

2008 LABORATORY ACQUIRED VACCINIA INFECTION: A RETROSPECTIVE


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Laboratory-Acquired Vaccinia Virus Infection — Virginia, 2008

Vaccinia virus (VACV) is the live viral component of smallpox vaccine. Inadvertent exposure to VACV can result in infection, and severe complications can occur in persons with underlying risk factors (e.g., pregnancy, immunodeficiency, or dermatologic conditions) (1). The Advisory Committee on Immunization Practices (ACIP) recommends workplace vaccination for laboratory workers who handle nonhighly attenuated VACV strains or other orthopoxviruses (e.g., monkeypox, cowpox, or variola) (2). On July 8, 2008, CDC was notified by a Virginia physician of a suspected case of inadvertent autoinoculation and VACV infection in an unvaccinated laboratory worker. This report describes the subsequent investigations conducted by the Virginia Department of Health and CDC to identify the source of infection and any cases of contact transmission. Of the patient's 192 possible contacts, seven had underlying risk factors for developing serious vaccinia infection. Investigators found no evidence of contact transmission and, based on the results of molecular typing, further concluded that the patient had been exposed to a VACV strain that had contaminated the seed stock from the laboratory where the patient worked. This case underscores the importance of adherence to ACIP vaccination recommendations for laboratory workers and use of safety precautions when working with nonhighly attenuated VACV (3).

Case Report

On July 5, 2008, a man in his twenties who worked in a laboratory at an academic institution in Virginia went to a local urgent care clinic. He reported swelling of cervical lymph nodes and pain and inflammation of his right earlobe associated with purulent discharge beginning July 2, followed on July 3 by a forehead fever and swelling of his left eye with no change in his vision. The patient was prescribed cephalosporins for presumed bacterial infection and prednisone for swelling.

However, on July 6, his symptoms worsened, and he went to a hospital emergency department. The patient was given bacitracin for his eye and discharged. That night, he noted pustular lesions at similar stages of development on his right ear and left eye (Figure), and also on his chest, shoulder, left wrist, and right leg.

On July 7, the patient returned to the emergency department with increasing eye pain and mild photophobia and received a diagnosis of right auricular/plural cellulitis and suspected periorbital cellulitis. Prednisone was discontinued, and he was admitted to the hospital for treatment with intravenous vancomycin, ceftriaxone, and pain medications. The same-day ophthalmology consultation was obtained for left-sided severe preseptal cellulitis, confirmed by computed tomography scan. Biopsy of the conjunctival lesion revealed acute necrotizing

FIGURE. Left eye and right ear of a man with laboratory-acquired vaccinia virus infection—Virginia, 2008



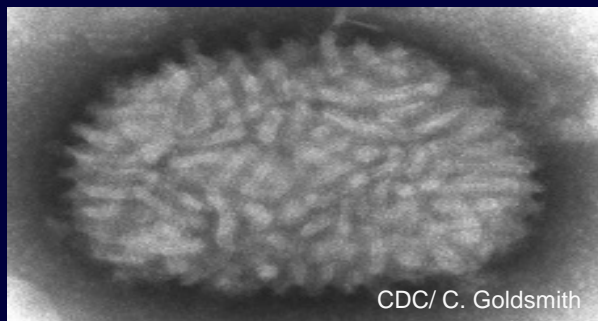
Photo/Virginia Department of Health

INSIDE
800: Fostering Control by Corle — Four States, 2003–2008
804: Status of Zoonotic Bacterial Disease Surveillance Systems — United States, 2007

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION**

October 22, 2013
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Vaccinia Virus



