

SMALLPOX

FACTS FOR THE FUNERAL SERVICE PROFESSIONAL



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HISTORY OF THE DISEASE

Smallpox is one of man's oldest disease enemies with a history that goes back thousands of years. At one time or another it has affected virtually every corner of the planet. It is an acute contagious disease that is fatal to as many as one-third to one-half of its victims.

In 1796 Edward Jenner demonstrated that an infection caused by cowpox protected against smallpox and an effective vaccination against smallpox was developed.

The last case of smallpox to be seen in the United States was in 1949. A global campaign against smallpox was begun in 1967 by the World Health Organization (WHO) and smallpox was successfully eradicated in 1977. In 1980 the World Health Assembly declared the disease conquered and recommended that countries cease vaccinations. No cases have been seen since that time.



The last smallpox patient was seen in 1977

EPIDEMIOLOGY

Smallpox is caused by the variola virus. The name *smallpox* comes from a Latin word for "spotted" and refers to the raised lesions that appear on the victim's skin.



Variola, the smallpox virus

There are two clinical forms of the disease. Variola major is the more common and more severe version. There are 4 types of variola major. (1) *Ordinary* is the most commonly seen

type and accounts for 90% of all cases. (2) *Modified* is mild and occurs in previously vaccinated persons. (3) *Malignant* and (4) *hemorrhagic* are rare (less than 10% of cases), very severe, and almost always fatal. Historically, variola major has an overall fatality rate of 30% or higher in an unvaccinated population.

The other form of the disease, variola minor is much less common and has a death rate of 1% or less.

Smallpox is an airborne virus and spreads from person to person primarily by droplets or aerosols expelled by an infected person and by direct contact. Usually prolonged face-to-face contact is necessary for infection. Smallpox can also be spread through direct contact with infected body fluids or contaminated objects. Contaminated clothing or bed linens can also spread the disease.

Animals and insects do not harbor or transmit the disease.

Smallpox is classified as a Class A agent by the Centers for Disease Control and Prevention (CDC). Class A agents pose the greatest threat to public health because of their potential for widespread dissemination.

Other Class A agents include anthrax, botulism, plague, tularemia, and viral hemorrhagic fevers including Marburg and Ebola. In a research setting, these agents are only handled in the most secure Bio-level 4 facilities.

HISTORICAL USE OF SMALLPOX AS A WEAPON

Smallpox was probably first used as a weapon during the French and Indian Wars (1754-1767) when British soldiers distributed blankets that had been used by smallpox patients with the intent of spreading the disease among the American Indians. With no acquired immunity and no knowledge of how to stop the spread of the disease, epidemics occurred killing more than half of the many affected tribes. With the development of an effective vaccine against the disease the potential threat of smallpox as a bio-weapon was greatly diminished.

SYMPTOMS AND PROGRESSION

Infection occurs when the virus is implanted into the respiratory system. Only a few virions are needed for infection. The virus quickly multiplies and migrates to the lymph nodes, spleen and bone marrow. A high fever develops and the patient is usually incapacitated.

The disease follows a predictable pattern of a rash, pustules, scabbing and resolution over a 3-4 week period. (See chart on page 4)

Death usually occurs in the second week of the illness from a toxemia associated with the circulating variola antigens. Secondary bacterial infections are also common as is encephalitis. The disease can also cause blindness.

It is also during this time that the patient is most contagious. The fluid within the pustules is highly infectious. The scabs also contain large amounts of viable virus.



Classic smallpox pustules



Classic smallpox on the face
The characteristic depressions in some of the pustules are visible

THE PROGRESSION OF SMALLPOX

Stage	Duration	Contagious?	Symptoms
Incubation	7-14 days (12-14 is typical)	Not contagious	None
Initial Symptoms (prodrome)	2-4 days	Sometimes	Fever, malaise, head and body aches. Vomiting not uncommon. High fever (101-104F). Patient usually too sick to carry on normal activities.
Early Rash	4 days	Highly contagious	Small red spots appear on the tongue and in the mouth. Rash appears on skin starting on face and spreading to arms and legs, then feet and hands. By third day rash develops bumps. By the fourth day, bumps fill with thick clear fluid. Initially may be confused with varicella (chicken pox). Distinguishing characteristic of small pox is a slight depression in the center that looks like a belly button. Fever continues.
Pustular Rash	5 days	Contagious	The highest death rates are at this point, about 6 days after the initial rash develops. Pustules become round and firm. Patients often say it feels like a BB pellet imbedded under the skin.
Pustules and Scabs	5 days	Contagious	For those who survive, the pustules begin to form a crust and scab. Two weeks after the initial rash, most of the sores are scabbed over.
Resolving Scabs	6 days	Contagious	Scabs begin to fall off leaving pitted scars.
Resolved Scabs		Not contagious	Once all of the scabs have fallen off, the person is not contagious.

