Remote hilly villages fall to an outbreak of Measles in district Kangra-Himachal Pradesh

Dr. Sarender Nikhil Gupta*, Dr. Naveen Gupta**

ABSTRACT

In India, measles is the leading cause of the pediatrics morbidity and mortality. It follows the heterogeneous pattern in the various states of the country. On 26th September 2006, a local health worker informed about sudden increased number of cases of fever and rash in three villages of district Kangra. The suspected outbreak was investigated to estimate its magnitude and to formulate recommendations for prevention and control. The measles case was defined as occurrence of fever with rash in a child between six months to 17 years of age, from 26th September to 2nd last week of Oct, 2006. Outbreak was declared according to time, place and person characteristics. A retrospective cohort study was conducted among children between 10 months and 15 years of age to estimate the vaccine efficacy. Mothers were interviewed for immunization status and reviewing immunization cards. Serological examination for presence of IgM antibodies was also done. 18 cases in three villages were identified. The overall attack rate (AR) was four percent. Sex specific AR was 4.1% for males and 4.2% for females. All 18 cases were between 6 to 17 years of age. There was no death and no one had any complications. The attack rate was maximum in the age group of 11-17 years as 17.3%. The proportion of the children vaccinated was 94.9%. Of 18 case-patients, 14 (78%) were vaccinated for measles. The AR of measles among unvaccinated children was 3.43% (14/408) as compared to AR among vaccinated of 18.18% (4/22) (Relative risk: 5.3; 95% confidence interval: 1.90 - 14.77). The vaccine efficacy was estimated to be 81.13%. Serological examinations of three case-patients confirmed the presence of measles IgM. Only 28% (5/18) of the cases took the treatment from modern system of medicine. Measles outbreaks can occur despite high immunization coverage in a population. Recommended the health authorities to (1) avail 2nd dose opportunity of measles vaccination in areas of high vaccination coverage, (2) Vitamin A supplementation to the cases, (3) IEC activities should be addressed in the measles affected areas.

Keywords: Measles, outbreak, IgM antibodies, Kangra.

INTRODUCTION

Rubeola or Measles is the fifth killer disease among children under five years in the world. Globally, in 2000, measles killed 770,000 children worldwide, accounting for nearly half of vaccine preventable deaths. Failure to deliver at least one dose of measles vaccine to all infants remains the primary reason for high measles mortality and morbidity in developing countries like India, Pakistan and African countries. WHO and UNICEF adopted a three-phase strategy for global measles elimination. The goal of this strategy is to reduce measles mortality by 90% in 2010 as compared with the 2000 baseline estimate. The three phases of the strategy are investigations of measles outbreaks which include identification of high-risk groups, description of changes in measles epidemiology and detection of weaknesses in routine immunization. In addition, outbreaks response interventions reduce case fatality by: (1) administering two doses of vitamin A to all children with measles, (2) treating complications (e.g. diarrhea, pneumonia and otitis media) and (3) ensuring that all children of 9 months or older are vaccinated against measles. The elimination strategy includes three objectives (1) a routine immunization coverage of exceeding 90% (2) a second opportunity for measles vaccination to be administered through the routine system or through supplementary immunization activities and (3) enhanced surveillance and case management.

Measles was the 6th vaccine preventable disease to be included in the Universal Immunization
Programme in 1984-85. Although global immunization coverage increased from less than 20% in 1983 to 80% in 1990 and the number of reported cases of measles declined from over 4 million per year to 0.7 million in 1997\(^{20}\). Measles immunization coverage in India from 42.2\(^{19}\) to 50.7\(^{19}\) to 58.8\(^{12}\) suggests that there is gradual rise over the years while in Himachal Pradesh, it is 95\%, 103\%, 98\%, 102\%, 101% and 103% from 2001-2006 respectively.