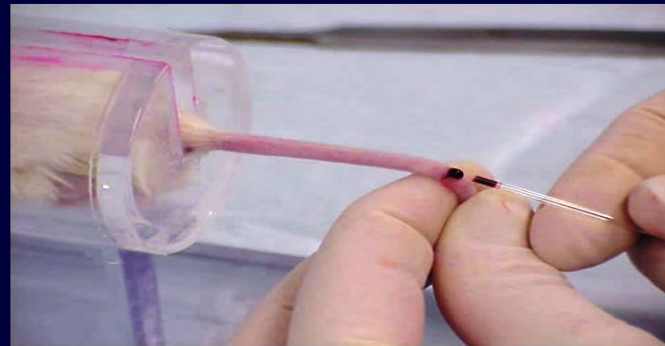
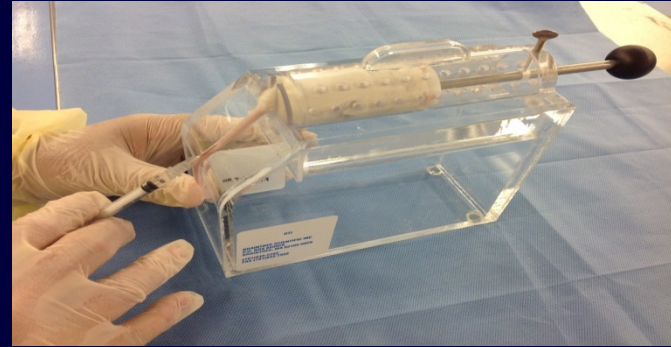
- Unknown Origin
- Unknown Natural Reservoir
- Protein Expression
- Antigen Delivery
- Vaccine Vector
- BMBL: BSL2 & ABSL2 plus vaccination
- >17 published LAI in U.S. since 2004
- Vaccinia LAI transmission typically via needlestick or eye splash (Virology, 385, 2009)

Origin Laboratory Research & Relevant Experiments

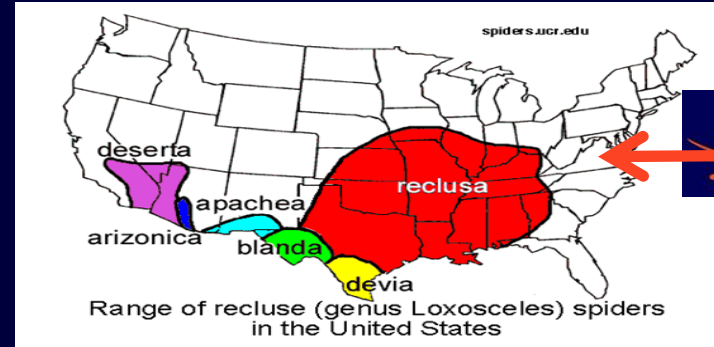
- Immunological response studies focusing on CD8+T cell memory.
- Western Reserve Vaccinia recombinant expressing heterologous ovalbumin antigen (OVA-vac) at TK locus.
- Primary CD8+ T cell response generated in mice by injecting 10^7 p.f.u. via tail vein injection of OVA-vac.
- Periodic blood samples via tail vein bleed.

Case Study Timeline

- 17 June: OVA-vac Administration
- 24 June: Blood Collection via Tail Vein



1 July: Ear Pain & Inflammation



- *Reports of Presumptive Brown Recluse Spider Bites Reinforce Improbable Diagnosis in Regions of North America Where the Spider is Not Endemic*
Rick Vetter & Sean Bush
Clinical Infectious Disease, 35(4) pp 442-445, 2002

Bee Sting



3 July

- Fever
- Left Eye Swelling
 - No Change in Vision



5 July (Saturday): Urgent Care Facility

- Ear Infection
 - Cephalexin
 - Antibiotic
- Bee Sting
 - Prednisone
 - Immunosuppressive
- 6 July
 - Eye Conditions Worsen
 - Hospital Emergency Department
 - Discharged

