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# Transmission of Vaccinia Virus, Possibly Through Sexual Contact, to a Woman at High Risk for Adverse Complications

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**ABSTRACT** Severe adverse events, including eczema vaccinatum (EV), can result after smallpox vaccination. Persons at risk for EV include those with underlying dermatologic conditions, such as atopic dermatitis. We investigated a case of vaccinia infection, possibly acquired during sexual contact with a recently vaccinated military service member, in a female Maryland resident with atopic dermatitis. The U.S. Department of Defense's Vaccine Healthcare Centers Network (VHCN) and the Centers for Disease Control and Prevention (CDC) worked in conjunction with the patient's physician and the Maryland Department of Health and Mental Hygiene (DHMH) to confirm the diagnosis, ensure treatment, and prevent further transmission. Specimens collected from the patient were tested at the DHMH laboratories and were positive by real-time polymerase chain reaction for nonvariola orthopoxvirus. Testing at the CDC verified the presence of vaccinia-specific DNA signatures. Continuing spread of the patient's lesions led to the administration of vaccinia immune globulin and strict infection control measures to prevent tertiary transmission to vulnerable family members, also with atopic dermatitis. VHCN contacted the service member to reinforce vaccination site care and hygiene. This case underscores the importance of prevaccination education for those receiving the smallpox vaccine to protect contacts at risk for developing severe adverse reactions.

## INTRODUCTION

Smallpox is a life-threatening vaccine-preventable disease that has been effectively eradicated from the world. In the United States, routine vaccination was stopped

in 1972, but U.S. military members, certain laboratory researchers, and first-response public health providers continue to be vaccinated through a national program that began in December 2002, largely because of concerns regarding bioterrorism.<sup>1</sup>

Vaccinia virus can be transmitted from a vaccinee's unhealed vaccination site to other persons through physical contact or contaminated items (e.g., clothing). For the majority of persons, this transmission results in a mild local skin reaction, but for persons with certain underlying skin problems, it can result in more severe life-threatening conditions.<sup>2</sup> One potential complication that can occur among vaccinees or infected contacts of the vaccinee is eczema vaccinatum (EV), which occurs 5 to 19 days after the exposure and often results in an extensive rash and severe systemic illness among persons with atopic dermatitis.<sup>3</sup> Smallpox vaccination is thus contraindicated for those with a history of atopic dermatitis or other active acute, chronic, or exfoliative skin conditions.<sup>3</sup>

Contact transfer of vaccinia virus, which includes cases of genital infection, has been reported, although rarely.<sup>1,2,4</sup> In almost all of these cases, resulting lesions resolved without treatment. A recent report, however, describes a case of both secondary and tertiary transmission of vaccinia virus after sexual contact with a smallpox vaccinee that required the administration of vaccinia immune globulin (VIG) because of the number, location, and progression of the lesions.<sup>5</sup> Here, we add to these reports of vaccinia virus by sexual transmission and further describe the particular concern of vaccinia infection in persons with underlying atopic dermatitis.

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## CASE REPORT

In March 2012, a woman aged 23 years presented to a physician complaining of 2 days of backache, fever, and vaginal pain associated with the development 1 day after fever onset of a pruritic and painful vulvar lesion. On the day of presentation, she reported multiple new vulvar and perineal lesions as well as painful nodule on her back, near the scapula. After initial diagnostic testing, she returned home, but again sought medical care 2 days later after having developed another lesion on her right thigh.

