What you should know about smallpox in the post-eradication era

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Because of the historic success of the public health vaccination program that began in the 1960s, a case of smallpox today that is not due to a laboratory accident would be the result of a deliberate act of bioterrorism.

The last case of smallpox in the U.S. was in 1949, and the last known case of naturally occurring disease anywhere in the world occurred in Somalia in 1977. By 1971, routine smallpox vaccination of U.S. children no longer was considered necessary, and vaccination of the general public was discontinued. Worldwide eradication of smallpox was declared in 1980.

Which of the following statements about smallpox are true?

a) The majority of patients with smallpox recover, but death may occur in up to 30% of patients.
b) Direct and prolonged face-to-face contact is the only means of spread of smallpox from one person to another.
c) An infected person is contagious until the last scab falls off.
d) The vaccinia vaccine (smallpox vaccine) is a live virus, so one dose will provide lifelong immunity against smallpox.
e) There is no proven treatment for smallpox, but some antivirals may be tried (cidofovir, brincidofovir, tecovirimat).

Answer: a, c and e are correct

Smallpox is a febrile exanthem caused by Orthopoxvirus variola (variola virus). The majority of the global population younger than 40 years of age has been neither vaccinated against nor exposed to smallpox virus and therefore is susceptible to disease. The threat of smallpox persists because the virus is maintained in certain laboratories around the world.

Variola virus is transmitted mainly by infectious respiratory droplets during close contact between humans. Smallpox also can be spread through direct contact with infected bodily fluids or contaminated objects such as clothing or bedding. There is some evidence that during the French and Indian War, British forces provided the Indians with smallpox-contaminated blankets, marking an early instance of germ warfare. Rarely, smallpox has been transmitted in enclosed settings such as buildings, buses or trains.

Infectivity begins with onset of symptoms, including high fever, severe constitutional symptoms and an enanthem of the oropharynx. Oral lesions release large amounts of virus into the mouth, which then is spread in secretions, causing the period of greatest contagion. Cutaneous scabs generally fall off after three weeks, leaving scars and ending the period of contagion.
Smallpox vaccines do not contain variola virus, the causative agent of smallpox. Instead, they are made from the related vaccinia virus, which induces a protective immune response against smallpox.

The Food and Drug Administration licensed a new smallpox vaccine in 2007 (ACAM2000), which replaced the previously licensed vaccine (Dryvax). Two other smallpox vaccines at the Strategic National Stockpile are Aventis Pasteur smallpox vaccine (WetVax) and Imvamune.

WetVax is a liquid formulation of a live vaccinia virus similar to the lyophilized smallpox vaccine, Dryvax. ACAM2000 and WetVax are administered by scarification (percutaneous route) using 15 jabs of a bifurcated needle that has been dipped in the vaccine. The live smallpox vaccine provides a high level of immunity for three to five years with decreasing immunity after that, but some protection against death may last 30 years.

Imvamune is a third-generation, non-replicating smallpox vaccine for use in healthy populations as well as people with immune disorders or pre-existing skin conditions such as atopic dermatitis and who cannot be safely vaccinated with a live smallpox vaccine. Imvamune requires two doses, four weeks apart and is administered subcutaneously.

In a public health emergency due to smallpox, the two live vaccines will be used primarily to stop the chain of transmission. Post-exposure vaccination has been shown to be effective because a rapid immune response can be generated in exposed people. The incubation period of smallpox averages 12 to 14 days. Following vaccination, antibodies can be detected within a week. Observational studies suggest that vaccination within three or four days of exposure may reduce severity of disease. Vaccination four to seven days after exposure may confer some protection.

Unlike the two live-attenuated smallpox vaccines, Imvamune was not evaluated during the eradication of smallpox, so its usefulness as post-exposure prophylaxis is unknown. An Emergency Use Authorization would permit use of this vaccine in children.
If vaccination with a live vaccine is successful, a red and itchy bump develops at the vaccination site within three or four days (see photos below). The bump becomes a blister, fills with pus and begins to drain. During the second week, the blister begins to dry up and a scab forms. In the third week, the scab falls off, leaving a small scar.

Smallpox vaccines are not available for members of the general public. However, the U.S. has a sufficient stockpile to vaccinate anyone at risk in the event of a smallpox emergency. Recommendations for use of the vaccine will be determined by public health authorities based on the characteristics of the outbreak. Anyone directly exposed to smallpox would be offered the vaccine because risks associated with smallpox disease are far greater than those posed by the vaccine. Depending on the circumstances of the event, people without smallpox exposure may be at risk and may be recommended to receive vaccination.

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