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Original Articles

Outbreaks of measles and chickenpox in eastern Uttar Pradesh, India

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ABSTRACT

Aim: The sudden increase in number of cases of fever with rash at five sites in Uttar Pradesh, India was surveyed to establish the aetiology and investigate the extent of the disease.

Methods: We case defined, measles as a person with acute onset of fever, cough, coryza or conjunctivitis with maculopapular rash and a case of chickenpox as a person with acute onset of diffuse maculopapulovesicular rash. Blood samples were collected from clinically suspected cases and tested for anti-measles IgM/anti-VZV IgM and IgG antibody (depending on the clinical features) by ELISA. Detailed history was collected from each case including history of contact and immunization.

Results: Confirmed measles outbreaks were identified at 2/5 sites. There was neither any death nor any serious complications due to measles. However, varicella outbreaks were confirmed in 3/5 sites with one mortality.

Conclusion: Measles and chickenpox are still widespread in North India. Therefore, vaccination for varicella and better coverage of first dose and introduction of second dose opportunity for measles to susceptible population in affected areas is suggested.

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The investigation was carried at five sites in state of Uttar Pradesh, India, the details of which are given in [Table 1](#). Temperature in the affected sites varies from 21–39 °C, with average 0.123 mm rainfall and 40–55% humidity during the month of March–May 2011. The investigation team of epidemic surveillance staff consisted of doctors, research scientists, research assistants and technicians covering field work, who were trained at National Institute of Epidemiology, Chennai, India, visited the Community health centres (CHC) of the affected areas. The team was escorted by the local doctors and community members to the houses of the reported cases at times. In addition a door to door survey was conducted to identify any unreported case. In schools the administrators were informed and active case detection was carried out throughout the school.

A measles case was defined as a person who had acute onset of fever, cough, running nose, conjunctivitis with generalized maculopapular and erythematous rash during the outbreak period and was confirmed by laboratory investigations or was epidemiologically linked to a laboratory-confirmed measles case as per the WHO guidelines.² Relevant information regarding patient characteristics including clinical and outcome details was recorded. A chickenpox case was defined as a person with acute onset of diffuse maculopapulovesicular rash without any other apparent cause during the outbreak period, without a prior history of chickenpox,³ and met the laboratory criteria or was epidemiologically linked to a probable or confirmed case.

Data collection instrument was developed by using WHO guidelines for Epidemic preparedness and response to measles outbreak, Geneva, Switzerland May 1999 (WHO/CDS/CSR/ISR/99.1). After obtaining written informed consent from guardian/parent of each case, approximately 5 ml of blood sample was collected and labelled properly. All the samples were brought to Virology laboratory maintaining a cold chain where the serum samples were tested for anti-measles IgM antibodies by ELISA (Novatec Immundiagnostica GmbH, Germany) or for anti-VZV IgM and anti-VZV IgG (depending upon the clinical features) by commercially available ELISA kit (Novatec Immundiagnostica GmbH, Germany) according to manufacturer's instructions. A sample was considered positive for a test, if the absorbance value was more than 10% over the cut-off. Samples were considered negative if the absorbance value was lower than 10% below the cut-off, while samples with absorbance values of 10% above or below the cut-off were considered to be in the grey zone. For all the ELISA kits the sensitivity and specificity of the test was >95% as per the manufacturer.

For cases that tested positive for anti-VZV IgM, a convalescent serum sample was collected, approximately 15 days after the first sample since CDC states that experience with anti-VZV IgM antibody testing is limited, and therefore demonstration of rising titres of anti-VZV IgG is required for chickenpox confirmation. In these cases at the second visit, additional information was obtained on the numbers of lesions (<50, 50–99, 100–249, 250–499 or >500) to know the severity of disease, other signs and symptoms (eg, headache, bodyache and anorexia), history of co-morbidities (eg, asthma) and regular medicine use; and information about chickenpox-related hospitalizations or complications (eg, cellulitis, pneumonia, or encephalitis) as per the CDC guidelines.³ Vaccination card was referred to in each case for confirming the history of vaccination. District vaccination Data was obtained from the office of District immunization officer WHO unit Lucknow. Data was not available for Behraich.

3. Results

Outbreak investigations were done at two villages and three schools. These outbreaks were not related to each other geographically/epidemiologically hence, each outbreak is dealt with individually. The details of five sites are mentioned in Table 1. The epidemiologic details of each outbreak are as follows:

Table 2 – Laboratory results of cases seen in measles outbreak.