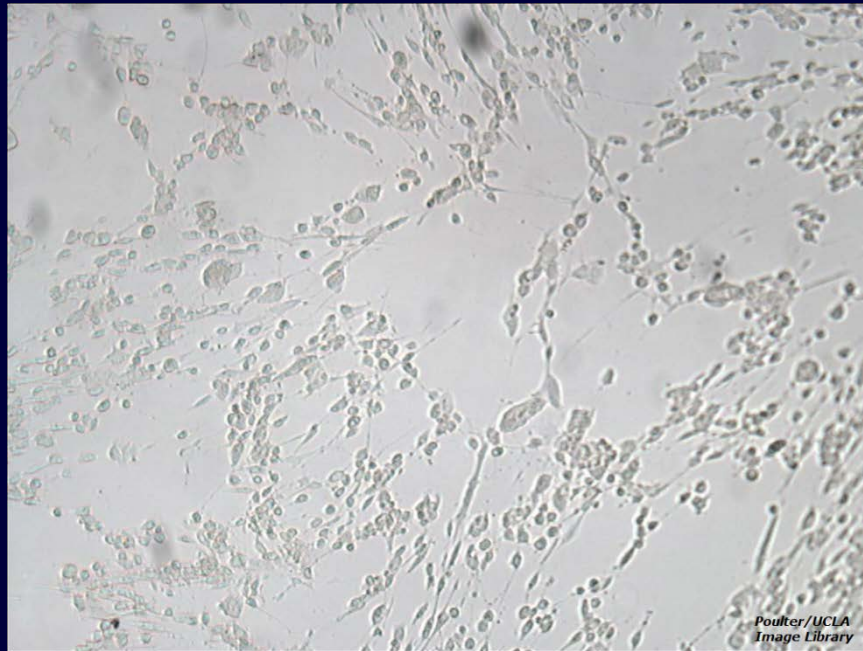
7 July: Hospital Admission

- Pustular Lesions:
Rt Ear, Lt Eye, Chest,
Shoulder, Lt Arm, Rt Leg,
Trunk
- Ophthalmology Consultation
- Infectious Disease
Consultation
 - 8 July...Poxvirus?
 - Wound scrapes sent to
Clinical Lab

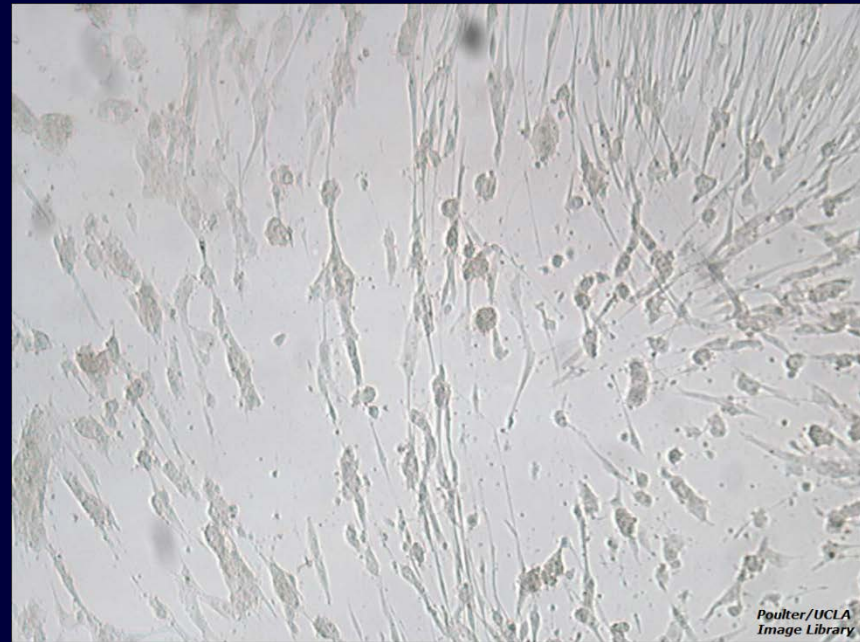


Clinical Laboratory: Specimens applied to MRC5 Cell Culture

HSV Growth (Expected)



Vaccinia Growth (Observed)