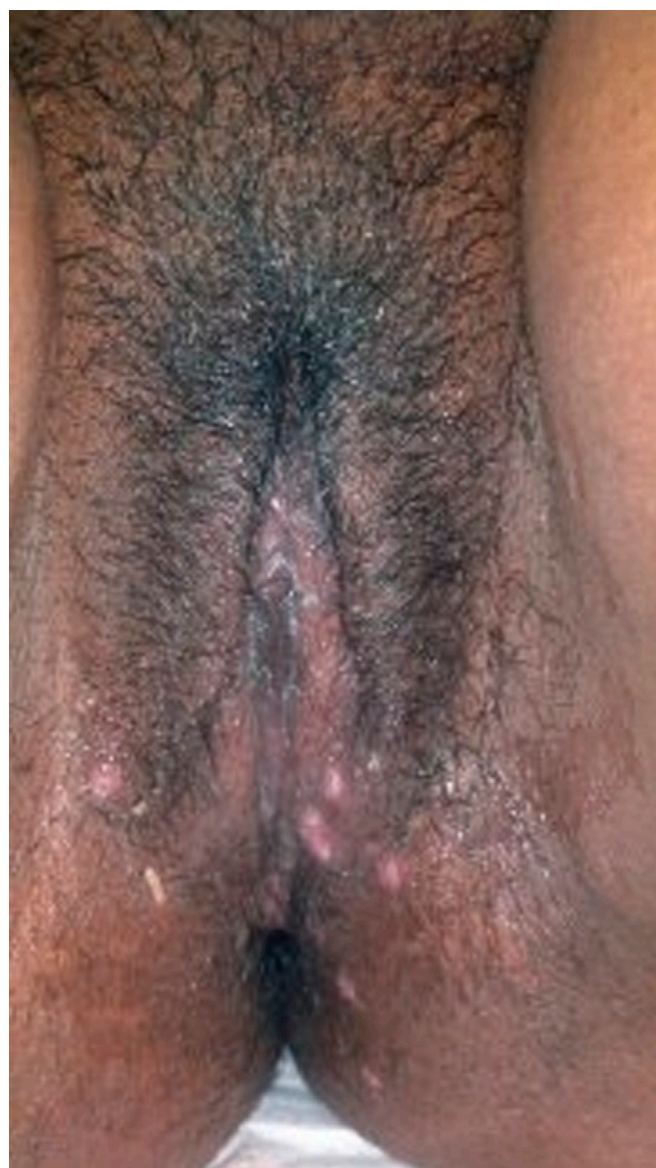
She was menstruating at the time of lesion development and using tampons. Her medical history was notable for atopic dermatitis. She denied any immunosuppressive conditions, including pregnancy or human immunodeficiency virus infection. Her only chronic medication was clobetasol cream, which she used topically for monthly atopic dermatitis flares. At the time of presentation, she also reported that she had tried, at a family member's suggestion, multiple daily applications of the clobetasol to the vulvar lesions to relieve symptoms after the first vulvar lesion appeared. She had never been vaccinated against smallpox. However, 2 weeks before symptom onset, she had had sexual contact with a military service member who had been vaccinated against smallpox 4 days previously. Their last sexual contact was 3 days before symptom onset. Although the vaccination site was covered with a dressing, the dressing fell off during one of their encounters and was not immediately reapplied.

The patient lived alone but had spent extensive time with her family since becoming ill. At least 2 family members also had a history of atopic dermatitis. The patient had sat on the family couch with the lesion on her back uncovered and draining, and family members had helped her with her laundry, which included cloths she had used to clean drainage from the lesions. At presentation, she was afebrile and noted to have approximately 12 vulvar and perineal lesions as well as lesions on her back and thigh without associated lymphadenopathy (Fig. 1). The lesions were <1 cm, nodular, erythematous, and painful to the touch.

Testing for herpes simplex virus was negative. Specimens collected from the right thigh, vulva, perirectal area, and back were tested at the Maryland Department of Health and Mental Hygiene (DHMH) laboratories and were positive by real-time polymerase chain reaction (PCR) for nonvariola orthopoxvirus. Testing at the Centers for Disease Control and Prevention (CDC) verified the presence of vaccinia-specific DNA signatures.

## TREATMENT AND PUBLIC HEALTH RESPONSE

The U.S. Department of Defense's Vaccine Healthcare Centers Network (VHCN) and CDC worked in conjunction with the infectious disease doctor and DHMH to ensure treatment and infection control measures. The patient was strongly encouraged to (1) stay at home, avoid sexual con-



**FIGURE 1.** Vulvar lesions in patient before treatment.

tact, and avoid using tampons until the lesions healed; (2) stop using the topical steroid cream in the vulvar area; and (3) adhere to strict hygiene instructions.