Laboratory results	Anti-measles IgM			
	Site 1		Site 3	
	Cases (n = 12)	Contacts (n = 6)	Cases (n = 17)	Contacts (n = 9)
Positive	10 (83%)	5 (83.3%)	16 (94%)	7 (77.8%)
Equivocal	1 (8.3%)	1 (16.7%)	1 (6%)	2 (22.2%)
Negative	1 (8.3%)	0 (0%)	0 (0%)	0 (0%)
Total	12	6	17	9

Site 1: Samples were collected from 17 clinically suspected measles cases. Laboratory results are shown in Table 2. The highest attack rate was seen in population less than 10 years of age (10.9%), though 3.5% of children between 10 and 14 years and 2.3% of adults were also affected. The frequency of symptoms is shown in Table 3. There was no history of immunization in all the 17 cases.

The primary case was a resident of the village aged 22 years who developed fever with rash on 10th day after exposure (9th March 2011). On probing into his source of infection, it was known that his 13-year-old relative from district Lucknow visited his house on account of a marriage at the patient's family, who developed fever and rash on day 9th after exposure one day before she left. The patient was not isolated and after 3 days his two siblings also developed the disease. Within a span of 20 days several of their family friends, neighbours and members of their family who attended the function, developed the disease. Total 17 persons from 10 families were affected. The outbreak was unrecognized until 18th March 2011, when members of few families visited the PHC after experiencing onset of measles symptoms at various times over the previous few days. Last case was reported on 1st April, 2011. Local residents were given health education regarding reporting and isolation of any new case.

Site 2: Clinical suspicion of chickenpox was present in 5 cases of which one case died. Acute phase and convalescent phase serum sample was available for 4 and 3 of 5 cases respectively. Laboratory results are shown in Table 4. The outbreak in Harsakri turned out to be chickenpox rather than measles. The age specific attack rates were 30% in the 5–9 year age group, 12.5% in 10–14 year age group and 1.5% in >14 year age group. No case was reported in children <5 years of age. The frequency of symptoms is shown in Table 3.

The primary case was 18-year-old male who developed fever with >500 rashes all over the body on 26th April, 2011. Despite his illness, he went to his farm for working, where he fainted and was declared dead on reaching the hospital. When his source of infection was traced, it was found that his sister developed a similar but milder disease 7 days earlier. The sister had probably acquired the disease from her friend whose mother was also affected. Later, the deceased man's another sister also developed the disease, who was then isolated. No further case of chickenpox was reported after 27th April, 2011.

Site 3: A government organization that caters to the needs of 100 selected girls from lower socioeconomic background, aged between 10 and 16 years, providing housing, cloths, food

Table 3 – Frequency of symptoms of measles/chickenpox cases.

Symptoms	Number positive (%)				
	Site 1	Site 2	Site 3	Site 4	Site 5
Number of cases	17	5	12	12	16
Mean age in years (range)	15.7 (6–55)	16.8 (10–27)	13 (10–16)	11.6 (6–30)	9.4 (6–18)
Male: Female ratio	2.2:1	0.7:1	No males	11:1	1.7:1
Fever	17 (100)	5 (100)	12 (100)	12 (100)	16 (100)
Rash	17 (100)	5 (100)	12 (100)	12 (100)	16 (100)
Cough	11 (64.7)	–	2 (16.7)	–	–
Coryza	11 (64.7)	–	4 (33.3)	–	–
Conjunctivitis	0	–	8 (66.7)	–	–
Complications	0	–	1 (8.3) (Diarrhoea)	–	–
Chills and rigour	–	3 (60)	–	9 (75)	3 (18.7)
Bodyache	–	3 (60)	–	8 (66.7)	7 (43.5)
Headache	–	2 (40)	–	1 (8.3)	4 (25)
Severity of disease					
Mild	–	2 (40)	–	12 (100)	9 (56.3)
Moderate	–	2 (40)	–	0	7 (43.7)
Severe	–	1 (20)	–	0	0
Mortality	0	1	0	0	0
Aetiology	Measles	Chickenpox	Measles	Chickenpox	Chickenpox

and education. A total of 12 girls were epidemiologically linked to have measles from 10th March to 1st April, 2011. Samples were collected from these cases. The frequency of clinical symptoms is shown in Table 3 and laboratory results in Table 2. History of immunization in all 12 cases was not available.

