

Tertiary Contact Vaccinia in a Breastfeeding Infant

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IN RESPONSE TO RECENT CONCERNS that smallpox virus might be used as a biological weapon against military or civilian targets, the US Department of Health and Human Services (DHHS) and the US Department of Defense (DOD) implemented large-scale smallpox immunization programs, including vaccination of volunteer health care workers who may be first responders or secondary providers for smallpox patients and all military personnel prior to deployment to an area where smallpox might be used as a weapon. More recently, a monkeypox outbreak in the midwestern United States led the Centers for Disease Control and Prevention (CDC) to issue interim guidelines for vaccinia administration to protect individuals at risk of that infection.¹

The United States discontinued routine childhood smallpox immunization in 1971 and routine immunization of health care workers in 1976. With the renewed smallpox immunization program, many health care workers have confronted vaccinia reactions for the first time. Although recommendations have been made to minimize complications such as inadvertent inoculation, risk of household transmission remains a concern, and risk estimates are currently based primarily on historical information. Such information has limitations because it is derived from surveillance studies that likely underreported mild reactions; also, it applies to a population with different levels of baseline immunity.^{2,3} We report a recent case of tertiary contact vaccinia in the infant of a

On May 4, 2003, a US Army soldier received primary smallpox vaccination and experienced a primary uptake reaction at the inoculation site on days 6 through 8. The vaccinee reported observing all of the standard precautions to avoid household spread. In mid May, his breastfeeding wife developed vesicles on both areolas. On May 29, their infant daughter developed a papule on her philtrum. Contact vaccinia was confirmed by positive polymerase chain reaction and culture for vaccinia of both the maternal and infant lesions. This is the first documented case of inadvertent contact vaccinia transmission from a mother to her infant through direct skin-to-skin and skin-to-mucous membrane contact while breastfeeding. The mechanism of transfer from the vaccinee to the spouse is uncertain. This report demonstrates that breastfeeding infants living in close contact with smallpox vaccinees are at potential risk for contact vaccinia, even if the vaccinee is not the breastfeeding mother, and highlights the need for special precautions to prevent secondary transfer to breastfeeding mothers.

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breastfeeding wife of a primarily vaccinated soldier. This case highlights the potential for inadvertent household spread and the importance of recognition of this complication.

REPORT OF A CASE

On May 4, 2003, a 27-year-old soldier received primary smallpox vaccination; he experienced a primary reaction (local reaction papule on an erythematous base consistent with vaccine uptake on days 6 to 8 after immunization, accompanied by headache and lymphadenopathy for several days, but no significant pruritus). In accordance with established educational protocols, he had received standardized instruction on the prevention of autoinoculation and contact transmission at the time of vaccination. In addition to hand washing and keeping the site covered with a gauze nonocclusive dressing, he was also told to limit contact with his

5-month-old breastfeeding daughter. The vaccinee slept in the same bed with his 27-year-old wife, wearing a short-sleeved shirt with bandages in place. He denied any drainage from the dressing or any significant pruritus. Neither the vaccinee nor his spouse recalled the dressing ever falling off while in bed. After bathing, he dried the vaccination site with tissue that he disposed of in a trash receptacle. He placed bath towels used to dry himself in a laundry container, rolling the towels so that the area that dried his arm was rolled to the inside. His wife did handle all the laundry, including bed linen and towels. She denied seeing any drainage on either clothing or linens or having any direct contact with his vaccination site.

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Figure. Vaccinia Lesion on Breastfeeding Infant



In mid May, the wife developed painful vesicular skin lesions on both areolas. She did not recognize that the lesions might be due to a contact infection with vaccinia, so she continued to breastfeed the infant. She was seen several times as an outpatient for this complaint, beginning on day 4 of the infection, and was treated for mastitis with nystatin, fluconazole, and cephalexin, without improvement. On May 29, she ceased breastfeeding because of pain.

On May 29, the infant developed a papule on her philtrum, which progressed to a papulo-vesicle-pustule and then formed a crust. On May 30, a similar lesion developed on her left cheek. On June 2, the infant was taken to her pediatrician, where she was noted to have an ulcer on the left lateral side of her tongue in addition to the other 2 lesions. She also had a temperature of 38.4°C but was otherwise healthy in appearance, with no other lesions. The infant did not have a history of eczema, skin disease, or immunocompromise. The only other family member, the infant's 4-year-old brother, did not have any skin lesions. The infant was diagnosed with suspected contact vaccinia and transferred to Madigan Army Medical Center, Tacoma, Wash, on June 2 for further evaluation, observation, and treatment.

