

Smallpox

As a Bioterrorism Agent

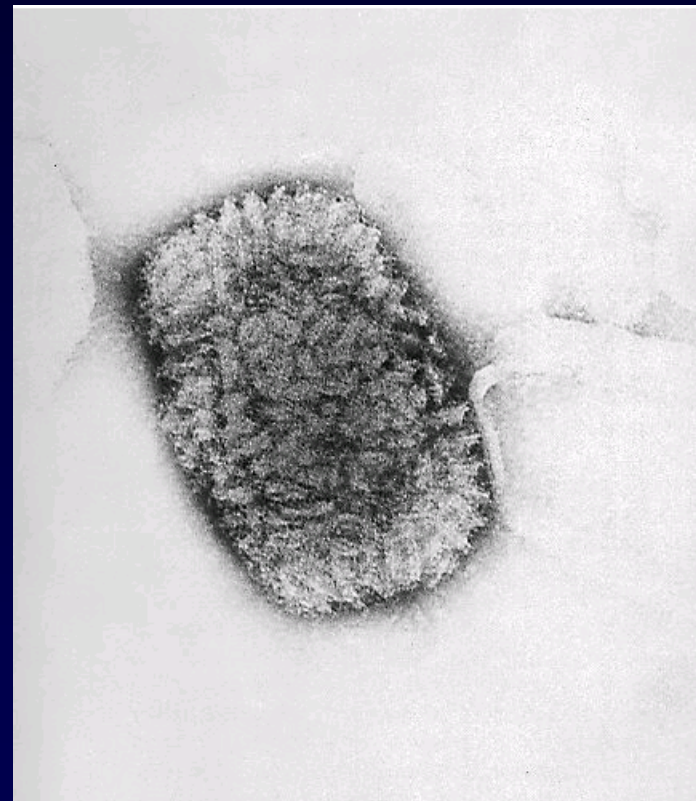
Updated 12/31/02

Smallpox History

- Last naturally-occurring case in 1977
- High (30%) case fatality rate
- Caused at least 500 million deaths in the 20th century
- Routine vaccination in U.S. ceased in 1972
- U.S.S.R. weaponized

Smallpox Microbiology

- **Caused by variola virus**
- **Family Poxviridae**
- **Brick shaped, DNA virus**
- **200 nm in diameter**



Variola Virus

- Occurs in 2 strains
 - variola major
 - 90% of cases are clinically characteristic
 - 30% case fatality rate
 - variola minor
 - Less severe
 - 1% case fatality rate

Smallpox Pathogenesis

- Incubation: 12-14 days (range 7-17d)
- Infection occurs after implantation of virus on the oropharyngeal or respiratory mucosa
- Day 3-4: viral multiplication in lymph nodes; asymptomatic viremia
- Viral spread to spleen, bone marrow, lymph nodes
- Day 8: secondary viremia followed by fever and toxemia

