

Containment of varicella outbreak in intensive care unit of a tertiary level hospital

Raman Sharma, Kapil Goyal¹, Nidhi Bhatia², Vikas Rana¹, Mini P. Singh¹, Ashish Bhalla³, Gurpreet Singh⁴, Ashok Kumar, Kajal Jain²

Departments of Hospital Administration, ¹Virology, ²Anaesthesia, ³Internal Medicine and ⁴General Surgery, PGIMER, Chandigarh, India

Abstract

Background: Varicella-Zoster virus (VZV) infection in healthcare organizations, especially in intensive care units (ICU), having admitted immunocompromised patients, is of serious concern as well as poses threat to healthcare workers working in such critical areas. The present report defines the transmission and infection control measures initiated to curtail VZV infection spread in the trauma ICU of a tertiary care hospital of North India.

Outbreak Report: At the infection outset, there were 12 patients admitted in ICU and 54 healthcare workers were posted to manage these critical patients. After confirmation of VZV infection, all susceptible patients as well as healthcare workers were quarantined and fresh intake of patients was restricted. Out of the total healthcare workers, 14 (25.92%) were found susceptible (as per protective VZV IgG titers) and were vaccinated. Of the 12 patients admitted in the ICU, six patients were discharged and sent home directly, four patients expired due to their critical disease state, one patient left against medical advice, and one patient remained admitted in ICU till the incubation period was over. Epidemiologically, line listing for index case reporting was done. The efficacy of control measures was re-evaluated to strengthen existing infection control practices and general measures viz. strict hand washing, adherence to aseptic protocols and intensification of environmental cleaning.

Conclusions: Established varicella surveillance measures ensure VZV outbreaks are identified in a timely manner and control measures implemented to prevent further transmission. Also, vaccination policy among HCWs is the utmost requirement despite having huge financial implications.

Keywords: Containment, immunization, intensive care unit, outbreak, varicella

Introduction

Varicella-Zoster virus (VZV), a double-stranded DNA virus has been implicated in the causation of chickenpox, a common communicable disease affecting humans.^[1,2] The infection is self-limiting in children; however, certain group of patients, particularly neonates, adults, pregnant women and immunocompromised patients are at increased risk of complications.^[3,4] The nosocomial transmission of this virus in healthcare organizations, where potentially susceptible

immunocompromised patients are admitted is of serious concern as infection in these patients can lead to high morbidity and mortality. Also, it may pose an additional threat to the healthcare professionals (HCPs) working in these critical areas who may further transmit it to their co-workers and other susceptible patients.^[5] The infection among HCPs and susceptible patients can be transmitted through respiratory route and occasionally by close contact with the blister fluid. Considering that the secondary attack rate is around 80% in household settings, and is likely to reach 90% in healthcare institutions, such outbreaks when occur in critical areas of

Address for correspondence: Dr. Nidhi Bhatia,
Department of Anaesthesia and Intensive Care, PGIMER,
Chandigarh, India.
E-mail: nidhi.bhatia75@gmail.com

Access this article online	
Quick Response Code:	Website: www.joacp.org
	DOI: 10.4103/joacp.JOACP_542_20

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Sharma R, Goyal K, Bhatia N, Rana V, Singh MP, Bhalla A, *et al.* Containment of varicella outbreak in intensive care unit of a tertiary level hospital. *J Anaesthesiol Clin Pharmacol* 2021;37:279-83.

Submitted: 11-Sep-2020 **Revised:** 29-Nov-2020

Accepted: 06-Dec-2020 **Published:** 15-Jul-2021

hospitals such as intensive care units (ICUs), may be difficult to control. To prevent the transmission of VZV infection in the hospital settings, the development and implementation of hospital policies for appropriate infection control is always warranted.^[6]

We report the transmission of VZV infection among healthcare staff and patients admitted in one of the ICUs of a tertiary care hospital of North India and define the infection control measures initiated to curtail the spread of the disease within the ICU and among HCPs, as well as the additional measures put in place by the institute to prevent future outbreaks.