On admission, the infant was alert, afebrile, and in no distress. There was

no conjunctival injection or palpebral irritation or erythema. The 2 lesions noted on her philtrum and left cheek had eschar formation, with the beginnings of ulceration with mild surrounding erythema (FIGURE). Her tongue lesion was a small, white, shallow ulcer on the left lateral aspect. There were no other skin lesions and the remainder of her examination was unremarkable.

The clinical appearance of these lesions as well as the history were all consistent with inadvertent localized vaccinia inoculation. Both initial viral culture and polymerase chain reaction results for vaccinia were positive from the infant's facial and tongue lesions as well as from the maternal areolar lesions. These results were confirmed when repeated with new specimens at the Madigan Army Medical Center Laboratory. Cultures were negative for herpes simplex virus. To prevent further inadvertent inoculation, the infant was placed in isolation, her lesions were covered with film dressings, eye goggles were placed, and soft restraints were used while the infant was awake and not in the mother's arms. An ophthalmologist was consulted and confirmed no evidence of ocular vaccinia.

Treatment of the infant with vaccinia immune globulin (VIG), intravenous VIG (IV-VIG), or cidofovir was discussed, but the infant did not meet any of the CDC criteria for treatment of a vaccinia complication.⁴ The infant was monitored closely for spread or other complications. By day 7 after onset of signs, the oral lesion had become a small ulcer and the lesion on the cheek was entirely crusted. However, the lesion on the philtrum continued to weep, which was attributed to occlusion with the dressing and excessive moisture. To facilitate healing, the lesion was aired 2 to 3 hours a day while exposed to heat lamps. The initial bacterial culture of the philtrum lesion grew methicillin-sensitive *Staphylococcus aureus*, which was treated with topical mupirocin calcium (Bactroban). By postonset day 13, all of the infant's lesions were crusted over completely,

and there was no autoinoculated spread to other sites. The infant remained afebrile and alert throughout the hospital course. She was discharged to home after a 12-day stay. At follow-up on July 7, 2003, her lesions had entirely resolved with no significant scarring.

The maternal breast lesions healed slowly, which was attributed to excessive moisture in the area. The mother also did not meet criteria for VIG, IV-VIG, or cidofovir therapy. She was told to air-dry the lesions with a blow-dryer 3 times a day, which improved crusting. By the time of discharge, approximately 28 days into her course, the lesions on the mother's areolae were no longer painful and mainly crusted. Prior to discharge, the mother received further education on prevention of household transmission to her older child. No further spread was recorded from either patient, and the maternal lesions had entirely healed by July 7, 2003. Both cases of contact vaccinia were reported to the Military Vaccine Agency of the Office of the Surgeon General and the Vaccine Adverse Events Reporting System.

COMMENT

We report the first documented case of inadvertent contact vaccinia transmission from mother to infant through direct skin-to-skin and skin-to-mucous membrane contact while breastfeeding. This incident represents transmission of vaccinia from a primary vaccinee to 2 household contacts. Because of the timing of onset of the lesions and the plausible route of spread from infant contact with maternal breast, we believe that contact vaccinia in the infant occurred after secondary transmission from the vaccinee to his spouse, followed by tertiary transmission from the spouse to the infant. The mechanism of transfer from the vaccinee to his spouse is uncertain and may have been from fomites such as bed linens or clothing. Although the vaccinee's spouse denied any direct contact of her breasts with the dressing site, this possibility cannot be completely excluded. Another possibility is that she failed to wash her hands between handling the laundry and initiating breastfeeding. She

could not recall if she always washed her hands prior to breastfeeding.

We encountered several dilemmas in caring for the infant. Although she ultimately did not meet criteria for treatment of a vaccinia complication, none of the currently available therapies are licensed for use in children. The pharmacodynamics of cidofovir in children are unknown. These drawbacks to potential therapy underscore the primary importance of prevention. We also found that because of the location of the infant's lesions, it was difficult to keep them covered to prevent autoinoculation. The moist environment of both patients' lesions also delayed crust formation. Using a heat source local to the areas helped to enhance the crusting.

The CDC recommends against smallpox vaccination of breastfeeding mothers.⁵ However, there is no recommendation against vaccination of other family members when there is a breastfeeding infant in the home. To the contrary, the CDC smallpox fact sheet "Smallpox Vaccination Information for Women Who Are Pregnant or Breastfeeding" states that it is safe for a woman to breastfeed her baby if a close contact received smallpox vaccine, provided that the vaccinee follows the standard handwashing and site protection precautions. These precautions are described by the CDC as remembering "to wash their hands with soap and warm water after direct contact with the vaccination site, or anything that has touched the vaccination site (bandages, clothing, towels, bedding, etc)."⁶ Despite reported adherence to these guidelines by both parents, tertiary transmission to the infant occurred. Additionally, neither the mother nor her physician recognized inadvertent inoculation of her breasts, which led to a delay in diagnosis and continued breastfeeding of the infant.