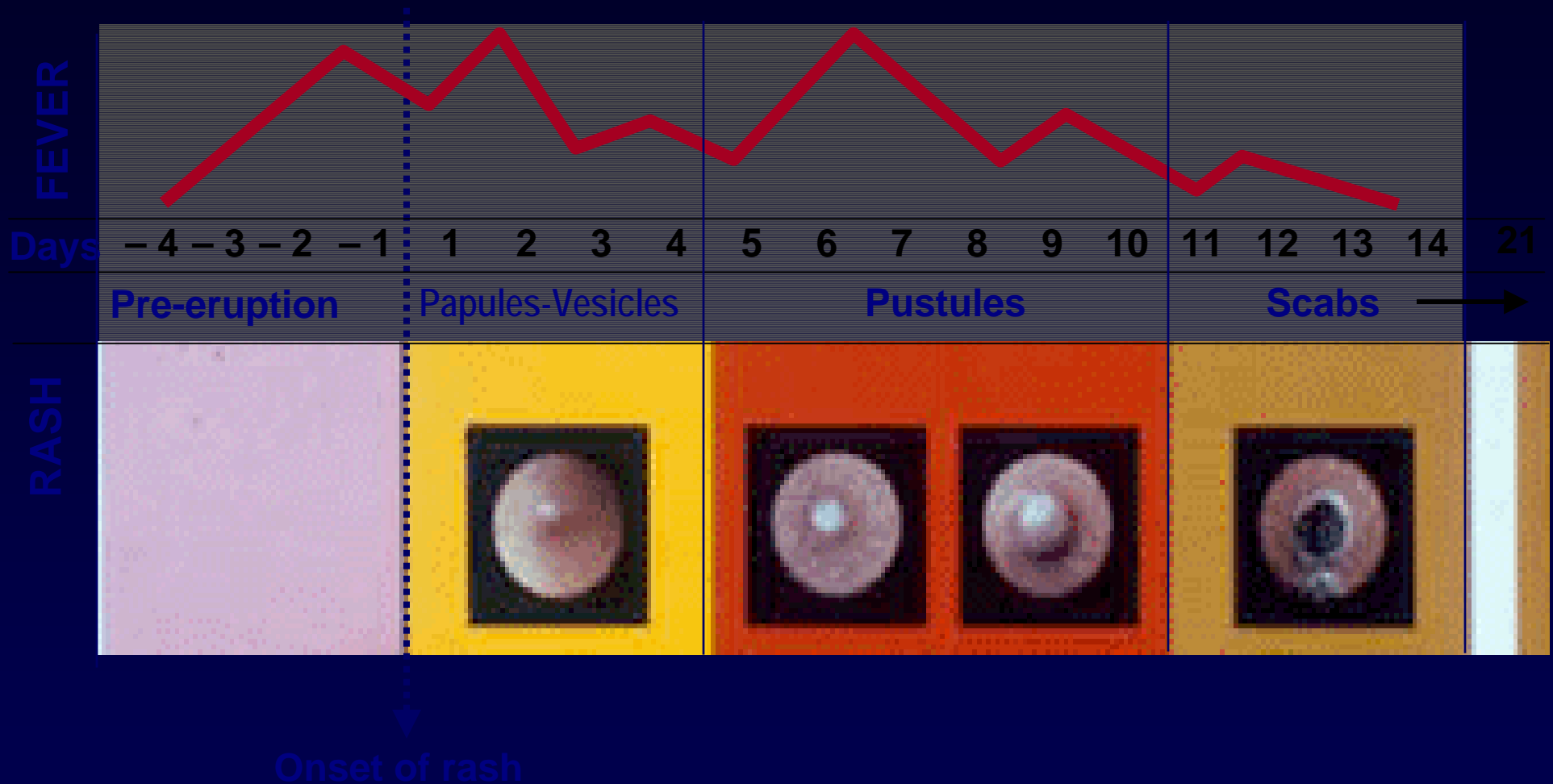
Smallpox Clinical Presentation

- After incubation period, onset of high fever (usually not infectious)
 - Malaise, prostration with headache and backache
- Rash develops 1-2 days later (infectious)
 - First appears on tongue, mouth, oropharynx
 - Spreads to face, forearms 2-3 days later
 - Finally appears on trunk and legs
- Rash becomes vesicular then pustular
- Most infectious from rash onset to first 7-10 days of rash
- Death from smallpox occurs in 2nd week of illness due to toxemia

Smallpox Rash

- **Stages of rash: maculopapular → vesicular → pustular**
- **Smallpox rash has centrifugal distribution (i.e., most dense on face, then extremities)**
- **Synchronous lesions (appear during a 1-2 day period and evolve at the same rate)**

Smallpox Rash and Lesion Development



Source: WHO

Smallpox Rash Progression



3



4



5



7



9



13



Smallpox Rash

3rd Day



Smallpox Rash

3rd Day



Smallpox Rash

5th Day



Smallpox Rash

5th Day



Smallpox Rash

7th Day



Smallpox Rash

7th Day



Smallpox Rash



Smallpox Rash

Smallpox Differential Diagnosis

- **Varicella (chickenpox)**
- **Vaccinia**
- **Monkeypox**
- **Cowpox**
- **Herpes zoster**
- **Drug-induced rashes**
- **Sulfonamide reaction**
- **Morbilliform rash**
- **Coxsackie virus**
- **Secondary syphilis**
- **Molluscum lesions**

