SHORT COMMUNICATION

Chickenpox and measles clusters among college students in Pune, Maharashtra

Avinash R. Deoshatwar¹ · Vijay P. Bondre¹ · Babasaheb V. Tandale¹

Received: 11 April 2017 / Accepted: 28 August 2017 / Published online: 20 September 2017
© Indian Virological Society 2017

Abstract Chickenpox and measles, both vaccine preventable febrile rash illnesses, present in a comparatively severe form among young adults/adults than among children. Immunity levels against chickenpox are not known in India and those against measles have been found variable across the country. Places where students or adults/young adults from various parts of the country come together pose a peculiar challenge in preventive policy making regarding these diseases. In this article, we present findings from parallel outbreaks of the two diseases in a graduate/post-graduate institute in the city of Pune. A team from National Institute of Virology [Pune] investigated outbreak of febrile rash illness in a premier graduate institute and found that it was a case of two parallel outbreaks of chickenpox and measles. In this outbreak chickenpox cases did not present with greater severity but measles cases were severe. The concerned institute hosts more than 800 students and 300 staff including faculty. These outbreaks were contained because of the alert physician in the institute; but it also highlights a need for uniform policies across such educational institutions in the country.

Keywords Chickenpox · Measles · Adults · Educational institutes · Clusters · Prevention

Chickenpox outbreaks have been reported from Northern parts of India. Data on incidence of chickenpox are not available which poses a challenge in formulating control

strategies. Chickenpox infections in adults are known to present in severe forms than in the children [1]. Chickenpox vaccine is not a part of the universal immunization program [UIP] however it is provided in general practice. [http://mohfw.nic.in/WriteReadData/1892s/Immunization_UIP.pdf].

Measles too presents in a more severe form in adults than in children [2]. Measles vaccine is a part of the vaccination program since 1985 in India [3]. The vaccination coverage, vaccine efficacy and immunity levels against measles in the community have been variable across the country [4]. NIV provides diagnostic support regarding measles outbreaks in the state of Maharashtra. Many outbreaks involve adult and young adult cases, some of them vaccinated against measles. [NIV unpublished data].

More than 800 students from all parts of the country and 300 staff work on the campus of this graduate institute in Pune city. Extensive interaction of students of the same class occurs on day to day basis. Students from across the classes as well as educational levels [bachelors/masters/doctoral] interact every day at places like common halls, canteens and play grounds. There is a clinic manned by a full-time nurse and a doctor who visits in stipulated hours. An outbreak of febrile illness with rash in this premier institute was reported by the medical officer in October 2013. Students from a particular class, aged 18–27 years along with their teacher, 59 years female, were reported to have mild febrile illness with rash. The institute requested NIV to conduct an investigation.

All students and staff in the institute were invited via e-mail and requested by the team to report a febrile illness with or without rash during previous 3 months. The team inquired into the origin, duration and progression of illness. Data was collected regarding age, sex, history of vaccination, date of onset of illness, date of onset of rash, severity

✉ Babasaheb V. Tandale
drtandale@gmail.com

¹ National Institute of Virology [NIV], Indian Council of Medical Research, 130/1, Sus Road, Pashan, Pune 411021, India

of rash, associated symptoms/signs, hospitalization, treatment, and the outcome. Serum samples were collected from all consenting subjects. Scabs from the lesions were also collected. Serum samples were tested for presence of Chickenpox specific IgM in a private laboratory with the help of EUROIMMUN kit [D-23560 Leubeck, Germany] as per the manufacturer's instructions. Samples from the PhD students whose rash was different than that of the BSMS [combined bachelor and masters in science degree] were tested for Measles IgM. Scabs were tested for presence of Chickenpox as well as Measles virus with the help of PCR.

We used the following case definitions—chickenpox suspect: An illness with acute onset of diffuse (generalized) maculopapulovesicular rash without other apparent cause. [CDC Chickenpox outbreak manual <http://www.cdc.gov/chickenpox/outbreaks/manual.html> (accessed December 2014)]; and for measles—measles suspect: Any person in whom a clinician suspects measles infection, or.

Any person with fever and maculopapular rash (i.e. non-vesicular) and cough, coryza (i.e. runny nose) or conjunctivitis (i.e. red eyes) [WHO Measles immunization standards (http://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles_standards/en/) Accessed December 2014]. The study was conducted as an outbreak investigation hence did not require ethics committee approval.