TREATMENT

There is no specific treatment for smallpox. Ongoing research is evaluating the use of antiviral agents against smallpox. Early indications are that the drug cidofovir may have some effect against smallpox if administered within 1-2 days of infection.

Patients with smallpox are given supportive therapy of intravenous fluids, medications to control fever and pain, and antibiotics to fight secondary infections that may occur.

A 21ST CENTURY BIO-WEAPON

Shortly after smallpox was officially eradicated, the World Health Organization (WHO) recommended that all laboratories destroy their stocks of variola virus or transfer them to one of two laboratories-- The Institute of Virus Preparations in Moscow or the Centers for Disease Control and Prevention (CDC) in the United States. All countries reported compliance.

The organization later recommended that all virus stocks be destroyed in 1999, but this was never accomplished. In 1998 WHO and the Institute of Medicine concluded that there were still possible research uses for the virus and samples of the virus were retained.

Also at about this time, concern that smallpox might again be used as a bio-weapon were heightened when a former deputy director of the Soviet Union's civilian bio-weapons program alleged that the Soviet government had been experimenting with smallpox as a possible bio-weapon since 1980. He alleged that they had successfully developed an industrial production capacity for the virus and had adapted it for use in bombs and intercontinental ballistic missiles. He also said they were working on producing more virulent and contagious strains.

With the collapse of the Soviet government and decreased financial support to laboratories in Russia, there has been an increased concern that existing expertise, equipment, and even samples of the virus itself might have fallen into non-Russian hands.

Several countries with hostile relationships with the United States are suspected of either having smallpox stockpiles or of being capable of producing it in bio-weapon quantities. Iraq is among them.

With the threat of terrorism heightened by the attacks on America in 2001, smallpox is also increasingly being named as a possible weapon of terrorist groups independent of any particular nation.

The deliberate reintroduction of smallpox as an epidemic disease would be an international crime of unprecedented proportions, but it is now regarded as a possibility.

Models based on a terrorist release of smallpox into a major city estimate that, at a minimum, thousands would be infected and hundreds would die. (Without any intervention, a single smallpox patient would normally infect 10-20 others, who would infect others, and so on, until in theory, the entire human population could be exposed to smallpox within 6 months.)

Smallpox would make a very good bio-weapon. The virus is relatively stable and the infectious dose quite small. An aerosol release of the virus would disseminate widely and could infect a large number of people. In addition, as many as 10-20 second-generation cases can come from a single primary case if isolation techniques and/or immunization are not successfully implemented. Finally, even with only a minimal number of actual cases, the widespread concern and public panic would further fulfill the terrorist's objectives.

INFECTION CONTROL

The most likely terrorist use of smallpox would be a clandestine release of the virus into the atmosphere. It would be most effective in an area of high population density such as in a metropolitan area or in a more confined area such as a sports venue.

Between the time of the aerosol release and the diagnosis of the first cases there would be an interval of two weeks or more. The incubation period typically is 12-14 days plus an additional few days for the rash to become sufficiently distinct to suggest smallpox.

By that time, the threat of any additional infections from the initial release is long past. The virus is usually inactivated within 24 hours and sometimes less in higher temperatures and humidity. In any case it is fully inactivated in 2 days.

At this point the use of anti-viral drugs would be ineffective, since they must be administered within 1-2 days of infection.

As soon as the smallpox diagnosis is made, the patient would have to be immediately isolated and all household or other face-to-face contacts would have to be vaccinated and put under surveillance. Since the threat of further transmission would exist in the hospital setting, most patients could be treated at home since the only treatment available is supportive in nature.

Anyone treating these patients would also have to be immediately immunized if this has not already been accomplished.

While immunization is most effective if given within 3 days of exposure to the disease, vaccination given 4-7 days after exposure will offer at least some protection and likely modify the severity of the disease or at least prevent death.

Anyone caring for the patient must use standard isolation techniques including the use of gloves, masks, and gowns.

PREVENTIVE VACCINATION

Prior to 1972, smallpox vaccination was routine for all U.S. children at age one and usually required prior to beginning school.

No one has been vaccinated against smallpox in the United States in 30 years, meaning that almost half of the population has not been vaccinated against smallpox.