Differentiating Smallpox from Chickenpox

	SMALLPOX	CHICKENPOX
FEVER ONSET	2 to 4 days before rash	At rash onset
RASH		
Evolution	Lesions at same stage	Lesions appear in crops
	Lesions evolve at same rate	Lesions in different stages
Distribution	Rash centrifugal	Rash centripetal
	Rash on palms and soles	Never on palms or soles
Development	Slow	Rapid
	Pox don't burst when probed	Lesions burst when probed
MORTALITY	30%	Rare

Rash Distribution



SMALLPOX



CHICKENPOX

Chicken Pox



Chicken Pox



Possible Case of Smallpox

- Call MDH immediately (24/7) at 612-676-5414 or 1-877-676-5414 if a case of smallpox is suspected.

Smallpox Clinical Treatment

- **Vaccination up to 4 days post-exposure can prevent/attenuate clinical symptoms**
- **Supportive care is the mainstay of smallpox therapy**
 - **Ensure adequate fluid intake**
 - **Alleviate pain, fever**
 - **Aggressive treatment of secondary infections**
- **Antiviral therapy is experimental (Cidofovir)**


SMALLPOX

KEEP OUT OF THIS HOUSE

By Order of BOARD OF HEALTH

HEALTH OFFICER

Any person removing this card without authority is liable to prosecution.

Buckley & Curtin  739 Market Street

Smallpox Transmission

- **Smallpox spreads primarily through respiratory droplets**
- **Direct contact and contaminated clothing, bedding can also spread infection**
- **Transmission: rash onset → scabs fall off**
- **Winter and early spring most favorable for spread**
- **Virus inactivated within 1-2 days in event of aerosol release**

Smallpox Infection Control

- **Strict adherence to airborne and contact precautions**
- **Isolate suspected case in negative air pressure room**
- **Healthcare providers should be immunized and use standard, airborne and contact precautions**
- **Virus destroyed with standard disinfectants and heat**

Smallpox Laboratory Procedures

- **Specimens should be collected by recently vaccinated personnel**
- **Vesicular or pustular fluid, scabs, scraping of skin lesions, blood samples, tonsillar swabs**
- **Diagnosis confirmed by PCR and electron microscopy**

Smallpox Vaccination

- Routine vaccination of civilians stopped in the U.S. in 1972
- Immune status of those previously vaccinated is unclear
- Beginning January 2003 smallpox vaccination for certain military personnel and smallpox response teams starts
- Current vaccine, Dryvax, is same vaccine used in 1970s and contains live virus (vaccinia)

Smallpox Vaccination Adverse Events

- 1/10,000 persons have serious side effects including:
 - lymphadenopathy
 - fever
 - encephalitis (1/300,000)
 - progressive vaccinia (1/2,000)
 - eczema vaccinatum (1/26,000)
 - death (1-2/1,000,000)

Vaccine Contraindications (Pre-exposure)

