Overview of Smallpox

2002
Smallpox as a Bioterrorism Agent

- Last reported case in Minnesota in 1947
- Eradicated in 1977
- Intelligence reports indicate virus has been stolen
- Potential for use as bioweapon
- High (30%) case fatality rate
- Small infectious dose (10-100 organisms)
- Much secondary spread; 10 to 20-fold increase each generation
Variola Virus

- Orthopoxvirus
- Infects only humans in nature
- Rapidly inactivated by UV light, chemical disinfectants, heat
Smallpox Clinical Presentations

• Variola major
  – Severe illness
  – Case fatality rate of >30%

• Variola minor
  – Less severe
  – Case fatality of <1%
Clinical Presentations of Variola Major

- Ordinary (>90% of cases in unvaccinated people)
- Modified (mild; occurs in previously vaccinated people)
- Flat (uncommon; usually fatal)
- Hemorrhagic (uncommon; usually fatal)
Modified Smallpox

- Occurs in previously vaccinated persons
- Prodrome may be less severe
- No fever during evolution of rash
- Skin lesions evolve more quickly
- Rarely fatal
- More easily confused with chickenpox
• Severe prodrome

• Fever remains elevated throughout course of illness

• Extensive enanthem

• Skin lesions soft and flat, contain little fluid

• Most cases fatal
Hemorrhagic Smallpox

- Prolonged severe prodrome
- Fever remains elevated throughout course of illness
- Early or late hemorrhagic signs
- Bleeding into skin, mucous membranes, GI tract
- Usually fatal
Smallpox Complications

- Bacterial infection of skin lesions
- Arthritis
- Respiratory
- Encephalitis
- Death
  - 30% overall for ordinary smallpox
  - 40%-50% for children <1 year
  - >90% for flat and hemorrhagic smallpox
Smallpox Prodrome

- Incubation period 12 days (range 7-19 days)

- Prodrome
  - abrupt onset of fever $>101^\circ F$
  - malaise, headache, muscle pain, nausea, vomiting, backache
  - lasts 1-4 days
Smallpox Rash

- Enanthem (mucous membrane lesions) appears approx. 24 hours before skin rash
- Minute red spots on the tongue and oral/pharyngeal mucosa
- Lesions enlarge and ulcerate quickly
- Virus titers in saliva highest during first week of exanthem
Smallpox Rash

- Exanthem (skin rash) appears 2-4 days after onset of fever
- First appears as macules, usually on the face
- Lesions appear on proximal extremities, spread to distal extremities and trunk
- Vesicles often have a central depression ("umbilication")
- Pustules raised, round, firm to the touch, deeply embedded in the skin
Smallpox Rash

- Lesions in any one part of the body are in same stage of development
- Most dense on face and distal extremities (centrifugal distribution)
- Lesions on palms and soles (>50% of cases)
Day 2 of rash, papules apparent
Day 3, rash more discrete and raised above the skin surface. Fluid beginning to accumulate in papules to form vesicles.
Day 4, vesicles are more distinct and feel firm to the touch.
Day 5, fluid in vesicles becomes cloudy, rash now pustular. Fever usually rises and patient feels more ill.
Day 7, rash definitely pustular
Days 8-9, pustules increase in size, are firm to the touch and are deeply embedded in the skin.
Days 10-14, scabs form. The scabs contain live virus. Until all scabs fall off, patient may infect others.
Day 20, scabs have fallen off and depigmented areas evident. Skin may return to normal appearance, however scars may remain on the face.
Smallpox Differential Diagnosis

- Varicella (chickenpox)
- Vaccinia
- Monkeypox
- Cowpox
- Herpes zoster
- Drug-induced rashes
- Erythema multiforme
- Coxsackie virus
- Herpes Simplex Virus
- Secondary syphilis
- Molluscum contagiosum (esp. HIV patients)
- Scabies and insect bites
- Impetigo
- Contact dermatitis
Smallpox (Variola)

- Febrile prodrome
- Centrifugal distribution (most dense on face, then extremities, less on trunk)
- Synchronous lesions (appear during a 1-2 day period and evolve at the same rate)
- Rash maculopapular, then vesicular, and later pustular
- Lesions firm to touch, deeply embedded in skin
- Lesions on palms and soles
Chickenpox (Varicella)

- Fever with onset of rash
- Centripetal distribution (greater concentration of lesions on the trunk rather than the face and extremities)
- Lesions appear in crops every few days and develop at different stages: papules, vesicles, pustules, and scabs
- Lesions are more superficial and will burst if probed
- Not on palms and soles
Day 1-2, difficult to distinguish rash
Lesions same stage and deeply embedded in skin

Lesions in different stages and more superficial
Scabs not yet formed

Most lesions have formed scabs
Smallpox Major Criteria

• Febrile prodrome 1-4 days before rash onset; fever of >101 F, and at least 1 additional symptom*

• Rash lesions deep, firm/hard, round and well circumscribed

• On any one part of the body lesions in same stage of development

*Prostration, headache, backache, chills, vomiting or severe abdominal pain
Smallpox Minor Criteria

- Greatest concentration of lesions on face and distal extremities
- Lesions first appeared on oral mucosa/palate, face, forearms
- Patient appears toxic or moribund
- Lesions evolve from macules to papules to pustules over days
- Lesions on palms and soles
Risk of Smallpox by Clinical History and Examination

- **High risk**
  - febrile prodrome and
  - classic smallpox lesions and
  - same stage of development

- **Moderate risk**
  - febrile prodrome and
  - 1 major OR > 4 minor criteria

- **Low risk**
  - no febrile prodrome or
  - febrile prodrome and < 4 minor criteria
POSSIBLE CASE OF SMALLPOX

REPORT TO MDH IMMEDIATELY:
1-877-676-5414 or 612-676-5414
Smallpox Clinical Treatment

• Strict airborne and contact isolation

• 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)

• Vaccination of contacts up to 4 days post-exposure can prevent/attenuate clinical symptoms
Infection Control

• Strict adherence to Standard, Airborne, and Contact Precautions

• Airborne:
  – Closed door, negative pressure rooms with > 6 air exchanges per hour. Exhaust outside or through HEPA filtration.
  – Caregivers must wear NIOSH respiratory protection when entering rooms (N95 masks preferred because PAPRs difficult to clean).
Smallpox Information on the Web

• American Academy of Dermatology: www.aad.org/BioInfo/smallpx.html

• CDC smallpox: www.bt.cdc.gov/agent/smallpox/index.asp

• Center for Civilian Biodefense Strategies: www.hopkins-biodefense.org

• Center for Infectious Disease Research and Policy: www.umn.edu/cidrap/

• IDSA Website. www.id society.org/BT/ToC.htm

• MDH: www.health.state.mn.us/bioterrorism/professionals.html