All students were between 18 and 27 years of age and a professor was 59 years female. Vaccination history of the students was not available. The index case was 21 years female student from Kerala. She had travelled within the Kerala state for 2–3 weeks before joining the classes on 1st August 2013. She did not have any symptoms before joining the classes nor did she report any contact with an infected person. She reported fever followed by rash on 4th August 2013. The details are given in Table 1. Additionally, the chronology of events with incubation and communicable periods of chickenpox and measles cases is depicted in Fig. 1.

These students and their faculty noticed the rash on their limbs first which then spread to other body parts. The rash gradually formed blisters of less than 1 cm size. Two students refused to give samples. Five students were positive for Chickenpox IgM while one student and the professor were negative. A vesicular swab from a student was positive for Chickenpox Polymerase Chain Reaction [PCR] test.

Three PhD candidates, all females between 22 and 27 years of age, experienced severe form of disease and had a different pattern of rash. Their rash, maculopapular in nature, typically started on the face, neck and then spread to other parts of the body. All three students were friends and spent considerable amount of time together daily.

They, however, did not spend time with the graduate students who experienced milder disease with a different rash pattern. One of the doctoral students received Valacyclovir hydrochloride on day one of rash. She experienced a relatively mild disease and the rash started disappearing from second day of medication. Other two measles cases experienced a severe form of disease and needed hospitalization, one of them, aged 27, required to be admitted to intensive care unit [ICU] for observation. Another student who was hospitalized for severe rash and fever had oral lesions, Koplik's spots, typical of measles. Vaccination history regarding measles could not be confirmed for any of the doctoral students.

Samples from doctoral students were tested for presence of Measles specific IgM and were found positive. Efforts were made to isolate the Measles virus from scab samples from one of the subjects.

One case of suspected chickenpox was reported from the institute in the month of April 2014, since the outbreak in 2013. No cases of measles were reported after October 2013.

The institute involved in this outbreak is a premiere and prestigious graduate educational and research institute in Pune. More than 800 students and around 300 staff interact extensively on the campus every day. Students from all parts of the country attend the institute and large majority of them stay in the dormitories where the contact is extensive and across the educational levels. It is a limitation of this article that the nature and duration of contact between infected and non-infected persons on campus could not be quantified. Similar observations were noted in cases of measles. This indicates that isolation of a person with fever/rash in the early stage of the rash may have helped limit the spread of disease in such settings. Minimizing the contact of other people with the patient may help in breaking the transmission and control of epidemic in similar settings. Sero-prevalence studies in such settings and similar age-groups may help formulate strategies for outbreak control in future. This outbreak occurred in an institute where the medical officer as well as administration was proactive and invited NIV for investigation; the authors suspect that such incidences in other educational institutes may go unreported. There is a need of proactive surveillance for such communicable illnesses in similar settings.

A lot of measles outbreaks are reported from this part of the state but most of them involve children >15 years.

Chickenpox vaccination is not given routinely in India [2]. The vaccine costs 2400–2800 rupees for two doses [40–45 USD] in the market. Though there are reports from India as well as developed countries like Spain and USA that chickenpox vaccination of whole population might be cost effective, empirical evidence is not available for

Table 1 Characteristics of Chickenpox and Measles cases in a post-graduate institute, Pune, Western India, 2013

Sr. no.	Age (years)	Gender	Class	Vaccination status	Rash onset date	Severity of rash ^a	Hospitalized	Serum	Scab/swab	Test result
1	21	F	II nd yr graduate	No	4-Aug-13	B	No	No	No	NA
2	19	F	II nd yr graduate	No	22-Aug-13	B	No	Yes [Inadequate]	No	Negative
3	19	F	II nd yr graduate	No	25-Aug-13	B	No	Yes	No	Chickenpox IgM+
4	18	F	II nd yr graduate	No	6-Sep-13	A	No	Yes	No	Chickenpox IgM+
5	19	M	II nd yr graduate	Don't know	7-Sep-13	B	No	Yes	No	Chickenpox IgM+
6	20	M	II nd yr graduate	Don't know	21-Sep-13	A	No	Yes	No	Chickenpox IgM+
7	22	M	II nd yr graduate	No	21-Sep-13	B	No	No	No	NA
8	23	F	PhD	No	6-Oct-13	C	No	Yes	No	Measles IgM+
9	21	M	III rd yr graduate	No	7-Oct-13	A	No	Yes	Yes	Chickenpox IgM+, swab PCR+
10	27	F	PhD	No	7-Oct-13	C	Yes	Yes	Yes	Measles IgM+
11	59	F	Faculty	No	9-Oct-13	A	No	Yes	No	Negative
12	26	F	PhD	Not available	21-Oct-13	D	Yes	Yes	Yes	Measles IgM+

