

Smallpox:

global biosecurity threat

Smallpox Biosecurity Conference
Geneva, Switzerland

D.A. Henderson M.D., M.P.H.
October 21, 2003

Criterion Rating of Bioagents

Anatoliy Voroboyov - April 1994

■ Smallpox	26 (31)
■ Plague	23
■ Anthrax	21
■ Botulism	21
■ VEE	20
■ Q fever	20

On U.S. list of Class A agents

"On May 8, 1980, WHO announced that smallpox had been eradicated from the planet... Soon after the WHO announcement, smallpox was included in a list of viral and bacterial weapons targeted for improvement in the 1981-85 Five-Year Plan... Where other governments saw a medical victory, the Kremlin perceived a military opportunity... the military command issued an order to maintain an annual stockpile of 20 tons (of smallpox virus)."

Alibek, 1998

Deaths in the 20th Century

Due directly or indirectly to armed conflict:

100,000,000

Due to smallpox

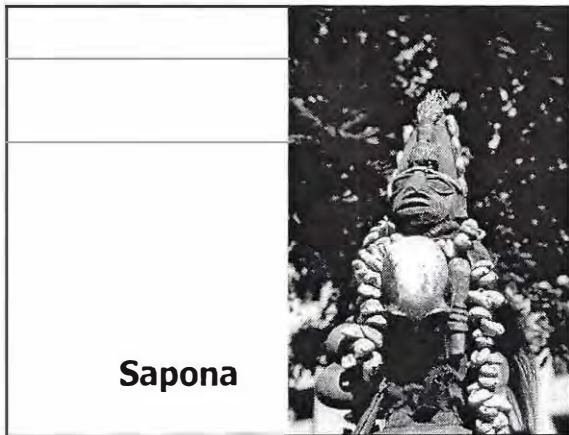
300,000,000+

"That disease was the most terrible of all the ministers of death. The horror of the Plague... visited our shores only once or twice within living memory but the smallpox was always present, filling the church yards with corpses... and making the eyes and cheeks of the betrothed maiden objects of horror to the lover."

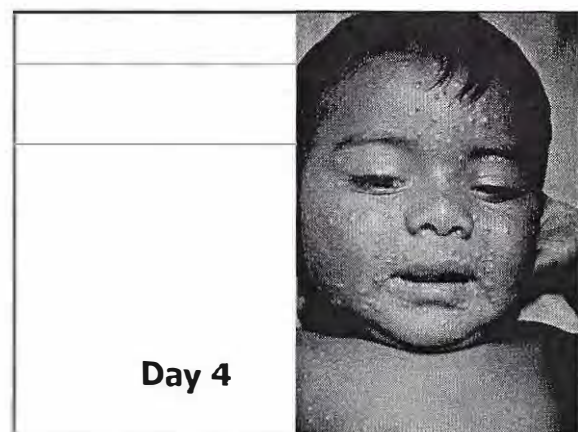
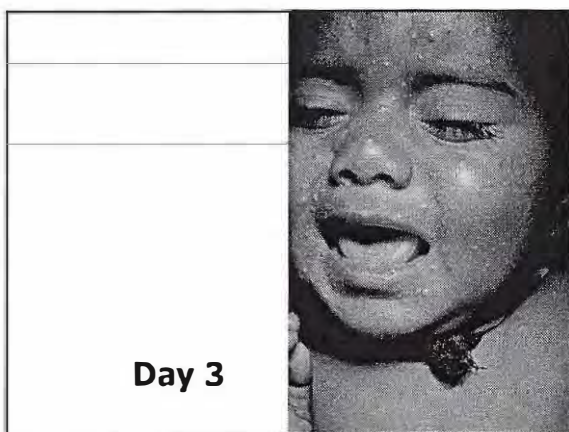
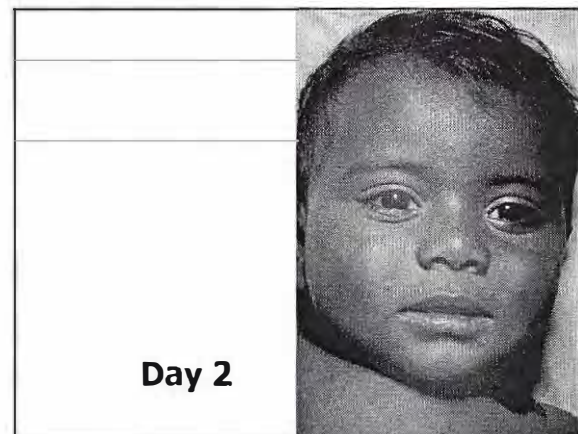
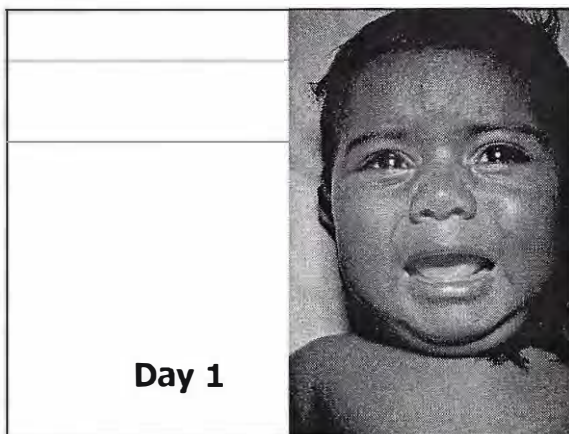
Macauley