Five days after the onset of symptoms and 1 day after laboratory diagnosis, she reported difficulty voiding because of dysuria and an aching low pelvic pain; the following day, she reported a new toe lesion. Given the concern of progressing lesions, her underlying atopic dermatitis, her use of a potent topical immunosuppressive agent, and concern about the potential for ascending vaginal infection, she was treated with vaccinia immune globulin (VIG) intravenous (Cangene, Berwyn, Pennsylvania) 6 days after symptom onset in accordance with accepted indications. Additional samples obtained from the back, vulva, and perirectal area were also positive by PCR for nonvariola

orthopoxvirus. Serum was negative by PCR for orthopoxvirus. Serology (enzyme-linked immunosorbent assay) obtained before VIG administration indicated IgM and IgG orthopoxvirus antibodies.

Repeat examination 5 days after the administration of VIG showed no new lesions and that the thigh and toe lesions had almost completely resolved and the scapular lesion had scabbed over. The patient did not return for follow-up testing to determine laboratory-confirmed clearance of the orthopoxvirus or to determine further clinical course, but by 22 days after symptom onset, she reported by telephone that her lesions had resolved. At the time of last contact with the patient, no family member had reported symptoms.

VHCN contacted the military service member to ensure he was caring for the vaccination site to prevent further transmission. Vaccination site care and hygiene were reinforced, and he was also given instructions on cleaning the surfaces in his home. The scab at the inoculation site fell off 1 month after vaccination.

## DISCUSSION

We describe a case of vaccinia infection that might have been acquired through sexual contact in a patient with a history of atopic dermatitis and that resulted in VIG administration. As is shown in this case, vaccinia can spread beyond the initial vaccinee. During December 13, 2002 to March 2011, a total of 115 cases of contact vaccinia associated with vaccinated military personnel were identified, the majority of which occurred among women ( $n = 67$ ) or children ( $n = 17$ ) who lived in the same household or shared a bed with a vaccinee or a vaccinee's contact.<sup>1</sup> The patient in our investigation reported sitting on the family couch with an open, draining wound. Environmental testing was not performed, but previous studies have reported fomites as potential infection sources, and viable virus can persist in the home environment for at least 2 weeks after being shed.<sup>6</sup>

This patient was especially vulnerable to severe complications not only because of her history of atopic dermatitis but also because she had used a high-potency topical steroid cream, which heightened her risk through autoinoculation. Her family, with whom she was in close contact, was at risk for tertiary transmission, which might have resulted in severe adverse conditions, including EV.

EV is characterized by symptoms or signs of a systemic viral illness as well as lymphadenopathy; a history of atopic dermatitis, Darier disease (keratosis follicularis), or presence of skin conditions with loss of epithelial integrity; concentrated or generalized skin lesions; and laboratory confirmation of vaccinia infection from the blood or lesions other than the vaccination site.<sup>7</sup> This patient had subjective fever, a history of atopic dermatitis, and multiple skin lesions that tested positive for nonvariola orthopoxvirus. However, fever was not documented; lymphadenopathy was absent; the lesions were not concentrated; and serum was

negative for nonvariola orthopoxvirus by PCR. Thus, although this patient was at high risk for experiencing EV, her presentation of multiple lesions at different body sites over 6 days probably was caused by autoinoculation.

Although we do not believe that this was a case of EV, the case was concerning because of the high risk for experiencing severe disease or for spreading the virus to others also at risk. Although rare, EV carries considerable risk for morbidity and mortality. Atopic dermatitis is a common condition, with an estimated prevalence of  $\leq 20\%$ .<sup>8</sup> Approximately 175,000 U.S. military service members are vaccinated against smallpox annually<sup>9</sup>; thus, the number of persons who might experience EV is relatively large. In response to this, the military screens for those who have a history of atopic dermatitis or live with others who do<sup>10</sup> and offers specific education.<sup>11</sup> The military service member in this investigation had not been aware that the patient had atopic dermatitis. Additionally, the U.S. Food and Drug Administration requires that licensed vaccines include a medication guide with information about potential side effects.<sup>12</sup> In the United States, only 1 confirmed EV case has occurred among military vaccinees and only 1 EV case involving contact transmission to a family member since the U.S. Department of Defense smallpox vaccination program began in 2002 (unpublished data). This underscores the importance of prevaccination education efforts. Continued emphasis on education regarding both vaccination site and hand hygiene for those receiving the smallpox vaccine remains necessary to protect contacts most vulnerable to severe adverse reactions.

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