Outbreak Report

One of the staff nurse posted in Trauma ICU of our institute gave history of fever followed by vesicular lesions on face, chest, and back, which later spread to the whole body. She was clinically suspected to have varicella and was quarantined. During that time there were 12 patients admitted in the ICU, all of whom were on ventilatory support. Fifty-four HCPs were posted in the ICU during this time. Two days later, two more staff nurses and two resident doctors posted in the ICU developed varicella infection. The blister fluid from their active lesions was tested for the presence of VZV DNA, which was reported as positive.

The DNA was extracted from the vesicular swabs using commercially available kit (Qiagen, Hilden, Germany) and then subjected to Polymerase Chain Reaction (PCR) targeting ORF28 gene of VZV. The PCR was performed in 25 μ L volume reactions containing 5 μ L of DNA. The reaction mixture consisted of 1X PCR buffer (10 mM Tris with 15 mM MgCl₂), 1 μ M of each primer, 200 μ M of dNTPs, and 0.5 U Taq polymerase. The thermocycler conditions were 94°C for 3 min followed by 39 cycles at 94°C for 30 s, 55°C for 30 s, and 72°C for 45 s and final extension at 72°C for 3 min. The amplicons of 355 bp were visualized by gel electrophoresis using 2% agarose gel followed by ethidium bromide staining.^[7]

The following primers were used:

- Forward primer: 5'ATCGCGGCTTGTTGTTTGTC TAAT3'
- Reverse primer: 5'GGGCGAAATGTAGGATATAA AGGA3'

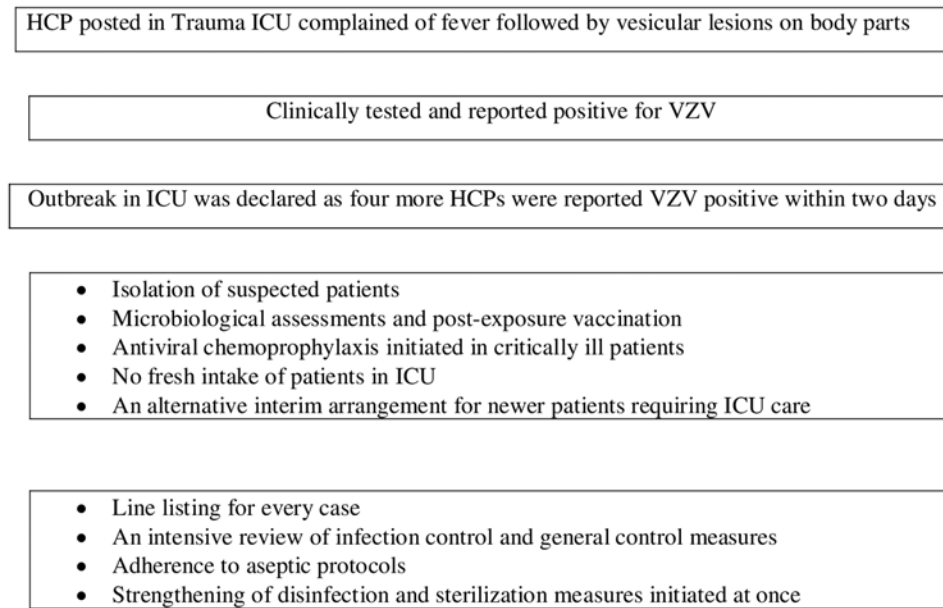
An outbreak of varicella was confirmed among the health care workers of the ICU. The measures opted to prevent further spread were isolation of suspected patients, microbiological assessments and post-exposure vaccination of susceptible HCPs. Antiviral chemoprophylaxis was initiated in critically