Historically, the rate of contact vaccinia household transmission has been low. For example, in a recent review of published reports from 1931 to 1981 of secondary household transmission of vaccinia, Sepkowitz³ provides details on 27 cases, including fatalities. An identified risk factor in these cases was shar-

ing close quarters with a vaccinee with sustained, intimate contact. In 1 case, an 18-year-old female military vaccinee inadvertently transmitted vaccinia to an 18-year-old female neighbor, who developed facial lesions. Two contacts of this neighbor, one who had kissed her and another who had "had contact" with her, also developed facial lesions. Although such incidents may have been underreported in the past, these 2 cases constitute the only previously published report of tertiary inadvertent transmission.

Despite concerns that contact vaccinia might occur more frequently today because of more immunocompromised hosts and primary vaccinees, recent data from the DOD and DHHS vaccination programs support historical data that the risk of contact vaccinia remains low. Surveillance studies conducted in the United States by the CDC in the 1960s estimated a contact vaccinia risk of 2 to 6 per 100 000 primary vaccinations.^{7,8} In these studies, transmission required close contact with a vaccine recipient, usually within the home. Between December 2002 and January 12, 2004, the DOD vaccinated 548 438 people against smallpox. From this cohort, 29 suspected cases of contact vaccinia were identified (18 confirmed by polymerase chain reaction), for an incidence of 5.3 contact transfers per 100 000. Only 2 of the cases reported, including the case reported herein, occurred in children (Col John D. Grabenstein, deputy director, Military Vaccine Agency, US Army Medical Command, Office of the Surgeon General, written communication, January 15, 2004). Additionally, between January 24 and June 20, 2003, 37 802 civilian health care and public health workers were vaccinated with no reported cases of contact vaccinia.⁹

This report demonstrates that breastfeeding infants living in close contact with smallpox vaccinees are at potential risk for contact vaccinia, even if the vaccinee is not the breastfeeding mother, and highlights the need for special precautions to prevent secondary transfer to breastfeeding mothers. We recommend that the CDC revise its guidelines to state that vaccine recipients

should not sleep in the same bed as a breastfeeding mother, that vaccine recipients handle their own laundry, and that breastfeeding mothers in these households be reminded to wash their hands prior to breastfeeding. Clinicians should be alert to the possibility of contact vaccinia in any family member of a smallpox vaccine recipient presenting with a pustular or vesicular rash. Breastfeeding women living with vaccine recipients should be educated about the appearance of contact vaccinia lesions and told to seek medical attention if they develop any skin lesions.⁶ Breastfeeding should be temporarily stopped until such lesions can be evaluated.

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REFERENCES

- Centers for Disease Control and Prevention. CDC recommends smallpox vaccination to protect persons exposed to monkeypox [press release]. Available at: <http://www.cdc.gov/od/oc/media/pressrel/r030611.htm>. Accessed December 16, 2003.
- Neff JM, Lane MJ, Fulginiti VA, Henderson DA. Contact vaccinia—transmission of vaccinia from smallpox vaccination. *JAMA*. 2002;288:1901-1905.
- Sepkowitz KA. How contagious is vaccinia? *N Engl J Med*. 2003;348:439-446.
- Centers for Disease Control and Prevention. Clinical evaluation tools for smallpox vaccine adverse reactions. Available at: <http://www.bt.cdc.gov/agent/smallpox/vaccination/clineval>. Accessed December 16, 2003.
- Centers for Disease Control and Prevention. Smallpox fact sheet: people who should not get the smallpox vaccine. Available at: <http://www.bt.cdc.gov/agent/smallpox/vaccination/contraindications-public.asp>. Accessed December 16, 2003.
- Centers for Disease Control and Prevention. Smallpox fact sheet: smallpox vaccination information for women who are pregnant or breastfeeding. Available at: <http://www.bt.cdc.gov/agent/smallpox/vaccination/preg-factsheet.asp>. Accessed December 16, 2003.
- Neff JM, Lane JM, Pert JP, Moore R, Millar JD, Henderson DA. Complications of smallpox vaccination, I: national survey in the United States, 1963. *N Engl J Med*. 1967;276:1-8.
- Lane JM, Ruben FL, Neff JM, Millar JD. Complications of smallpox vaccination, 1968: national surveillance in the United States. *N Engl J Med*. 1969;281:1201-1208.
- Centers for Disease Control and Prevention. Update: cardiac and other adverse events following civilian smallpox vaccination—United States, 2003. *MMWR Morb Mortal Wkly Rep*. 2003;52:639-642.