Student lecture.
Handout : Sepkowitz KA, How contagious is vaccinia?
N Engl J Med 2003; 348:439-446.

Smallpox Vaccination Policy

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Epidemiological and Policy Issues
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"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 Soviet military command issued an order to maintain an annual stockpile of 20 tons."

Alibek, 1998

Biological Weapons -- Russia

- A program with 6000 staff in 500 labs
  - Smallpox activities (1980+)
    - Sergiev Posad
    - Novosibirsk
    - Kirov
- Intended use for smallpox virus
  - 1994 meeting with Soviet bioweaponeers
- Dispersal of staff after 1992

Appraisal of the threat – 9/18/01

- A "second event"
- Status of smallpox immunity in the population
- Status of vaccine production
- U.S. stocks of smallpox vaccine and needles

Wyeth DryVax 15 million

- NYCBH strain, calf skin, lyophilized
- 100 dose vials
- Dilution of !:5

Aventis Pasteur -"Wetvax" 85 million

- NYCBH, calf skin, wet frozen, glycerol
- IND status -- emergency use only
- Diluted 5:1 -- 500 dose vials

ACAM 2000 — 209 million

- Acambis/Baxter
- NYCBH-derived strain -- Vero cells
- Lyophilized, 100 dose vials
- Licensure – early 2004

Policy decision – April 2002

- Anticipation --autumn, 2002
  Sufficient vaccine will be available to deal with an epidemic. Should vaccine before an event be made available more widely and, if so, to whom?

Options for Vaccination Before an Event

- **Vaccinate no one**
- **Vaccinate those at highest risk -- candidates:**
  - **Healthcare workers**
  - **First responders**
  - **Postal workers**
  - **Other essential persomel**
- **Vaccinate anyone desiring to be vaccinated**
  - **Recommend vaccination**
  - **Recommend against vaccination**
- **Make vaccination compulsory**

A Balance of Risks

- What is the likelihood that smallpox will be used as a weapon?
- What will be the frequency of adverse reactions in 2003 and what will be the public acceptance?
- How rapidly could an epidemic be controlled?

Smallpox Vaccine-- adverse events
based on 1960s experience

Life-threatening complications	**No/million**
Post-vaccination encephalitis	2-3
Progressive vaccinia	1-2
Eczema vaccinatum	10-15

- **Less serious**
  - **Rash, fever, accidental inoculation**
  - **Pericarditis and myocarditis (NEW)**
- **If 100 million vaccinated-- 100-400 deaths and 1500 to 2000 complications perhaps requiring hospitalization**

Smallpox Vaccine—adverse events
expectations today

- Eczema/ atopic dermatitis – increased
- HIV/AIDS
- Organ transplantation
- More aggressive treatments for cancer

Epidemic control—how effective

- Controversies over "ring vaccination"
  - The modelling crowd
  - The wandering infected terrorists theories

Clinical Course of Smallpox

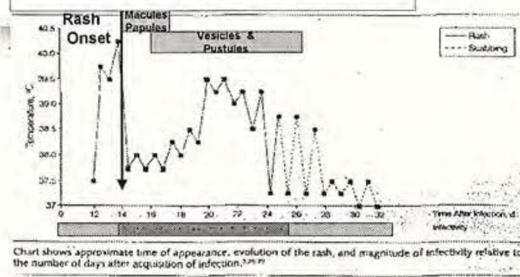

Chart shows approximate time of appearance, evolution of the rash, and magnitude of infectivity relative to the number of days after acquisition of infection.

JAMA, June 9, 1999 · Vol 281, No. 22 **2129**

The Spread of Infection

Spread of smallpox is comparatively slow

- <u>Household spread</u> -secondary household attack rates
  - **Measles 76%**
  - **Chickenpox 74%**
  - **Smallpox 58%**
- <u>**Community spread**</u>
  - **Measles and chickenpox -- spread more rapidly than smallpox because of transmission before symptoms**

Epidemiology of Smallpox

Transmission Patterns in Europe: 1958-1973

- **Outbreaks: 34**
- **Cases: 573**
  - **Transmission in hospital: 277 (48%)**
  - **Transmission in home: 143 (25%)**
- **Hemorrhagic and malignant cases – a threat to hospitals**
  - **Bradford, UK (1961) Hemorrhagic smallpox 10 cases**
  - **Germany (1970) Malignant smallpox 16 cases**
  - **Yugoslavia (1972) Hemorrhagic smallpox 38 cases**
- **Seasonal variation**
  - **Dec to May 24 importations average= +45.6 cases**
  - **June to Nov 10 importations average= + 0.5 cases**

Vacillation – March to December

- Who should make the decision?
- Problems of education re:complications
- A phased program
  - Phase I – those at immediate greatest risk
  - Phase II – First responders and critical personnel
  - Phase III – Dealing with a licensed product
- Vaccine injury compensation

I Vaccinia experience –2003

- Military vaccinations – 325,000+
  - Contraindicated –self or family 25%
  - Sick leave (average –1.5 days)
    - Hospital 3% Theater 0.5%
  - Vaccine transfer to others
    - Spouse (?); close contacts (?); patients (?)

II Vaccinia experience –2003

- Military
  - Generalized vaccinia - 17 (all mild)
  - Encephalitis - 2 (recovered)
  - Progressive vaccinia - 0
  - Eczema vaccinatum - 0
  - Myocarditis - 11 (recovered)

III Vaccinia Experience - 2003

- Civilian -- 30,000 vaccinated
  - Myocarditis 2
  - Angina association 2
  - Myocardial infarction 3 (2 deaths)

Temporal or causal

Secondary spread of vaccinia

- How serious might it be
- What measures to control it
  - How to deal with hospital staff
  - Problems of semi-permeable dressings