The primary case was a girl aged 13 years who visited her parent's house where one of her cousins had fever with rash. The primary patient developed a mild rash on 10th March, 2011. The patient was not isolated. She attended the mess, craft activities and prayers where all the resident children gather together. These girls lived in 7 dormitories. A girl, who shared the dormitory with the index case, developed a rash on day 9th after exposure to primary case. Within 20 days the disease spread to other girls in the school after the primary case become symptomatic for measles. All the cases were treated symptomatically by a local physician and were given Vitamin A.

Site 4: It is a school under CHC Itaunja where children are taught about Muslim religion in a common classroom. During the outbreak 50 children attended the school; these students were aged 5–15 years (median: 7 years), and 36 (72%) were male. None of the students had a prior history of chickenpox.

Total 12 cases were clinically suspected to have chickenpox. Convalescent serum was available for 8 cases. The laboratory results are shown in Table 4 and frequency of symptoms is shown in Table 3.

When the source of these cases was traced it was found that Maulviji, a 70-year-old male teacher of the children, was the primary case, who developed rashes on 12th April, 2012. The teacher visited the local doctor on 5th day of illness when his diagnosis was confirmed. His source of infection could not be identified. In spite of having active lesions, the teacher continued to take regular classes, thereby affecting a majority of students. Within 2 weeks time, 11 students and one teacher developed chickenpox. On further investigation it was known that 2 siblings and father of one student also developed the disease. The families of other cases could not be traced. In the school the last case was reported on 2nd May, 2011.

Site 5: The setting of the chickenpox outbreak was in a primary school with a school enrolment of 41 students. A total of 10 students and their 6 siblings, aged between 6 and 18 years, were epidemiologically linked to have chickenpox during 28th April to 25th May, 2011. The majority (62.5%) of cases were males. Samples were collected from 16 cases; convalescent serum was available for 9 cases. The chickenpox

Table 4 – Laboratory results of cases seen in chickenpox outbreak.

Laboratory results	Anti-VZV								
	Site 2			Site 4			Site 5		
	APS (n = 5)		CS (n = 5)	APS (n = 12)		CS (n = 12)	APS (n = 16)		CS (n = 16)
	IgM	IgG	IgG	IgM	IgG	IgG	IgM	IgG	IgG
Positive	4 (80)	3 (60)	3 (60)	9 (75)	3 (25)	8 (66.7)	11 (68.8)	14 (87.5)	9 (56.3)
Equivocal	0 (0)	0 (0)	0 (0)	2 (16.7)	7 (58.3)	0 (0)	3 (18.8)	2 (12.5)	0 (0)
Negative	0 (0)	0 (0)	0 (0)	1 (8.3)	2 (16.7)	0 (0)	2 (12.5)	0 (0)	0 (0)
Not available	1 (20)	1 (20)	2 (40)	0 (0)	0 (0)	4 (33.3)	0 (0)	0 (0)	7 (43.8)

APS: Acute Phase Serum, CS: Convalescent Serum, Anti-VZV: Anti-varicella Zoster Virus.

attack rate in the school was 24.4%. Laboratory results are shown in Table 4.

An initial cluster of three students, of which two were from the same class (2nd), and another from seventh standard was identified; disease onset was between 28th and 29th April, 2011. Investigations revealed that the primary case was the sibling of a student of 2nd standard who was responsible for this initial cluster. The primary case had visited her maternal house in Lucknow and developed symptoms on 24th April. Thereafter, the disease spread to other students and their families.

The epidemic curve is shown in Fig. 1. The shape of the epidemic curve indicated person-to-person propagation, with several transmission chains.

4. Discussion

The study describes outbreak investigations of fever with rash cases at five sites of Uttar Pradesh, India during 4th April and 27th May, 2011. Two of five outbreaks were due to measles and remaining three were caused by chickenpox. This highlights the fact that chickenpox can reach epidemic proportions in India and all outbreaks of fever with rash are not measles, chickenpox should also be considered in such instances. Mixed outbreaks of chickenpox and measles have also been reported earlier from Himachal Pradesh⁹ and outbreaks of measles^{10–13} or chickenpox¹⁴ have been reported from different parts of India. Poor vaccine coverage along with low vaccine efficacy leads to susceptible populations in which outbreaks occur.¹⁵