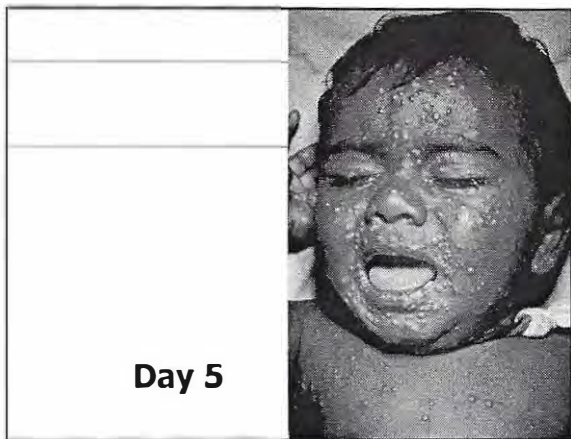
Sitala Mata

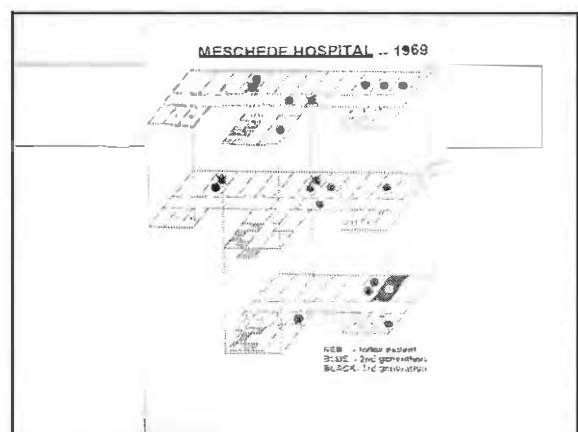
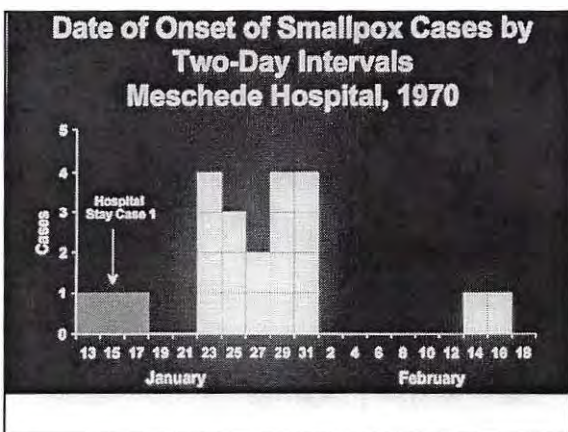
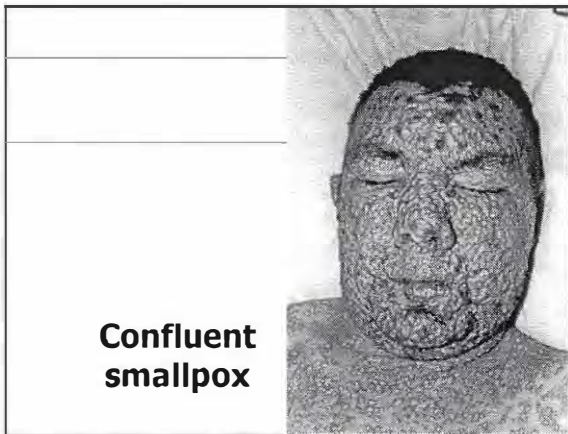




Smallpox -- characteristics ■ Incubation period is 10-12 days ■ Severe flu-like symptoms then rash ■ Case fatality rate -30 % in unvaccinated ■ No therapy available







Susceptibility of US Population to Smallpox -- 2003

- Vaccination stopped in 1972
- Few under 32 years of age have been vaccinated -- 45% of population
- Americans successfully vaccinated only once before 1972 have little immunity-- about 35% of population

Possible sources of smallpox virus

- WHO-authorized laboratories
 - CDC, Atlanta, Georgia
 - VECTOR, Novosibirsk, Russia
- Bodies in the tundra -- doubtful
- Viruses isolated before 1977
 - Note 1972 epidemics in Iran, Iraq, Syria
- Virus production laboratory
 - Sergiev Posad, Russia

Expertise to weaponize smallpox

- Specialists in smallpox weaponization
 - Russian laboratory scientists
- The all-purpose Internet
- Trial and error

Vaccine availability

September 12, 2001

- Vaccine manufacturers
 - U.S. None
 - World None
- Vaccine in storage
 - U.S. 15 million doses
 - World ? 80 million doses
- Ready for emergency shipment in U.S.
 - 90,000 doses of vaccine
 - Limited quantities -- needles, VIG