ill patients who were found to be susceptible to varicella as evidenced by VZV seronegative IgG levels. It was decided to restrict fresh intake of patients in ICU and to retain the admitted patients in the ICU itself for three weeks since the last fresh case. It was advised that these patients should be discharged home directly without shifting them to a step-down facility to prevent the spread of infection. The rotational duty of the doctors was canceled and same staff was asked to continue working in the ICU to prevent spread of infection among HCPs including resident doctors and nursing students who may further spread it to their hostel inmates. Further, an alternative interim arrangement was created, in a separate area, to cater to needs of newly admitted patients requiring critical care. The number of attendants were restricted to only two per patient and these were the ones who had either previously suffered from chickenpox or were found to be immune to chickenpox (as shown by protective VZV IgG titers). The HCPs who did not give a past history of chickenpox were screened for the presence of VZV IgG antibodies and 14 (25.92%) of total of 54 HCPs were found to be susceptible. They were also tested for the presence of VZV IgM antibodies and seronegative HCPs were offered 2 doses of varicella vaccination within 3-5 days of exposure. A total of two doses were given subcutaneously four weeks apart after ruling out contraindications to the vaccine. The HCPs who gave a history of varicella and had evidence of immunity were asked to continue working and were monitored daily for symptoms or signs of varicella, within 8 to 21 days of exposure.

Line listing for every case, patient details, place and time of occurrence, and infection details were done. An intensive review of infection control measures was made and general control measures viz. strict hand washing, intensification of environmental cleaning and hygiene measures, adherence to aseptic protocols, strengthening of disinfection and sterilization measures were initiated at once. Measures taken to contain VZV outbreak in the ICU have been summarised in Figure 1.

The efficacy of control measures was evaluated by a continued follow-up of cases after outbreak, as well as microbiologically. Control measures were found to be clinically effective as number of cases ceased to occur within 15 days of the occurrence of first case. Though, out of the total of 54 HCPs, five got infected in the outbreak over a period of 36 days, yet, with strict implementation of safety control measures, none of the patients admitted in ICU got infected.

Out of the 12 patients admitted in the ICU, six patients were discharged and sent home directly, four patients expired due to their critical disease state, one patient left against medical advice, and one patient remained admitted in ICU till



HCP: Health Care Professional; ICU: Intensive Care Unit; VZV: Varicella-Zoster virus

Figure 1: Steps Followed to Contain the VZV Outbreak in Trauma Intensive Care Unit

incubation period was over. The ICU was re-opened for fresh admissions after three weeks had lapsed since the occurrence of the last fresh case.

Discussion

Varicella outbreak is defined as occurrence of five or more cases in epidemiologically linked setting.^[8] According to the CDC case classification, VZV case is confirmed when laboratory testing or clinical case definition is met and is epidemiologically linked to a confirmed or a probable case.^[9] Cases should be considered as a part of an outbreak if they occur within at least one incubation period (10–21 days) of the previous case-patient.^[8] For effective disease containment, it is recommended that the surveillance measures should continue through 21 days after the rash onset of the last identified patient to ensure that the outbreak has ended.^[8,10]

In our setting, the point source for the outbreak was an HCP, who was exposed to infection and later propagated the infection in this closed ICU environment. The index case possibly acquired the infection 10–14 days prior to the onset of fever and vesicular rash. Since the number of cases also depends on the individual susceptibility, only five HCPs got infected during the outbreak [Figure 2] and the outbreak was curtailed due to timely post-exposure vaccination and implementation of strict isolation measures.

The present case study demonstrated the significance of assessing HCPs' susceptibilities to VZV infection before

