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Varicella in the prison setting: A report of three outbreaks in Rhode Island and a review of the literature

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ABSTRACT

Background: The prison setting carries unique risks for varicella outbreaks and the disease in adults, particularly those who are immunocompromised, can be life-threatening. In 2016–17, there were three outbreaks of varicella at three different correctional facilities in Rhode Island. The Centers for Disease Control and Prevention (CDC) recommend post-exposure vaccination within three to five days for affected populations however the Federal Bureau of Prisons (BOP) notes the logistical challenges of vaccinating exposed incarcerated individuals.

Material and methods: A descriptive analysis was performed for each outbreak along with an overview of the response. Varicella serologies were obtained from the exposed population at each facility and the results compiled for comparative analysis. A literature review was then performed to identify and analyze other reported varicella outbreaks in incarcerated populations.

Results: In each outbreak, the sentinel event was an inmate with herpes zoster. In prison A, there were 432 inmates exposed to the virus leading to 5 cases of varicella, while the outbreak in Prison B exposed 46 inmates and led to 3 cases. In Prison C, there was one case of primary varicella and 97 inmates were exposed.

Discussion: It is remarkable that there were 3 unrelated outbreaks in a short time and, although corroborating data would be necessary to establish a trend, it may signal an increased risk of varicella transmission within this population. Correctional facilities should remain vigilant and have plans for managing the disease including isolation protocols, serology testing and post-exposure vaccination when indicated. While the BOP does not provide clear recommendations on the use of post-exposure prophylaxis during an outbreak response in this population, the experience in Rhode Island and the review of the literate demonstrate steps that can be taken to facilitate a response including post-exposure vaccination in line with CDC recommendations.

1. Introduction

Varicella is a highly contagious viral illness caused by the varicella-zoster virus (VZV) which is much more severe in adults and the immunocompromised than in children [1]. Exposure usually confers lifelong immunity and the epidemiology of varicella is seasonal in non-tropical areas with near universal exposure recorded in countries without vaccination programs [2–4]. After the initial infection, the virus lies dormant in the dorsal root sensory ganglia where it can reappear later in life, more commonly affecting the elderly population, in the form of herpes zoster [5]. Herpes zoster can result in the development of chickenpox and systemic illness in a non-immune individual after contact with an active lesion or inhalation of fluid or lesion aerosols [6].

A vaccine was first approved for use in the United States in 1995 where current Advisory Committee on Immunization Practices (ACIP) vaccination guidelines recommend a series of two vaccinations [7]. Two doses of the vaccine are 88–98% effective in preventing any form of varicella and 100% effective in preventing severe disease, with documented immunity in vaccinated children lasting 20 years [8]. Despite the success of the vaccine, outbreaks continue to be reported, particularly among undervaccinated populations [9]. During outbreaks, the CDC recommends post-exposure

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prophylaxis of non-immune individuals exposed to the virus within 5 days of exposure. The ACIP defines evidence of immunity as either documentation of age appropriate vaccination, birth in the United States before 1980, clinical diagnosis of chickenpox or shingles by a healthcare provider or a positive VZV IgG enzyme linked immunosorbent assay [10].

Varicella poses a unique threat to incarcerated individuals who live in close quarters where the disease can spread easily. In addition, there may be a higher prevalence of immunocompromising conditions among incarcerated populations than the general population [11–13]. The Federal Bureau of Prisons (BOP) varicella outbreak guidelines note that VZV serology testing is not always feasible within the recommended time frame for post-exposure prophylaxis [14].

In May 2016, there was a varicella outbreak in the maximum-security state prison in Rhode Island. Over the next nine months, two additional varicella outbreaks were identified in other Rhode Island prison facilities. This article describes these outbreaks and subsequent public health responses while reviewing the literature on varicella outbreaks in correctional facilities since the development of the varicella vaccine. Based on these findings, several interventions are identified to help manage and prevent future outbreaks.

