

“Vaccinia” Smallpox Vaccine virus -VS- “Variola” Smallpox Disease virus

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A. Definitions:

- Vaccinia virus is the DNA orthopoxvirus in the smallpox vaccine. Mortality due to vaccinia vaccine in the USA has been < 0.001%.
- Vaccinia virus was originally (Jenner 1796) related to cowpox (Latin “vacca”, cow), but is now clearly distinct from cowpox.
- Vaccinia virus does not cause smallpox.
- Variola virus is the DNA orthopoxvirus that causes smallpox the *disease*.
- The agent of bioterrorism is Variola major virus, which has a mortality rate > 30%.

B. Transmission:

- Vaccinia virus from the vaccine is spread by direct contact and NOT through the air (unlike variola).
- Vaccinia exists in a live, but weakened, form in the smallpox vaccine.
- Vaccinia can be transmitted by skin-to-skin contact with the active vaccinia skin lesion that is present in a recently vaccinated person. Those who become infected in this way can develop adverse reactions to the live vaccinia virus just as though they themselves had been deliberately vaccinated.
- Variola virus from a person with smallpox the *disease* is spread both through the air (+ airborne transmission) and by direct skin-to-skin contact, or contact with variola virus on inanimate objects (“fomites”) such as clothing.

C. Immune Responses

- Vaccinia virus vaccine induces a cross-protective immune response against the variola virus and thus protects against smallpox *disease*.
- If immunocompromised persons are vaccinated or exposed by contact to vaccinia virus, they can develop life-threatening reactions to the vaccine.
- These reactions include “progressive (necrotic) vaccinia,” which can be fatal.
- Variola virus induces an immune response that is often inadequate to prevent *disease* and death (mortality is >30% in persons never vaccinated).
- Immunocompromised persons may have more severe smallpox, with atypical smallpox skin lesions termed “flat-malignant”, or “hemorrhagic” (> 90% mortality).

D. Therapy:

- Vaccinia virus: there is no FDA-licensed drug for treating severe vaccinia vaccine reactions.
- Cidofovir is an antiviral drug that may be studied against vaccinia virus. Cidofovir’s kidney toxicity is decreased by giving it with probenecid.
- Vaccinia Immune globulin (VIG) is effective for most of the severe vaccinia vaccine reactions.
- Variola virus: there is no FDA-licensed drug for treating smallpox *disease*.
- Cidofovir is an antiviral drug that may be studied on an investigational basis against variola virus.
- VIG is not effective against variola virus.