VCU Health System

Policy on Smallpox Vaccination

Rationale

On October 17, 2002, the Advisory Committee on Immunization Practices (ACIP) recommended that each acute care hospital in the United States identify a team of personnel to undergo voluntary smallpox vaccination in order to evaluate and care for any initial cases of smallpox that may present to hospitals following an act of bioterrorism. The ACIP recommended that such Smallpox Health Care Teams include:[1]

1. Emergency Department staff, including both physicians and nurses
2. Intensive Care Unit staff, including physicians, nurses, and in hospitals that care for infants and children, this encompass pediatricians, pediatric intensivists, and pediatric emergency room physicians and nurses
3. General Medical Unit staff, including physicians, internists, pediatricians, obstetricians, and family physicians in institutions where these individuals are the essential providers of primary medical care
4. Medical house staff (i.e., selected medical, pediatric, obstetric, and family physicians)
5. Medical subspecialists, including infectious disease specialists, dermatologists, ophthalmologists, pathologists, surgeons, and anesthesiologists
6. Infection control professionals (ICPs)
7. Respiratory therapists
8. Radiology technicians
9. Security personnel
10. Housekeeping staff (e.g., those staff involved in maintaining the health care environment and decreasing the risk of fomite transmission).

ACIP's recommendations are now under consideration by the CDC and Department of Health and Human Services and a final decision is pending.

Background

Effective smallpox vaccination requires infecting the host with a virus (vaccinia) that must replicate and produce lesions to evoke immunity. Because the vaccine is a live virus serious complications may ensue. These complications are well described[2,3] and are summarized below:

- Eczema vaccinatum: This complication was seen in persons with eczema/atopic dermatitis or a history of eczema/atopic dermatitis. Following vaccination, vaccinia lesions appeared at sites of current or previous skin disease and in some cases spread to normal skin. Severity of the complication was independent of the activity of the eczema/atopic dermatitis, and in most cases eczema/atopic dermatitis was quiescent at the time of infection. Associated constitutional symptoms were severe, and included fever and generalized lymphadenopathy. Case fatality rates varied from 1 to 6%.[12]

- Progressive vaccinia: This complication was seen in persons with underlying immune deficiencies, including agammaglobulinemia, defective cell mediated immunity, tumors of the reticuloendothelial system (e.g., leukemia, Hodgkin disease, lymphoma), or in patients receiving immunosuppressive drugs. The local lesion at the vaccine site failed to heal, secondary lesions appeared elsewhere on the body, and lesions typically spread progressively until the patient died. Case fatality rate was 36%.[12]

- Generalized vaccinia: This complication manifested as a vesicular rash 6-9 days after primary vaccination and was usually self-limited.

- Accidental infection: This was the most common complication of smallpox vaccination, whereby recently vaccinated individuals after touching the vaccine lesion accidentally inoculated vaccinia virus onto the skin of the eyelids, vulva and perineum. Accidental inoculation of the cornea may lead to blindness.

- Encephalitis: This complication was manifested by fever, vomiting, headache, malaise, confusion, disorientation, convulsions, and coma, and in some cases, paralysis. The case fatality rate was 35%. Unfortunately, no identifiable risk factors for this complication have been elucidated.

- Other complications:
  - Postvaccinial tonsillitis
  - Fetal vaccinia via in utero transmission (typically fatal)
  - Vaccinial osteomyelitis
  - Erythema multiforme and Stevens-Johnson Syndrome
  - Bacterial superinfections
  - Melanoma in the vaccine scar (association unclear)

The best estimates of the incidence rates of smallpox vaccination complications were derived from a 10-state survey performed in 1968.[4] However, experts believe that these data are underestimates of the true incidence.[5] Results are shown in the table below:

	Cases per million vaccinations	
Complication	**Primary vaccination**	**Revaccination**
Encephalitis	12	2
Progressive vaccinia	1.5	3
Eczema vaccinatum	38.5	3
Generalized vaccinia	241	9
Accidental infection	529	42
Erythema multiforme	165	10
Other	266	39
TOTAL	1,253	108

Rates of complications are 10-fold higher in primary vaccines.[4] Because the vaccine has not been used for the general public since 1972 in the United States, 40% of the population have never received the vaccine;[12] thus, a greater number of complications is expected due to the large proportion of individuals who will receive the vaccine for the first time.