2. Material and methods

2.1. Varicella surveillance and case identification

In Rhode Island, all individual cases of varicella are 4-day reportable to the Rhode Island Department of Health (RIDOH), and all outbreaks are immediately reportable. In each prison outbreak, RIDOH learned of the first case of varicella via phone call from the prison health center. Outbreak-associated cases were defined as clinically compatible varicella illness in an individual residing in the affected prison. As there was no illness among non-incarcerated individuals with prison exposure, non-inmates were not included in the outbreak case definition. In this outbreak and with all cases of varicella, RIDOH utilizes the 2010 CDC varicella case definition.

2.2. Questionnaire and data collection

In Prison A, all inmates were provided a Vaccine Information Statement (VIS) and interviewed by a clinician prior to receipt of the first dose of vaccine. The interview questionnaire collected information including self-reported varicella vaccination, varicella infection and herpes zoster. In Prison B, only the 5 seronegative inmates were interviewed and thus information on self-reported varicella disease was not collected. In both prison outbreaks, information on race/ethnicity and dates of birth was collected from a roster of inmates. In Prison C, because there was only one case of primary varicella disease, information regarding race/ethnicity, dates of birth and prior self-reported history of varicella disease was not collected.

2.3. Variables

Inmate rosters captured race and ethnicity in one variable, not allowing for more than one response. Post-collection, age was divided along the lines of assumed immunity to varicella in the general population, defined as birth before or after 1980, and analyzed as a binary variable. For the variable "self-reported chickenpox disease", the responses for "No" and "Unknown" (encompassing both blank answers on the questionnaire and inmates who did not know their medical history) were condensed into one level of the variable. Race was divided into a binary variable as well: "white" and "not white."

2.4. Analysis

Variables from the screening tool and inmate rosters were analyzed using SAS software, Version 9.3. For data from Prison A, Chi square analysis was used to analyze associations between varicella immunity and race, birth before 1980, and self-reported chickenpox. Due to small numbers of non-immune inmates in the Prison B outbreak response, Fisher's Exact Test was used to analyze association between varicella immunity and birth before 1980, and immunity and race. Student's *t*-test was used for the continuous variable age for data from both prisons. A significant association was defined as a 2-sided p-value of <0.05. Odds ratios and 95% confidence intervals were calculated for all binary categorical variables. A significant odds ratio was defined as one with a confidence interval that did not cross 1. When sufficient information was available, sensitivity, specificity, positive and negative predictive values were calculated.

3. Results

3.1. Setting and outbreak description

3.1.1. Outbreak in Prison A

Prison A is a state-run maximum security prison with all inmates contained in one building. Here, the outbreak was traced to an inmate who had herpes zoster in the distribution of the trigeminal nerve and had active lesions on his face and nose, including the nasal mucosa. Shortly after the appearance of the facial lesion, the decision was made to isolate the patient. Twenty one days after the onset of herpes zoster, one of the inmates who had been tasked with cleaning the cell of the patient with facial zoster reported systemic symptoms as well as a rash consistent with primary varicella. Due to the open floor plan of the prison and intermingling at meals and recreational periods, all 432 inmates in that facility were considered exposed to varicella. Five inmates in total were diagnosed with primary varicella zoster over three generations of transmission, with onsets one, three, and sixteen days after the onset of the first case of varicella.

RIDOH and the Rhode Island Department of Corrections (RIDOC) collaborated to hold a two-day post-exposure prophylaxis vaccination clinic held six and seven days after onset of the first case. Due to the constraints of laboratory turnaround time, the entire exposed population without an immunocompromising condition was offered an initial dose of varicella vaccine without consideration of immune status. Serum specimens were collected immediately prior to vaccination in order to assess immunity to varicella via IgG serology. Individuals who did not receive the first dose of vaccine were isolated with contact and droplet precautions until their serology results were available. Once serology results were available, the 384 seropositive inmates were considered immune and did not receive the second dose of the vaccine. The 48 inmates who were seronegative were given the second dose of the vaccine 41 days after the first dose.

3.1.2. Outbreak in Prison B

Prison B is a private prison where the outbreak was traced to one case of ocular herpes zoster. Since it did not appear that this was a case of disseminated herpes zoster, the patient was not isolated. Approximately one month later, varicella developed in one inmate, with a second inmate developing varicella four days later. A third case developed eighteen days following the first case.

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