^a Severity of rash based on total number of lesions on the body: A = <50, B = 50–249, C = 250–499 and D = 500+

Fig. 1 Outbreak progression by the week of onset of illness along with parallel measles outbreak in the later phase of chickenpox outbreak. X-axis shows week number of the outbreak. Y-axis shows

number of cases. [For chickenpox- blue square Incubation Period, red square Communicable period; For measles- green square Incubation period, brown square Communicable period] (color figure online)

outbreak situations in such institutions in a country like India [5–7]. Cost-effectiveness of vaccinating all students on campus of large institutes needs to be assessed. This was

an outbreak with mild disease (Chickenpox) where no hospitalization was required but it is known to present more severely among adults than children [1].

Cost-effectiveness analyses of VZV vaccinating all students on campus need to be considered.

Measles vaccination was incorporated in the universal immunization program (UIP) in India in 1985 [3]. The coverage initially was not 100%. There is a need of understanding measles antibody prevalence among people born between 1980 and 2000 [period before measles vaccination was started and during early years after] across socio-economic strata in urban and rural populations in India. The need is higher considering measles may be considered for elimination after successful poliomyelitis eradication in India.

Chickenpox and measles circulating parallel in the communities have been reported in India and other parts of the world before; but no suggestions have been made towards epidemiological or biological associations for parallel circulation [8–10].

Early isolation of patient with fever and rash may help in interrupting transmission of chickenpox as well as Measles in settings where a large number of people interact extensively on day to day basis. Policies like vaccinating large number of students against chickenpox will need evidence from intensive cost-effectiveness analysis studies. Seroprevalence studies for immunity levels against measles in population ages 15–25 need to be done in India to quantify at risk population in that age.

Acknowledgements The investigators are grateful to the Director General, Indian Council of Medical Research, New Delhi for providing the funds for this investigation. We are also thankful to the registrar and other faculty of the institute in Pune for their cooperation during the investigation. Authors are also thankful to Mr Kailas Gadekar for technical support. Financial support ICMR [NIV intramural funds].

References

1. Galil K, Brown C, Lin F, Seward J. Hospitalizations for chickenpox in the United States, 1988 to 1999. *Pediatr Infect Dis J*. 2002;21(10):931–5.
2. Casasoprana A, Honorat R, Grouteau E, Marchou B, Claudet I. A comparison of adult and pediatric measles patients admitted to emergency departments during the 2008–2011 outbreak in the Midi-Pyrénées region of France. *Jpn J Infect Dis*. 2014;67:71–7.
3. Madhavi Y. Vaccine policy in India. *PLoS Med*. 2005;2(5):e127. doi:10.1371/journal.pmed.0020127.
4. Murhekar M, Hutin YJ, Ramakrishnan R, Ramachandran V, Biswas AK, Gupte MD, et al. The heterogeneity of measles epidemiology in India: implications for improving control measures measles epidemiology in India. *JID*. 2011;204(suppl 1):S421.
5. Domingo JD, Ridao M, Latour J, Ballester A, Morant A. A cost benefit analysis of routine Chickenpox vaccination in Spain. *Vaccine*. 1999;17(11–12):1306–11.
6. Gray AM, Fenn P, Weinberg J, Miller E, McGuire A. An economic analysis of Chickenpox vaccination for health care workers. *Epidemiol Infect*. 1997;119(2):209–20.
7. Bhatti VK, Budhathoki L, Kumar M, Singh G, Nath A, Nair GV. Use of immunization as strategy for outbreak control of Chickenpox zoster in an institutional setting. *Med J Armed Forces India*. 2014;70:220–4.
8. Gupta SN, Gupta N, Gupta S. Epidemiological investigation of mixed outbreaks of measles/Chickenpox in hilly villages of district Kangra, Himachal Pradesh, India. *Glob J Med Public Health*. www.gjmedph.com ISSNn- 2277-9604 2013; 2.
9. Ivić-Hofman I, Cvitkovic A, Kaic B, Vilibic-Cavlek T, Pandak N, Juric D, et al. Simultaneous chickenpox and measles infection among migrant children who stayed in Italy during the second half of June 2011. *Clin Pract*. 2011;1(4):e113.
10. Singh KP, Jain P, Prakash O, Khan DN, Gupta S, Jain A, et al. Outbreaks of measles and chickenpox in eastern Uttar Pradesh, India. *Clin Epidemiol Glob Health*. 2014;2(1):3–9.