Generally speaking, measles outbreaks follow a cyclic pattern and occur every 3-4 years as a result of build up of the susceptibles. As the coverage increases, inter epidemic interval increases as well as a shift towards older age groups may be observed as in Thailand and Sri Lanka\(^{21}\). But in the country, Delhi state has higher vaccine coverage since it has taken the lead and initiative of the two dose schedule of measles and mumps, rubella (MMR) at 9 months and at 15 months respectively. Goa, Maharashtra and Tamil Nadu reached 84-88 per cent coverage. Six states, Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, Punjab and Madhya Pradesh achieved coverage of more than 70 per cent\(^{15}\). High reported measles immunization (95\%) in Himachal Pradesh have brought down the incidence of the measles cases from 19.28 to 11.4 to 7.86/lac16 from 2001-2003.

MATERIALS AND METHODS

On 26th September, 2006, a local health worker of sub centre Sarah reported an outbreak of measles in the remote hilly villages of Jahrehar, Bathreer, Gujreer under sub centre Sarah of Shahpur block, District Kangra, Himachal, India.

A written informed consent of the mothers of children in local language for quantitative as well as qualitative interview schedule, physical examination and also for laboratory samples was taken. Coding was used to maintain confidentiality while analysis. After the completion of the interview, each individual was given health education and fact sheet about the risk factors related to measles. The data was analysed by MS-excel sheet and using Epi info version 3.3.2.

The outbreak was investigated on 28th Sept., 2006 after the call from the district health authority Kangra district, Himachal Pradesh. A review of the number of cases reported and a comparison with retrospective data indicated that there was an increase of more than 10\% in the number of case patients, exceeding two standard deviations, thereby suggesting an outbreak. As there was no population migration and no change in surveillance practices, it was decided to investigate. Active case search was initiate by visiting house to house to identify the cases that meet the case definition or stimulated passive surveillance in affected fore named four villages with the population of 430. The mother of the every case patient or the next elder available member of the family was interviewed with the semi structured questionnaire in Hindi language for 20 minutes.

The purpose and processing of the samples was explained and then, had three randomly collected samples of blood, three samples of nasopharyngeal swabs for virus isolation and genotyping of the strain circulating in Himachal Pradesh and three samples of urine for culture/sensitivity at random from afflicted population and from different places under the written informed consent; using sterile equipment, separated the serum and transported the specimen to National Institute of Virology (NIV), Pune in cold chain separately. The laboratory tested specimens for IgM antibodies using ELISA.

Coverage assessment and vaccine efficacy using the screening method

Administrative measles vaccine coverage estimates were collected. Those had been obtained by dividing the number of doses administered by the number of eligible children. We also estimated the vaccine coverage in the population using mothers' interviews, cards reviews and health care facility records reviews. We compared the proportion of vaccinated among case-patients with the proportion of vaccinated in the population to obtain estimates.
of the vaccine efficacy using the screening method.

**Vaccine efficacy using analytical epidemiology**

Retrospective cohort design was adopted to estimate the vaccine efficacy. The affected age groups from 10 months to 17 years was selected as study populations. A case of measles was defined as per WHO criteria for the analytical study and ascertained the vaccination status using one or more of three criteria: immunization cards, health care facility records and mothers' history. The null hypothesis was that the measles vaccine was not associated with any protection against the disease. Exposure variables were the vaccination status. The disease status was the outcome variable. Children who have had measles in the past, as reported by mother were excluded, as they were not susceptible. The preventable fraction among exposed (i.e., those vaccinated) was calculated to obtain the vaccine efficacy. (Formula used was ARU-ARV/ARU*100).

**RESULTS**

A review of the number of cases of febrile rash reported seven years ago under sub centre Sarah of Shahpur block of Kangra district were 9289 (3.11%); a comparison with retrospective data was made. There is a history of the measles outbreak in the area seven years ago. The history of the febrile rash was 100% in the 18 cases while 14 cases have conjunctivitis (78%); 12 cases have the cough (65%) and 11 cases have coryza (61%) (Figure 1). No person had any complication in form of diarrhea, pneumonia or otitis media etc. According to the mothers' statements, among 18 cases in the three villages were listed out as Jathrear-13; Bathrear-03; Gujrer-02. 14 cases (78%) were immunized whereas 04 cases (22%) were unimmunized. No supplemental measles immunization in the form of ring immunization was done to the children in the three villages.

