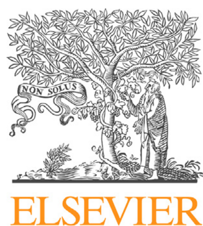

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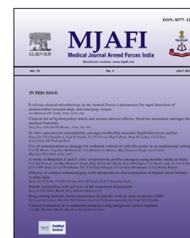

Original Article

Use of immunization as strategy for outbreak control of varicella zoster in an institutional setting

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ABSTRACT

Background: Outbreaks of varicella gets reported often in India. However, outbreak in health care providers living in closed institutional setting and role of vaccination as post exposure prophylaxis for control of outbreak has not been studied extensively. This paper presents epidemiological investigation and control strategy undertaken in such scenario.
Methods: This is an epidemiological investigation of chickenpox in nursing students which highlights role of early identification and appropriate control strategy to prevent explosive outbreak in high risk vulnerable population. Vaccination of all susceptible in addition to isolation of cases, quarantine of suspects and proper screening for new cases was the major control strategy adopted.
Results: The index case was imported and all eight cases occurred within the incubation period of the case. Two cases occurred in students previously vaccinated for chickenpox. No second or third wave of infection occurred showing vaccination as effective tool in outbreak control strategy.
Conclusion: Early identification of cases and vaccination of all susceptible contributed to effective control of the outbreak.
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Introduction

Chickenpox (Varicella) is an acute infectious disease caused by exposure to Varicella Zoster Virus (VZV) and is characterized by a maculopapulor vesicular rash; fever and malaise .The clinical course is highly dependent on the age and immune status of the patient. Children usually have a milder disease whereas adults can have severe disease. The incubation period varies from 10 days to 21 days with an average of 14–16 days.[1,2] The period of infectivity ranges from one to two days before the appearance of rash till all vesicles crust, usually 4–5 days after the rash.[1,2] With a secondary attack rate up to 90%,[1,3] an outbreak of chickenpox in schools, barracks and

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institutions can be serious. Outbreaks of chickenpox get reported quite often in countries like India where vaccination is not part of the country's national immunization policy.

An outbreak of varicella occurred amongst nursing students in an institutional setting of a tertiary care hospital from 23rd November to 13th December 2012. An inbuilt Health Intelligence (HI) surveillance unit exists in the institution and based on the information obtained from the unit, investigation and control measures were initiated.

The students undergo training over a period of 4 years, with batch strength of 40 per year, therefore at any given time there are about 160 students undergoing training at the institute who reside in a hostel in rooms on a sharing basis ranging from two to six in each room with common dining hall facilities.

The institution has recently adopted a strategy to vaccinate first year students as part of the institutional vaccination policy enforced since September 2011 which lays down that all cadets and recruits will be vaccinated with two doses of vaccine, 4 weeks apart, on entry. After checking the VZ IgG level, two doses of vaccine were given on 9th October and 6th November 2012 to those negative for antibodies for IgG VZV antibodies.

This study reports the investigation and control strategy adopted during the outbreak.

Materials and methods

This is an epidemiological study of an outbreak amongst nursing students, the index case was reported on 23rd of November 2012. On reporting of the case, an alert was sounded by the HI division as the occurrence was in a nursing trainee who visits hospital wards for training activities. The case was admitted and kept in an isolation ward. A list of close contacts was prepared and standard daily screening of them implemented, as per protocol, along with advisory for avoiding visits to health care facility till further instructions.

One case each was reported on 6th and 7th December 2012. These two cases were within the incubation period of the initial case and gave history of contact with the first case. An epidemiological investigation was undertaken and notification was immediately done to the hospital authorities. Aggressive control measures were instituted as the risk of explosive outbreak of cases in close settings is very high and in this situation cases being trainees who visit various units in the tertiary care institute there was an impending risk of outbreak spilling over to individuals (patients and other staff) in the hospital setting.

First and foremost susceptible population at risk was identified; "Susceptible individuals" were regarded as people without prior history of chickenpox or no history of vaccination for varicella.

Case definitions used in this outbreak were as under:

A clinical case/possible case was defined as one with acute onset of diffuse (generalized) maculopapulor vesicular rash having fever without apparent cause occurring from 23rd November to 24th January 2013 in a student with no prior history of chickenpox.

Breakthrough case of varicella was defined as a vaccinated person who develops varicella more than 42 days after vaccination.

A probable case was one which met clinical case definition, was not lab confirmed, and was not epidemiologically linked to another probable or confirmed case.

A confirmed case was one that was laboratory confirmed or a case which meets clinical case definition and was epidemiologically linked to a confirmed or a probable case.

Close contact were any one with close indoor contact like residing in same room or having face-to-face contact.

Confirmation of cases was done, epidemiological case sheet generated for each case and line listing was done. Blood sample for VZ IgM antibodies was taken from all cases on admission. Search for primary case was done for the index case. A spot map was prepared of the hostel and the all blocks where the cases and contacts resided and contact tracing was done. All cases that occurred were admitted and kept in isolation ward and quarantine done for close contacts. Health education for case identification and reporting was given. Meal timings of the students in each year were changed to minimize contacts and other group gatherings were withheld. Ventilation of individual rooms was improved by ensuring the windows were opened. Chickenpox screening drill was implemented every morning and evening for all residing in the hostel. Hospital training visits were stopped and only training activities in class rooms were permitted.

To determine potential VZV vaccine-related complications and to differentiate Varicella Zoster Virus (VZV) wild-type strains from an attenuated varicella vaccine, PCR targeting the ORF 38 segment was carried out which was further sequenced to differentiate the vaccine strain from wild-type VZV. Amplicon 600 bp in size for ORF 38.

Scrapings from the vesicles were taken. A sterile beveled hypodermic needle was used to de-roof vesicle and using a swab moistened with Viral Transport Media (VTM), the base of the opened lesion was scrubbed and placed in VTM tube and sent immediately to Virology Department where centrifugation was done at 4000 $\times$g, the sediment was used for extraction of DNA using spin column method (QIAGEN GmbH, Hilden, Germany) as per manufacturer's instructions. Similarly DNA of the OKA Strain was also extracted from the vaccine vials that had been used for vaccinating the patient (OKAVAX, Sanofi Pasteur India Ltd).

PCR was carried out in a 25 uL reaction volume with primers targeting the ORF 38 region of the VZ virus. Briefly the reaction cocktail consisted of 0.5 uM of each primer with 1.5 mM $MgCl_2$, 0.2 mM dNTPs, 0.2 U of Taq polymerase and 5 uL of template. Cycling conditions of the PCR were as follows, initial denaturation at 95 °C for 5 min followed by 35 cycles of denaturation at 95 °C for 1 min, a 1 min annealing step at a temperature of 60 °C and an extension step at 72 °C for 1 min followed by a final extension step at 72 °C for 5 min. On electrophoresis in a 1.5% agarose gel the amplified products were visualized with an UV transilluminator after staining with 0.05% ethidium bromide.

The amplicons were sequenced in an Capillary Electrophoresis System (ABI 3730 xl) using a Prism BigDye Terminator Cycle sequencing Kit (Applied Biosystems, Foster City, USA) as per manufacturer's instructions. Sequencing results were

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