How we conquered smallpox

10,000 years ago, a deadly virus arose in northeastern Africa.
The virus spread through the air, attacking the skin cells, bone marrow, spleen, and lymph nodes of its victims. The unlucky infected developed fevers, vomiting, and rashes. 30% of infected people died during the second week of infection. Survivors bore scars and scabs for the rest of their lives. Smallpox had arrived.

In 1350 B.C., the first smallpox epidemics hit during the Egypt-Hittite war. Egyptian prisoners spread smallpox to the Hittites, which killed their king and devastated his civilization. Insidiously, smallpox made its way around the world via Egyptian merchants, then through the Arab world with the Crusades, and all the way to the Americas with the Spanish and Portuguese conquests.

Since then, it has killed billions of people with an estimated 300 to 500 million people killed in the 20th century alone. But smallpox is not unbeatable. In fact, the fall of smallpox started long before modern medicine. It began all the way back in 1022 A.D. According to a small book, called "The Correct Treatment of Small Pox," a Buddhist nun living in a famous mountain named O Mei Shan in the southern providence of Sichuan would grind up smallpox scabs and blow the

powder into nostrils of healthy people. She did this after noticing that those who managed to survive smallpox never got it again, and her odd treatment worked.

The procedure, called variolation, slowly evolved and by the 1700's, doctors were taking material from sores and putting them into healthy people through four or five scratches on the arm. This worked pretty well as inoculated people would not get reinfected, but it wasn't foolproof. Up to three percent of people would still die after being exposed to the puss.

It wasn't until English physician Edward Jenner noticed something interesting about dairy maids that we got our modern solution. At age 13, while Jenner was apprentice to a country surgeon and apothecary in Sodbury, near Bristol, he heard a dairy maid say, "I shall never have smallpox, for I have had cowpox. I shall never have an ugly, pockmarked face."

Cowpox is a skin disease that resembles smallpox and infects cows. Later on, as a physician, he realized that she was right: women who got cowpox didn't develop the deadly smallpox.

Smallpox and cowpox viruses are from the same family. But when a virus infects an unfamiliar host, in this case cowpox infecting a human, it is less virulent, so

Jenner decided to test whether the cowpox virus could be used to protect against smallpox.

In May 1796, Jenner found a young dairy maid, Sarah Nelmes, who had fresh cowpox lesions on her hand and arm caught from the utters of a cow named Blossom. Using matter from her pustules, he inoculated James Phipps, the eight-year-old son of his gardener. After a few days of fever and discomfort, the boy seemed to recover. Two months later, Jenner inoculated the boy again, this time with matter from a fresh smallpox lesion. No disease developed, and Jenner concluded that protection was complete.

His plan had worked. Jenner later used the cowpox virus in several other people and challenged them repeatedly with smallpox, proving that they were immune to the disease. With this procedure, Jenner invented the smallpox vaccination. Unlike variolation, which used actual smallpox virus to try to protect people, vaccination used the far less dangerous cowpox virus. The medical establishment, cautious then as now, deliberated at length over his findings before accepting them. But eventually vaccination was gradually accepted and variolation became prohibited in England in 1840.

After large vaccination campaigns throughout the 19th and 20th centuries, the

World Health Organization certified smallpox's eradication in 1979. Jenner is forever remembered as the father of immunology, but let's not forget the Buddhist nun, dairy maid Sarah Nelmes, and James Phipps, all heroes in this great adventure of vaccination who helped eradicate smallpox.

More information:

Cowpox and smallpox viruses belong to the family of Poxviruses, which are the largest and most complex viruses known so far. They are double-stranded DNA viruses of 130-300 kilobase pair.

Smallpox is also known by the Latin name 'Variola', derived from "varus", which means pimple or pox, named after the characteristic umbilicated pimples filled with pus that form on people's faces, limbs and torsos. It is this Latin name that gave the name to "variolation" used to describe inoculation of smallpox virus.

The Cowpox virus was subsequently used and gave birth to "vaccination." The virus used in the modern vaccine is called the Vaccinia virus, from the Latin term "vaca," meaning cow. Vaccinia virus is a big mystery in virology. It is not known whether Vaccinia virus is the product of genetic recombination, or if it is a species derived from Cowpox virus or Variola virus by prolonged serial passage in the laboratory. It is this Latin term however that gave the name to

"vaccination," which was subsequently employed as a generic term for defining the use of an attenuated or killed pathogen inoculated in humans in order to develop an immune response against that pathogen.

Dr. Matthew Maty (1718-1776), a Dutch physician who later worked as the principal librarian of the British Museum in London, foresaw the eradication of smallpox in his book "The Advantages of Early Inoculation" in 1767.

Eradication of smallpox became possible after the endorsement of vaccination and mass production of the vaccine. In 1864 French doctors started exploring the possibility of using lymph from calves infected with cowpox virus as vaccine. The use of animal lymph reduced transmission of human diseases, such as syphilis, and helped increase the production of the vaccine.

Dr. Leslie Collier, a scientist from Paris, France, further developed a freeze-drying method to produce a heat-stable formula of the vaccine in the late 1940's. Collier added a key component, peptone, to the process. This addition protected the virus, making it practical to distribute the vaccine worldwide.

In 1965, Dr. Benjamin Rubin patented the bifurcated needle, which allowed

using less material for the vaccination. In 1967, the World Health Organization launched the Intensified Smallpox Eradication Program, which led to the disappearance of smallpox.Smallpox has been used as a war weapon in the past. Infected people would be sent among soldiers to decimate them, as it happened in 1776 in Quebec (related in Ian Glynn and Jenifer Glynn book "The Life and Death so Smallpox") or during George Washington's siege of Boston in 1775.

Smallpox is not circulating anymore, but a few vials of the virus are kept in highly sophisticated and protected BSL4 (biosafety level 4) laboratories at US Centers for Disease Control and Prevention (CDC) in Atlanta, United States and the State Research Center of Virology and Biotechnology VECTOR in Koltsovo, Russia. Should they be destroyed or not? Is there a risk for bioterrorist attack? This controversy is subject for another chapter!

Questions

How did the smallpox virus infection spread most frequently?

A Through the air

B Through the soil

C Through blood

D Through feces

What percentage of infected people would die after amallpox virus infection?

A 13%

B 30%

C 33%

D 3%

What percentage of people would die after variolation?

A 13%

B 30%

C 33%

D 3%

What did they use in the 1700s to inoculate healthy people for variolation?

A Pus from the utters of a cow

B Pus from a lymphnode of an infected patient

C Pus from scabs of an infected patient

D Pus from the fresh sores of an infected patient

How intense were the clinical symptoms of cowpox as compared to smallpox in humans?

A More intense

B Less intense

C Same intensity

D We cannot compare them as they are caused by two different viruses

What are the organs attacked by the smallpox virus, and what are the clinical symptoms that can develop after infection?

Why does a previous infection with the cowpox virus protect humans against smallpox virus infection and disease?

How did Dr. Edward Jenner prove that cowpox virus inoculation was efficient in protecting against smallpox virus infection?