For Vaccinees and Potential Contacts

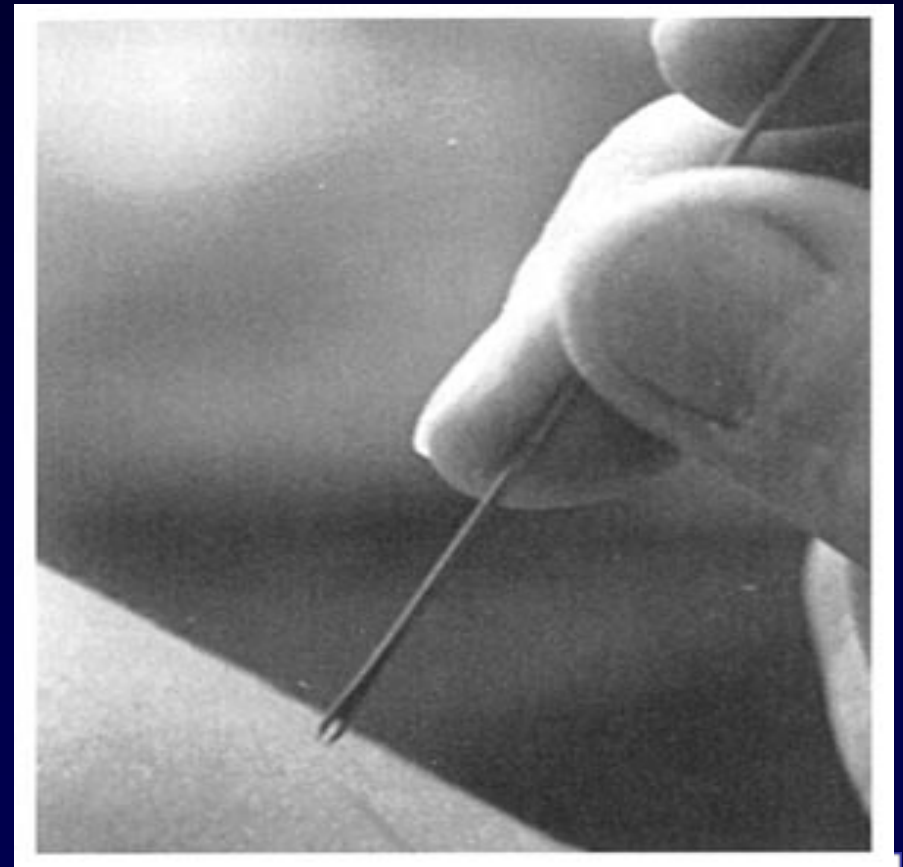
- **Immunodeficiency**
 - e.g., HIV infection, AIDS, many cancers, lupus
- **Immunosuppressive therapy**
 - Cancer, transplants, steroid therapy*, topical steroids for skin dz, inhaled steroids**
- **Eczema/Atopic Dermatitis**
 - Hx or presence of eczema, including “healed” eczema, atopic dermatitis
- **Skin Disorders*****
 - Disruptive or eruptive, e.g., acne, burns, impetigo, zoster, wounds, contact dermatitis, current surgical incision wounds
- **Pregnancy**
 - Current or planning within 4 weeks of vaccination
 - Current nursing
- **Child age 1 yr or less in household**
- **Eye disease of the conjunctiva or cornea (Vaccinee only)**
 - Pruritic lesions, florid inflammation
- **Allergies to Dryvax vaccine components (Vaccinee only)**
 - Polymyxin B sulfate
 - Streptomycin sulfate
 - Chlortetracycline hydrochloride
 - Neomycin sulfate
 - Tetracycline

Source: CDC



Smallpox Vaccine Administration

- Administered via scarification with bifurcated needle
- Needle held at right angles to skin
- 15 rapid strokes in upper arm*
- Trace amount of blood at site indicates successful vaccine delivery



Preventing Contact Transmission

- **Until a scab has formed:**
 - **Vaccination site must be covered**
 - **No touching, scratching, or rubbing vaccination site**
 - **Avoid person-to-person contact with susceptible persons**
 - **Avoid touching, rubbing or otherwise performing any maneuvers that might transfer vaccinia virus to the eye or surrounding skin**
 - **Carefully discard vaccination site covering**
 - **After handling the vaccination site covering, thoroughly wash hands with soap and running water**

Smallpox Vaccination Site Reaction

Primary Vaccination Site Reaction



Day 4



Day 7



Day 14



Day 21

Vaccinia Immune Globulin

- **Vaccinia immune globulin (VIG) is used to treat persons with adverse reactions to smallpox vaccine**
- **Sufficient stock of VIG must be on hand before smallpox vaccinations can be administered**
 - **5,000 doses available at end of 2002**
- **Additional VIG is being supplied from the plasma of recently inoculated persons**

Ring Vaccination for Smallpox



Index Case

Jerry



Elaine

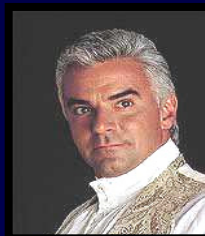


George



Kramer

Close Contact



J. Pederman



Susan



Newman

Contacts of Contacts



Current Smallpox Vaccine Supply

- U.S. government has 15.4 million doses of Dryvax vaccine
- Additional 85 million doses (Aventis Pasteur) held for emergency use
- Clinical studies underway to determine safety and efficacy of other potential vaccines; Acambis vaccine in production