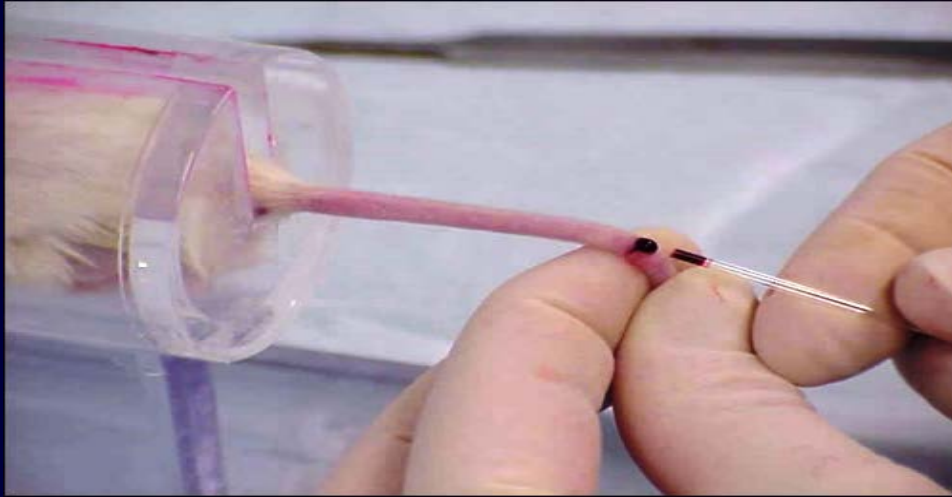


Images courtesy Dr. M. Poulter, UVA Clinical Lab

9 July

- Presumptive Vaccinia Diagnosis
- Specimens to:
 - Virginia Laboratory Response Network
PCR detects non-variola orthopox DNA signatures
- CDC Poxvirus Lab
 - Confirmation via Molecular Typing, however...

Mechanism of Transmission



Transmission





- Compromised Skin?
- Vaccinia virus may persist from weeks to months, depending upon conditions (Wood, et al (2013), Environmental Persistence of Vaccinia Virus on Materials. Letters in Applied Micro)

Select Contributing Factors

- Contaminated Glove Contact to Face (Ear)
- Decoys in Vaccinia Symptom Recognition: Spider Bite, Bee Sting
- Lack of Vaccination

Enhancements to Vaccinia Education & Vaccination Programs



- Development of Vaccinia-Specific Training Modules
 - Completion Required by IBC
- Mandatory Medical Counseling (unchanged)
- If Vaccination is not Received, Occupational Health Division alerts Supervisor:
 - *“John Doe is Not Cleared to Work with Vaccinia.”*



Vaccinia Virus

Part I:
Reducing Laboratory-acquired Exposures and Infection

This module does not replace medical counseling.
For Vaccinia medical counseling, please contact your PI and WorkMed.



Vaccinia Virus

Part II:
Vaccination Information

This module does not replace medical counseling.
For Vaccinia medical counseling, please contact your PI and WorkMed.

Random Informal Survey of 14 U.S. Universities Hosting Vaccinia Research (2011, Cornell University*)

- 12/14 Require Medical Counseling Prior to Vaccinia Exposure
- 2/14 Unclear or No Response
- 9/14 Recommend Vaccination
- 2/14 Require Vaccination
- 3/14 Unclear or No Response
- Actions taken for Medical Contraindication:
 - Advised to avoid Vaccinia exposure & supervisor notified: 4
 - Prohibited from work involving agent: 2
 - BSL3 precautions: 1
 - Unclear or No Response: 7

Insightful Survey Comments:

- University A: 42 counseled over 3 yrs
 - 1 individual requested vaccination & was vaccinated.
- University B: 63 counseled over 3 yrs
 - 6 were vaccinated
 - Most who declined were fearful of adverse vaccination outcomes.

* *Dr. Chip Patterson, Director of Occupational Medicine, Cornell University, Ithaca, NY*

Acknowledgements

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