The current list of contraindications to smallpox vaccination are shown below:[6,7,8]

#	Contraindication	Details
1	**Pregnancy**	• Women who are pregnant or may become pregnant within 3 months of vaccination
2	**Immunodeficiency disorders**	• Congenital or acquired immunodeficiency • HIV infection/AIDS • Organ transplantation • Stem cell transplantation • Cancer (not in remission or within 6 months of completion of chemotherapy) • Leukemia • Lymphoma • Agammablobulinemia • Autoimmune disease
3	**Immunosuppressive therapy**	• Radiation • Antimetabolites • Alkylating agents • Corticosteroids (equivalent to ≥ 20 mg/day) • Chemotherapy agents • Organ transplant medications • Topical steroids for skin disease • Inhaled steroids
4	**Eczema/atopic dermatitis**	• Active eczema/atopic dermatitis or history of eczema/atopic dermatitis
5	**Skin disorders**	• Severe acne • Burns • Wounds • Contact dermatitis • Current surgical incisional wounds • Chickenpox • Shingles • Herpes • Psoriasis • Darier's disease
6	**Diseases of the conjunctiva or cornea**	• Pruritic lesions or florid inflammation (itching of the eye may predispose to accidental inoculation of vaccinia) • Conditions requiring steroid eye drops
7	**Contacts**	• In non emergency situations, close contacts of any person in categories 1-6
8	**Vaccine component allergy**	• Polymyxin B sulfate • Streptomycin sulfate • Chlortetracycline hydrochloride • Neomycin sulfate • Phenol
9	**Women who are breastfeeding**	
10	**Persons with a child < 1 year old in household**	

It must be emphasized that the risk for smallpox vaccination complications today cannot be extrapolated from studies performed in the 1960s. That era presaged HIV infection, solid and bone marrow transplantation, and the effective use of many immunosuppressing agents for neoplastic and immunologic disorders. It is estimated that 300,000 persons in the United States are currently unaware that they are HIV infected.[9] More than 23,000 healthcare

workers have developed AIDS.[10] Only one individual with HIV infection is known to have received smallpox vaccine and he developed progressive vaccinia.[11] Nonetheless, the ACIP did not recommend mandatory HIV testing of healthcare workers prior to smallpox vaccination. In addition, the prevalence of atopic dermatitis is now thought to be 2-7 fold higher than three decades ago[12] with a prevalence of 10-15%.[13] In fact, Engler et al estimate that individuals with a history of or active disease with eczema/atopic dermatitis combined with their contacts comprise up to one-half of the U.S. population.[12]

Importantly, the complications of smallpox vaccination are not limited to those persons who receive the vaccine. The live virus induces an infection in the vaccine recipient and the lesion at the site of the vaccination contains live virus. Thus transmission of vaccine virus may occur from the recently vaccinated individual to others with whom he/she has direct or indirect contact. Vaccinated individuals are infectious from the time of papule development (2-5 days following vaccination) until the lesion has fully scabbed (10-17 days postvaccination).[3] The incidence of complications occurring in contacts of vaccinees in a ten-state survey in 1968 was 20 cases of eczema vaccinatum per million primary vaccinees and 45 cases of accidental infection per million primary vaccinees.[4]

In a published analysis it was recently estimated that 15% of the United States population is at risk for an adverse event following smallpox vaccination. An additional 10% are estimated to be close contacts of these high-risk individuals. Thus, 25% of Americans should be excluded from smallpox vaccination.[14] However, it is important to note that this analysis used fewer vaccine exclusion criteria than currently recommended by the CDC,[6,7] thus underestimating the proportion of the population that should be excluded from vaccination.

Nosocomial transmission of vaccinia from healthcare workers to patients was initially reported in the 1940s.[15] The risk is expected to be higher today since most healthcare workers have received only one smallpox vaccination in the remote past or have never been vaccinated; therefore these individuals would be expected to pose a higher risk of infectivity. It is also important to note that a recent study of healthy adult subjects receiving smallpox vaccination for the first time found that 36% were ill enough with fever and constitutional symptoms to miss work.[16] Although the recent recommendation of the ACIP is to not furlough vaccinated healthcare workers during their period of infectivity,[1] in the 1960s many hospitals did furlough recently vaccinated healthcare workers.[5]

Summary

On review of the historical data regarding smallpox vaccination, the risk for nosocomial transmission cannot be estimated. Certainly, the proportion of hospitalized persons who are immunosuppressed has markedly increased since the vaccine was last used. The incidence of eczema/atopic dermatitis has also significantly increased over the last 30 years. There is also a sizable contingent of healthcare workers who are immunosuppressed or have other contraindications to smallpox vaccination. Lastly, the expectations of the public for zero-risk in their medical care were not as high when the smallpox vaccine was last used. The historical data are useful, however, in documenting the severity of complications. Although newer antiviral therapies may prove useful in ameliorating the adverse effects, clinical data are lacking.