Smallpox Vaccine Reserve--2003

	<u>No. of doses</u>
■ Wyeth DryVax	15 million
■ Calf-lymph - 1978	
■ Aventis Pasteur	85 million
■ Calf-lymph - 1958	
■ Acambis/Baxter	209 million
■ Vero cell - 2002	

In emergency -- dilution of vaccine 1:5 is possible

Options for Vaccination Before an Event

- Vaccinate no one
- Vaccinate those at highest risk, candidates:
 - Health care workers
 - First responders
 - Truck drivers
 - Essential personnel
- Vaccinate anyone desiring to be vaccinated
 - Recommend vaccination
 - Recommend against vaccination
- Make vaccination compulsory

Use of vaccine: A Balance of Risks

- Probability that smallpox will be used as a weapon
- Frequency of adverse reactions and public response in 2003
- Likely effectiveness of outbreak control?

Smallpox Vaccine Expected Adverse Events

- **Life-threatening complications (per million)**
 - Post-vaccinal encephalitis (3)
 - Progressive vaccinia (1)
 - Eczema vaccinatum (12)
- **Less serious**
 - Generalized vaccinia
 - Accidental inoculation
 - Rash and fever
- If 100 million vaccinated, 100+ deaths might occur (1960's data)

Aspects of a smallpox bioweapons attack

- Aerosol dispersion
 - powder or wet slurry
 - only small quantities needed
- Probable perpetrators
 - Independent terrorist group (e.g. Aum Shinrikyo)
 - Terrorist group sponsored by nation-state
- Recognition that attack has taken place
 - After first cases have occurred

Outbreak control

- Smallpox doesn't spread readily
- Patient transmits only after symptoms
- Vaccine protects even when given 3-4 days after infection

Surveillance and Containment

Steps in Containment -- I

- Isolate patient
- Vaccinate **all** who had been in a room with the patient since he became febrile
- Place primary contacts under surveillance with daily temperatures
 - If contact develops fever, isolate until diagnosed
- Vaccinate **all** household members of primary contacts (secondary contacts)
- Make vaccine available to those who want it

Models of likely scenarios

- Epidemic Modeling – a new cottage industry
 - Military contractors
 - Academic centers
 - ? Recreational games
- **Working Group –U.S. National Advisory Council**
 - CDC – Glasser, Lane, et al.
 - Emory U. –Longini, Halloran
 - Hopkins/Brookings – Burke, Epstein

Principal options considered

- No intervention at all
- Isolation of patients; vaccination of close contacts and health personnel
- Pre-outbreak vaccination of health care personnel
- Large-scale vaccination of 40% or 80% of population

The Future

- Prospects for destruction of known stocks of smallpox virus -- nil
- Certainty of security against a possible release of the virus at some time in the future -- not possible

Eternal vigilance and a readiness to act promptly and decisively will be necessary for the indefinite future.

The return of history's most deadly and feared pestilence to a world more susceptible than at any time in history could be a major catastrophe.

A Balance of Risks

- Probability that smallpox will be used as a weapon
- Frequency of adverse reactions and public response in 2003
- Likely effectiveness of outbreak control?

Smallpox Vaccine Expected Adverse Events

- Life-threatening complications (per million)
 - Post-vaccinal encephalitis (3)
 - Progressive vaccinia (1)
 - Eczema vaccinatum (12)
- Less serious
 - Generalized vaccinia
 - Accidental inoculation
 - Rash and fever
- If 100 million vaccinated, 100+ deaths might occur (1960's data)

Aspects of a smallpox bioweapons attack

- Aerosol dispersion
 - powder or wet slurry
 - only small quantities needed
- Probable perpetrators
 - Independent terrorist group (e.g. Aum Shinrikyo)
 - Terrorist group sponsored by nation-state
- Recognition that attack has taken place
 - After first cases have occurred

Outbreak control

- Smallpox doesn't spread readily
- Patient transmits only after symptoms
- Vaccine protects even when given 3-4 days after infection

Surveillance and Containment

Steps in Containment -- I

- Isolate patient
- Vaccinate all who had been in a room with the patient since he became febrile
- Place primary contacts under surveillance with daily temperatures
 - If contact develops fever, isolate until diagnosed
- Vaccinate all household members of primary contacts (secondary contacts)
- Make vaccine available to those who want it

Models of likely scenarios

- Epidemic Modeling – a new cottage industry
 - Military contractors
 - Academic centers
 - ? Recreational games
- Working Group – U.S. National Advisory Council
 - CDC – Glasser, Lane, et al.
 - Emory U. – Longini, Halloran
 - Hopkins/Brookings – Burke, Epstein

meas
vaccination
pro - grant

Principal options considered

- No intervention at all
- Isolation of patients; vaccination of close contacts and health personnel
- Pre-outbreak vaccination of health care personnel
- Large-scale vaccination of 40% or 80% of population

The Future

- Prospects for destruction of known stocks of smallpox virus -- nil
- Certainty of security against a possible release of the virus at some time in the future – not possible

Eternal vigilance and a readiness to act promptly and decisively will be necessary for the indefinite future.

The return of history's most deadly and feared pestilence to a world more susceptible than at any time in history could result in a major catastrophe..