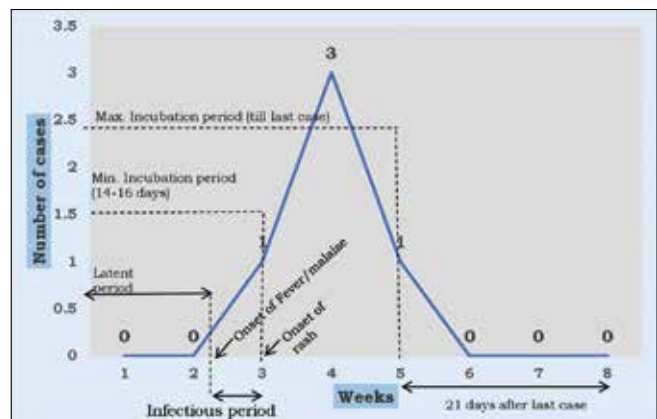


Figure 2: Epidemic Curve of Varicella-Zoster Virus Infection

exposing them to situations with increased risk of infection acquisition. It is well understood that acquisition of VZV infection is an occupational hazard among HCPs, especially those with no immunity to infection. In the present outbreak as the first case was diagnosed, all the HCP working in ICU were tested for VZV IgG levels and those found to be seronegative were given post-exposure vaccination. As per the CDC guidelines, persons having no evidence of immunity should be given prophylactic vaccine within 3–5 days of exposure. HCPs who have received one dose of varicella vaccine earlier should receive the second dose within 3–5 days after exposure to rash, if more than four weeks have passed since receipt of the first dose. Further, HCPs who have received two doses of varicella vaccine earlier and are exposed to varicella should be monitored for clinical status on daily basis from 8 to 21 days after exposure.^[11,12] Although post-exposure vaccination

was considered an encouraging solution, there are contrary reports which state that its real-life efficacy is not equivalent to that reported in earlier studies.^[13] Thus, it emphasizes the need for stringent preventive measures in averting outbreaks of VZV among HCPs.

Review of literature

VZV outbreaks occur worldwide, with epidemics befalling every 2–3 years.^[14] Usually, in healthy children most of the varicella infections are mild, self-limiting, and uncomplicated and treatment is usually confined to symptomatic relief.^[15] Though early antiviral therapy can reduce illness duration; however, it is reserved for those with severe varicella or for those who are considered at greater risk of developing complications owing to age, compromised immunity or chronic diseases of the skin or lungs.^[14] Varicella epidemiology has changed dramatically, especially in countries where varicella vaccination has been routinely recommended in childhood. Before the varicella vaccination, approximately there used to be 4 million cases, 10,500 hospitalizations and 105 deaths each year,^[16] whereas the introduction of the vaccine has dramatically improved quality of life and there has been a substantial decline in morbidity and mortality. In the Indian scenario, however, VZV vaccine is still not included in the Universal Immunisation Programme of India, and hence, sporadic outbreaks are still reported.^[17]

The detection and quantification of viral load during varicella infection may be potentially useful for diagnostic, prognostic and therapeutic monitoring purposes. An early diagnosis in an outbreak situation is desirable for prompt initiation of control measures so as to prevent further spread of the outbreak. Such outbreaks have been reported earlier also and have been managed by following early infection outbreak control measures, infection containment, prophylactic and post-exposure vaccination, and strictly implementation of basic infection control orientation programs.^[13,16,18]

Alanazi *et al.*^[18] have described measures taken to contain varicella outbreak among patients and HCPs in a psychiatric hospital of Saudi Arabia. The authors reported controlling the outbreak as per their Ministry of Health guidelines. Similar outbreak has also been reported in a residential facility for adults with intellectual disability in Connecticut.^[19] Galil *et al.*^[13] investigated an outbreak of varicella in a population of children with a high proportion of vaccinees who were attending a day-care center in a small community in New Hampshire. The authors concluded that vaccination provided poor protection against varicella, although there was good protection against moderate or severe disease, with a longer interval since vaccination being associated with an increased risk of vaccine failure. Sarit *et al.*^[6] reported an outbreak

of varicella infection among the HCPs in the pulmonary ICU of a tertiary care hospital. The authors investigated the outbreak as per the guidelines and suggested that appropriate dissemination of information on disease transmission, isolation of infected patients, and adequate protection for susceptible employees was important in preventing such outbreaks