Guidelines

The VCU Health System seeks to provide its patients, visitors, and personnel the highest level of safety in the prevention of nosocomial infections. To that end, the VCU Health System supports the following guidelines:

1. The VCU Health System would support smallpox vaccination of its employees if a case of smallpox is reported anywhere in the world or state and federal officials determine that a serious danger of smallpox transmission exists.

2. VCU Health System employees who receive smallpox vaccination will be furloughed from the time of vaccination until the vaccine scab has separated (typically 17-19 days).

3. Healthcare workers who receive smallpox vaccination must notify Employee Health and must be cleared by Employee Health prior to returning to duty.

4. Patients who have received smallpox vaccine and who have active vaccinia lesions will be placed in contact and airborne precautions. Contact Epidemiology for further instructions (8-2121 or beeper #4085). [modified by the Infection Control Committee January 21, 2003].

5. Healthcare workers who are immunocompromised or have chronic exfoliative skin conditions should be excluded from caring for persons with vaccinia lesions.

6. The Chief Medical Officer, Chief Nursing Officer and Hospital Epidemiologist will develop a plan for rapid vaccination of selected healthcare workers that will be used if a case of smallpox is reported.

7. As new data become available on the risks of smallpox vaccine and the risk for the potential of smallpox transmission, this guideline will be re-evaluated and revised if needed.

Approved by the Infection Control Committee, November 25, 2002.
Approved by the Medical Executive Committee, December 11, 2002.

(signature on file; dated December 16, 2002)
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Reviewed and endorsed by the Ethics Committee, January 13, 2003.

References

[1] CDC. Summary of October 2002 ACIP Smallpox Vaccination Recommendations. Available at: http://www.bt.cdc.gov/agent/smallpox/vaccination/acip-recs-oct2002.asp. Accessed November 10, 2002.

[2] Fenner F, Henderson DA, Anita I, Jezek Z, Ladnyi ID. Smallpox and Its Eradication. Geneva: World Health Organization, 1988.

[3] McClain DJ. Smallpox. In: Zatjchuk R, ed. Textbook of Military Medicine. Washington, DC: Office of the Surgeon General, Walter Reed Medical Center;1997:539-559. Available at:: http://chemdef.apgea.army.mil/textbook/Ch-27.pdf. Accessed November 8, 2002.

[4] Lane JM, Ruben FL, Neff JM, Millar JD. Complications of smallpox vaccination, 1968: results of ten statewide surveys. J Infect Dis 1970;122:303-309.

[5] Neff JM, Lane JM, Fulginiti VA, Henderson DA. Contact vaccinia—transmission of vaccinia from smallpox vaccination. JAMA 2002;288:1901-1905.

[6] CDC. Smallpox Vaccination and Adverse Events Training Module. Available at: http://www.bt.cdc.gov/training/smallpoxvaccine/reactions/contraindications.html. Accessed November 10, 2002.

[7] CDC. Smallpox Fact Sheet. Available at: http://www.bt.cdc.gov/agent/smallpox/vaccination/contraindications-public.asp. Accessed November 10, 2002.

[8] CDC. Smallpox Fact Sheet – Information for Clinicians. Available at: http://www.bt.cdc.gov/agent/smallpox/vaccination/pdf/contraindications-clinic.pdf. Accessed November 11, 2002.

[9]Walensky RP, Losina E, Steger-Craven KA, Freedberg KA. Identifying undiagnosed human immunodeficiency virus. Arch Intern Med 2002;162:887-892.

[10] CDC. Surveillance of healthcare workers with HIV/AIDS. Available at: http://www.cdc.gov/hiv/pubs/facts/hcwsurv.htm. Accessed November 10, 2002.

[11] Redfield RR, Wright DC, James WD, et al. Disseminated vaccinia in a military recruit with human immunodeficiency virus (HIV) disease. N Engl J Med 1987;316:673-676.

[12] Engler RJ, Kenner J, Leung DY. Smallpox vaccination: risk considerations for patients with atopic dermatitis. J Allergy Clin Immunol 2002;110:357-365.

[13] Larsen FS, Hanifin JM. Epidemiology of atopic dermatitis. Immunol Allergy Clin North Am 2002;22:1-24.

[14] Kemper AR, Davis MM, Freed GL et al. Expected adverse events in a mass smallpox vaccination campaign. Effective Clinical Practice March/April 2002. American College of Physicians-American Society of Internal Medicine Web site. Available at:: www.acponline.org/journals/ecp/marapr02/kemper.htm. Accessed November 10, 2002.

[15] Greenberg M. Complications of vaccination against smallpox. Am J Dis Child 1948;76:492-502.

[16] Frey SE, Couch RB, Tacket CO et al. Clinical responses to undiluted and diluted smallpox vaccine. N Engl J Med 2002;346:1265-1274.