymphadenitis.<sup>6</sup> Hematogenous spread can lead to severe septicemia, toxemia and, rarely, hemorrhagic meningitis. The toxin consists of at least 3 proteins. Edema factor increases intracellular cyclic adenosine monophosphate levels, resulting in massive edema; lethal factor plays a role in the expression of tumour necrosis factor and interleukin-1, leading to shock; and the protective antigen acts as a membrane channel, transporting the other 2 proteins into the cell cytoplasm.<sup>4</sup>

Cutaneous anthrax accounts for 95% of human cases in North America.<sup>6</sup> The primary lesion is usually a nondescript, painless, pruritic papule, often on the head, neck or extremities, that appears 3–5 days after exposure. In 24–36 hours the lesion forms a vesicle that undergoes central necrosis and dries, leaving a characteristic black eschar, which usually sloughs off in 2–3 weeks. The disease, usually localized, becomes systemic and potentially fatal in 5%–20% of cases if untreated.<sup>6</sup> Inhalational anthrax is rare, producing often-fatal hemorrhagic mediastinitis. The initial symptoms — fever, nonproductive cough, myalgia and malaise — may present as late as 6 weeks after exposure. Radiographs may show a widened mediastinum and marked pleural effusions. After 1–3 days the disease enters a rapid, fulminant course with dyspnea, strident cough and chills, culminating in death.<sup>6</sup> Gastrointestinal anthrax, extremely rare, results from the ingestion of contaminated meat; death results from intestinal perforation or anthrax toxemia.

Gram's staining and culture of pertinent body fluids should be done.<sup>4,5</sup> Excision of eschars is contraindicated since it may speed dissemination. Penicillin is the drug of choice, with ciprofloxacin and doxycycline as suitable alternatives.<sup>7</sup> (Ciprofloxacin is the drug of choice if bioterrorism is suspected.<sup>5,7</sup>)

#### Prevention

The human anthrax vaccine was licensed for use in the United States in

1970.<sup>5,7</sup> It is an inactivated, cell-free product designed to be given in 6 doses. In addition to military personnel, the vaccine is recommended for workers who come into contact with imported animal products such as hides, wool, hair (especially goat hair) and bristles, and for people doing diagnostic or investigational activities that may bring them into contact with anthrax spores. The vaccine is not licensed for use in Canada but can be obtained through Health Canada's special access program.

Vaccination of military personnel has met with some opposition because of the paucity of evidence of its long-term side effects and effectiveness. A recent systematic review of the effectiveness of anthrax vaccines in humans<sup>8</sup> identified only 2 trials (a US study conducted in 1962 using an inactivated vaccine similar to the current US one, and a Russian study conducted in 1976 using a live, attenuated vaccine). Although both studies had methodological limitations, the reviewers concluded that, overall, anthrax vaccines were safe and efficacious, with an overall efficacy of 84% and a variable but low incidence and severity of side effects. They remarked on the lack of trials to evaluate newer vaccine formulations. — *Erica Weir, CMAJ*

#### References

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