Conclusions

The outbreak emphasized that maintenance of high index of suspicion is one of the earlier requirements for triaging. The information, education, and communication activities of HCPs, patients and their attendants should be undertaken to make them aware about varicella transmission, reasons for isolation and preventive measures that need to be undertaken. CDC also emphasizes upon that future outbreaks of varicella can be mitigated by ensuring high levels of varicella immunity, vaccinating the ones having no evidence of immunity, varicella surveillance and reporting, establishing as well as maintaining an appropriate response whenever a case is identified in any setting.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. CDC. Varicella. In: Atkinson W, editor. Epidemiology and Prevention of Vaccine-Preventable Diseases. Atlanta, GA: Centers for Disease Control and Prevention; 2005. p. 159-75.
2. Gershon AA, Breuer J, Cohen JI, Cohrs RJ, Gershon MD, Gilden D, *et al.* Varicella zoster virus infection. *Nat Rev Dis Primers* 2015;1:15016.
3. Fleisher G, Henry W, McSorley M, Arbeter A, Plotkin S. Life-threatening complications of varicella. *Am J Dis Child* 1981;135:896-9.
4. Marin M, Watson TL, Chaves SS, Civen R, Watson BM, Zhang JX, *et al.* Varicella among adults: Data from an active surveillance project, 1995–2005. *J Infect Dis* 2008;197(Suppl 2):S94-100.
5. Kim S-H, Park SH, Choi S-M, Lee D-G. Implementation of hospital policy for healthcare workers and patients exposed to varicella-zoster virus. *J Korean Med Sci* 2018;33:e252.
6. Sarit S, Shruti S, Deepinder C, Chhina RS. Chicken pox outbreak in the Intensive Care Unit of a tertiary care hospital: Lessons learnt the hard way. *Indian J Crit Care Med* 2015;19:723-5.
7. Singh MP, Kaur R, Kumar A, Gupta M, Garg S, Ratho RK. Investigation of an outbreak of varicella in Chandigarh, North India, using a real-time polymerase chain reaction approach. *Indian J Med Microbiol* 2017;35:417-20.
8. Paul N, Jacob ME. An outbreak of cadaver-acquired chickenpox in a health care setting. *Clin Infect Dis* 2006;43:599-601.
9. Jumaan A, Hughes H, Schmid S, Galil K, Plott K, Zimmerman L, *et al.* Varicella. In: Wharton M, Hughes H, Reilly M, editors. Manual for the Surveillance of Vaccine-Preventable Diseases. Atlanta, GA:

- Centers for Disease Control and Prevention; 2002. p. 11-21.
10. Whitley RJ. Varicella-zoster virus. In: Mandell GL, Bennett JE, Dolin R, editors. Principles and Practice of Infectious Diseases. 5th ed. New York: Churchill Livingstone; 2000. p. 1580-6.
 11. CDC. Prevention of varicella: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2007;56(RR-4):1-40.
 12. Lopez AS, Marin M. Strategies for the Control and Investigation of Varicella Outbreaks. National Center for Immunization and Respiratory Diseases Centers for Disease Control and Prevention; 2008. 197(Suppl 2):S71-5
 13. Galil K, Lee B, Strine T, Carraher C, Baughman AL, Eaton M, *et al.* Outbreak of varicella at a day care center despite vaccination. N Engl J Med 2002;347:1909-15.
 14. Centers for Disease Control and Prevention (CDC). Updated recommendations for use of VariZIG-United States, 2013. MMWR Morb Mortal Wkly Rep 2013;62:574-6.
 15. Klassen TP, Hartling L, Wiebe N, Belseck EM. Acyclovir for treating varicella in otherwise healthy children and adolescents. Cochrane Database Syst Rev 2005;CD002980. doi: 10.1002/14651858.CD002980.pub3.
 16. Hambleton S, Gershon AA. Preventing varicella-zoster disease. Clin Microbiol Rev 2005;18:70-80.
 17. Singh MP, Singh G, Kumar A, Singh A, Ratho RK. Epidemiologic lessons: Chickenpox outbreak investigation in a rural community around Chandigarh, North India. Indian J Pathol Microbiol 2011;54:772-4.
 18. Alanazi KH, Bin Saleh GM, Hathout HM, Shiha HR, El Sherbini SG, Al Saqer TA, *et al.* Investigation of varicella outbreak among residents and healthcare workers in psychiatric hospital- Saudi Arabia. Arch Environ Occup Health 2020;1-5. doi: 10.1080/19338244.2020.1806775.
 19. Leung J, Kudish K, Wang C, Moore L, Gacek P, Radford K, *et al.* A 2009 varicella outbreak in a Connecticut residential facility for adults with intellectual disability. J Infect Dis 2010;202:1486-91.