These outbreaks occurred in the dry season which correlated with some of the rural outbreaks described earlier from India¹⁰ and abroad.¹⁶ Interference with VZV transmission by high temperature has been suggested as a possible explanation for this seasonal variation.^{16,17} The age distribution of cases in the village outbreaks of measles or chickenpox was

studied. Maximum cases of measles occurred in children less than 10 years of age, though a fair number of adolescents and adults were also affected. Such age distribution was seen, perhaps because the overall measles vaccination coverage in infants in Lucknow district of Uttar Pradesh is approximately 60% (unpublished data) as against the national average of 70%.¹⁸ It has been seen that in districts with a low measles vaccination coverage (<80%), during outbreak settings, maximum cases are among children less than 10 years of age.¹⁸ At the same time since the adults were also affected, accumulation of susceptible population could be seen. This observation is in confirmation with the MeaslesNetIndia, who also reported the presence of a susceptible adolescent population at various places in India.⁸ Unimmunized children coupled with vaccine failures provide a pool of older susceptible children that is sufficient to cause a measles outbreak.¹ Maximum chickenpox cases were in the 5–9 years age group, though adults were also found to be affected and had more severe disease as compared to children. Less opportunity to contract VZV during childhood in rural areas of tropical countries has been proposed as a possible explanation for infection in adults.¹⁹ The acute phase serum of most of the chickenpox cases was positive for VZV IgG. This may be due to the fact that most of the patients had duration of illness more than 15–30 days at the time of collection of first sample. All the outbreaks were detected late during their course. The primary case in 3 of 5 outbreaks had a history of epidemiological linkage with residents of urban areas, who themselves were cases. This population migration resulted in importation of measles from the urban area resulting in an epidemic among the susceptible population as has been described earlier.^{12,20} No complication or mortality was seen in any measles case. Most cases of chickenpox had a mild to moderate disease except one mortality, probably due to poor nutritional status, lack of awareness and vaccination.

Outbreaks of chickenpox^{21–23} in institutions and of measles in communities with a high one dose vaccination

Fig. 1 – Distribution of cases by date of onset of disease.

coverage have been recorded earlier.²⁰ In order to decrease the built up of susceptible population, many industrialized countries now administer the MMR booster dose prior to or at school entry²⁴ and chickenpox vaccine at <14 months of age.²⁵ The routine use of varicella vaccine should be encouraged as recommended by the Advisory Committee on Immunization Practices.²⁵ Since infection in children is associated with a higher morbidity atleast in northern part of India, it is suggested that varicella vaccination should be considered in the routine immunization program in North India.

The two dose strategy for measles vaccine has already started at 4 states and Union Territories in India.^{17,24} Consideration should be given to urgent implication of this strategy as well as improving the coverage of first dose of vaccine in Uttar Pradesh where the toll of disease is high and most cases are under-reported. Consideration should also be given to organizing regular training programmes for health care workers at peripheral centres so that outbreaks of communicable diseases can be prevented.

5. Conclusion

Not all cases of fever with rash are caused by measles, chickenpox is more widespread in India. A second dose opportunity for measles to susceptible population in affected areas of Uttar Pradesh is suggested. Outbreaks of chickenpox are associated with a higher morbidity and mortality in North India, therefore consideration should be given to chickenpox immunization in this part of India.

Conflicts of interest

All authors have none to declare.

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Maternal and foetal outcome of gestational diabetes mellitus in a rural block of Assam, India

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ABSTRACT

Aim: India is known as a diabetic capital of the world and it has been well recognized that women especially pregnant and lactating women form one of the most vulnerable segments of the population from nutritional point of view.

Objectives: To assess the incidence of gestational diabetes mellitus and measure the maternal and foetal outcome of gestational diabetes mellitus.

Methods: A cohort study was conducted in an area served by rural block primary health centre, where all consented pregnant women in first trimester registered between June and August 2011 were followed up in second and third trimester to measure incidence of gestational diabetes mellitus along with maternal and foetal outcome measurement during delivery and postnatal period.

Results: The incidence of GDM amongst the study population was 3% (28, $n = 930$). The impaired glucose tolerance was documented amongst 216 (23.2%, $n = 930$) ladies. Prevalence of underweight was 21.4% (202), while 5.7% (54) were overweight and 0.2% (2) was obese in first trimester. Anaemia prevalence was 72% (670) ($Hb < 110$ g/l). Serum albumin level was lower in 32.9%. LSCS rate was found significantly higher amongst GDM subjects compared to non-GDM subjects ($RR = 4.58$; 95% CI, 2.18–9.59, $p = 0.000$). Mean birth weight of neonate was 2.802 ± 0.479 . Birth weight was found significantly higher amongst GDM group compared to non-GDM group ($\chi^2 = 166.8$, $p = 0.000$). Neonatal death was more common amongst GDM group compared to non-GDM group ($\chi^2 = 6.776$, $p = 0.034$).

Conclusion: There is increased caesarean section rate, admission to an NICU among women who had gestational diabetes mellitus during pregnancy.

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