In addition, the immune status of those who were vaccinated decades ago is not clear. The duration of immunity for those vaccinated has never been successfully measured. The studies that do exist show that the antibodies for smallpox rapidly decline over a 5-10 year period. For those who received vaccinations at birth and at ages 8 and 18, the antibodies remained fairly stable during a 30 year period. Since relatively few people today have had

multiple vaccinations, it must be assumed that the population at large is highly susceptible to smallpox infection.

That is why the U.S. government has ordered the production of smallpox vaccine and has announced plans to immunize the public in the event of an outbreak or sooner as a precautionary measure.

The smallpox vaccination is the only preventive measure against smallpox.

The vaccine is made from a virus called *vaccinia*, another “pox” type virus related to smallpox. While the virus is not smallpox, it helps the body develop immunity to smallpox.

Because the virus is live, it can spread to other parts of the body or to other people from contact with the vaccination site. Touching the vaccination site and then rubbing one’s eye creates a serious and deforming infection. (We have elected not to include a picture of that.)

The vaccination is administered using a bifurcated needle that is dipped into the vaccine. A droplet of the vaccine is retained on the two prongs which are then used to prick the skin of the upper arm fifteen times, thus implanting the vaccine.



**The smallpox vaccination needle
Bottom needle shows drop of vaccine between prongs**

Although the vaccination does not cause smallpox, the progression of the vaccination site closely mirrors a smallpox infection. If the vaccination is successful, the person develops a red itchy bump at the vaccination site in 3-4 days. This becomes a blister, fills with pus, and begins to drain. Within two weeks the blister dries up, a scab forms, and in about three weeks leaves a scar when the scab falls off.

Most people experience normal, usually mild reactions to the vaccination including a sore arm, fever, sleeplessness, and body ache. As many as one in three however feel bad enough to miss work or recreational activities because of the vaccination.

More severe reactions occur in about 1,000 per million vaccinated. While not life-threatening, the reactions are serious and may include toxic reaction to the vaccine, or spread of the virus to other parts of the body.



Administration of the smallpox vaccine

Approximately 15-50 people per million vaccinated suffer severe and potential life-threatening reactions to the vaccine. Approximately 1-2 people per million will die from complications of the vaccination.

Vaccinia Immune Globulin (VIG) is one treatment available to those who exhibit a severe reaction to the vaccination. Approximately 2,700 doses of the drug are available, enough to treat the expected reactions from 27 million vaccinations. More is being produced.

People most likely to suffer side effects and who should not be given the vaccine include:

- ~~/~~ Those with eczema, atopic dermatitis or certain other skin conditions
- ~~/~~ People with weakened immune systems such as transplant patients or persons who are HIV positive
- ~~/~~ Persons receiving cancer treatment
- ~~/~~ Pregnant women
- ~~/~~ Women who are breastfeeding
- ~~/~~ Children under 1 year of age

Obviously, in the event of actual or suspected exposure to smallpox, the potential risks associated with the vaccination must be weighed against the threat of contracting the actual disease.

Because of the potential number and severity of reactions to the vaccination, the general population is not currently being vaccinated.

The federal immunization plans call for immunizations in a particular order as the vaccine is being produced. The military has been ordered to undergo immunization. Health care workers and other essential workers likely to be exposed are the next priority. Mortuary personnel and disaster mortuary team members (DEMORT) are likely to be included in this category. Preventive vaccination will eventually be offered to the general public. This is expected to begin in 2003 and be available to the entire population by 2004.

Meanwhile, an emergency stockpile of vaccine, enough to hopefully treat everyone who may be actually exposed to smallpox following a terrorist release of the virus, is on hand.

Although the plan to vaccinate is well underway, there is still much discussion within the medical community as to the appropriateness of vaccinating the general populace against smallpox.

First, we must be reminded that there are no smallpox cases anywhere in the world today. As a disease, it has been eradicated and has not been seen in 25 years. Additionally, there is no concrete evidence at this time that any foreign country or terrorist group actually has smallpox, has it in weapons quantity, has the means to transport or deliver it, or has the intent to use it against a civilian population. If smallpox is being prepared as a bio-weapon, some fear that it will have been genetically altered or made more virulent so that the current vaccines will not be effective against it anyway.

The risk of serious complications or death from the vaccination must be weighed against the chances of smallpox ever being seen again. Some experts feel that the vaccine should be simply made available in the event of an attack or that only emergency and health care workers should be vaccinated. Since a terrorist attack would not likely take place in a rural area, the wisdom of trying to vaccinate the entire populace is further questioned.

MORTUARY RESPONSE AND HANDLING OF SMALLPOX

Even a single case of smallpox would be considered a public health emergency. Smallpox does not just “happen.” It would be caused. It is unlikely that we will ever see a few isolated deaths from smallpox. The more likely scenario is a mass fatality situation.

Such a terrorist attack would be a disaster beyond anything we have ever seen. No funeral home could prepare for such an eventuality nor would they be expected to.

The government would be in charge of virtually every aspect of the disaster including the disposition of the deceased. Contact with the deceased would be limited and disposition would likely be immediate. Some experts advocate immediate cremation of the deceased although there does not appear to be a rationale for this method of disposition over earth burial other than to limit contact with the body and the chance of further contamination prior to disposition.

Nevertheless, there are standard protocols for handling the smallpox or suspected smallpox case and if a single case of smallpox were presented, standard mortuary practices are sufficient to handle it effectively and safely.

Only persons who have been vaccinated against smallpox should come into contact with the body of anyone suspected or confirmed to have died of smallpox. Mortuary personnel for whom vaccination is not contraindicated should be vaccinated prior to exposure to smallpox, or immediately afterwards.

Universal precautions should be utilized including gloves, gowns, shoe covers, and high filtration masks. Mortuary personnel must properly dispose of all protective clothing and equipment before coming into contact with other people. All waste must be disposed of in

sealed biohazard bags. Disposable items should be used whenever possible. Reusable items must be autoclaved. Reusable bedding and clothing should be laundered in hot water with bleach. Common household bleach (sodium hypochlorite) is effective against the virus.

Obviously, a body pouch is recommended for the removal and transportation of the body. Special care should be taken when handling the body to avoid exposure to the pustules, their fluid, or the scabs, since these are highly infectious. Topical embalming treatments should be utilized and the body should be wrapped in plastic or placed in a body pouch.

A negative pressure ventilation system should be in operation at all times during the care of a person deceased with smallpox. No one should get any closer than 25 feet from the exhaust outflow.

Standard disinfectants such as the hypochlorites (bleach), quaternary ammonia compounds, and the aldehydes (Cidex™) are effective against the virus.

If embalming is attempted, formaldehyde and gluteraldehyde based embalming fluids are effective against the smallpox virus.

Special care must be taken to insure disinfection of the removal vehicle, cot, and preparation room after a smallpox patient or suspected smallpox patient has been cared for.

In short, there is nothing more than universal precautions and standard operating procedures for mortuary personnel to do and certainly nothing less they should do when confronted with the smallpox case.

CONCLUSION

Given the enormous efforts that were made to eradicate a disease that has been characterized as the most devastating disease known to man, the thought of its re-emergence is ominous.

Nevertheless, the threat must be taken seriously and the nation must take steps to protect its citizens.

Whether we embark upon a nationwide vaccination program or not, early detection, isolation of infected individuals, surveillance of those who have come into contact with them, and a selective vaccination program, are the essential means by which an epidemic of smallpox will be controlled.

We must also prepare for the possibility of mass fatalities if this disease were to be again unleashed.

Handling of smallpox deaths is nothing new to funeral service. Our predecessors dealt with it with less knowledge and less sophisticated equipment, chemicals, and supplies than we have now. But it would be new to this generation.

Given the fact that the circumstances around an outbreak of smallpox would be a national disaster, it is unlikely that any funeral home would be called upon to handle a single or even a few isolated cases of smallpox. But if they were, a vaccinated, well-trained and careful embalmer, using standard mortuary methods, modern embalming and disinfectant products, and universal precautions, could successfully and safely deal with smallpox.

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About the Author

Curtis D. Rostad, CFSP, FACFE, is a licensed funeral director and embalmer with over 30 years experience as an employee, manager, and funeral home owner.

He is a Certified Funeral Service Practitioner (CFSP) through the Academy of Professional Funeral Service Practice and a member of the National Funeral Directors Association. He is a board certified forensics examiner (FACFE) with a specialty in death investigation through the American Board of Forensics Examiners.

He has authored over 50 articles for funeral service trade publications as well as authoring numerous training manuals for funeral service professionals. His technical paper on Creutzfeldt-Jakob Disease is the most thoroughly researched article on the subject in funeral service. His manual on controlling accounts receivable remains the premier authority on the subject and is distributed by United Communications Group. [1-301-287-2700, toll free 1-877-602-3835, or www.ucg.com]

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He is nationally known as a speaker and seminar presenter on various aspects of funeral service including service issues, business management, OSHA, and other government compliance issues. He has made over 200 presentations to groups in 36 states. For two years he served as the Director of Education for a national funeral service company and now provides on-site training for individual funeral homes.

He is currently affiliated with Dan Isard and the Foresight Companies. The Foresight Companies provide financial and business services to independent funeral homes including business valuations, estate and tax planning, management services, expert witness services, mergers and acquisitions, and business expansion consulting.

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