The IgM antibodies for 3 serological samples were positive for measles. All the nasopharyngeal swabs and urine samples were either destroyed or leaked out while in transportation & mismanagement in packing and others for want of logistics' support and hence, no result was available for them.

A total of 18 case patients were identified from a study population of 430 from the three villages with the attack rate of 7.4% in Jathrear; 2.0% in Bathrear and 1.9% in Gujrer under Sub centre Sarah with overall attack rate 4.18%. There was no case in the age group of 0-5 years. All the 18 cases belonged to the age group of 6-17 years. The attack rate was maximum in the age group of 11-17 years as 17.3%, 6.7% and 3.33% in the villages, Jathrear, Bathrear and Gujrer respectively. The sex-wise attack rate constituted 6.94% for the males and 7.20% for the females.

Median age of the case patients is 11 years and the range is 6 years to 17 years. The severity of the symptoms of the outbreak was less among the younger cases and more towards the older ones particularly in the lower socio-economic strata.

The index case identified in the area reported on 26th Sept., 2006 and maximum number of case patients clustered on 28th Sept., 2006. The outbreak started in Jathrear village and spread to the other villages, one incubation period after the local festival Sayar (16th Sept, 2006) at Kutharna (where the measles outbreak was ongoing) in which the people visit the relatives and exchange food preparations.

The dynamic of the outbreak in epidemic curve (Fig. 1) indicated that there were number of generations of cases with the propagated outbreak peaking around 28th September, 2006.

The number of cases declined during second week of October, 2006.

No case was treated with vitamin A supplementation. The case patients took the treatment from the nearby Military Hospital and Dr. Rajinder Prasad Govt. Medical College Hospital, Dharamshala and the supportive treatment and IEC were given from the sub centre and no supplemental measles vaccination was done in the ring fashion to the susceptible from the block health authorities. During the
vaccination session, the cold chain was observed maintained but the wrong practice of opening and closing the vaccine carriers persisted. **22% (4/18)** of the cases went for the traditional treatment of **Vannan bushes** (medicinal herbal plant) from the nearby local chelas/faith healers and diet rich in **seul**. (A herbal plant with small granules, thought to be hot in nature by the local community members and they are supposed to facilitate the eruption of measles; These granules are also roasted for eating as well as smoked fumes are placed underneath the cot of the ailing patients) more so in Kuthanna and Nauli areas while **28% (5/18)** had their treatment of choice to the modern system of medicine. Still majorities of the case patients, i.e., **50% (9/18)** believed the treatment in both ways; traditional conservative one first and then later on switched onto the modern one.

**Coverage assessment and vaccine efficacy using the screening method**

The immunization coverage of whole of this block as per health record is in between **104% to 113%** and that of the sub centre Sarah lies in between **80% to 100%** (from 2001 to 2005-06 for under 5 years children). The administrative vaccination coverage has surpassed 100% due to placement of the additional camps in the left out and the remote areas. The vaccination coverage as per mothers’ interview’s is **93%** the least specific criteria while according to vaccination cards, the most specific criteria— it is **68%**.

**Vaccine efficacy using analytical epidemiology**

Attack rates of measles by age and vaccination status indicated **04 patients of 22 non-immunized (18.18%)** compared to **14 case patients of 408 immunized (3.43%)** children. (Table 1) and it was statistically significant. (Relative risk: 5.3; 95% confidence interval: 1.90 to 14.77; P < 0.001). The calculation of vaccine efficacy among those exposed to the vaccine yielded an estimate of **81.13%** when children under 10 months of age and the previous history of measles were excluded (Table 2).

**DISCUSSION**

Although the cases in the outbreak were sporadic, belonging to the lower socio-economic strata and were malnourished, yet the duration of illness and severity of the symptoms were less especially in the younger generation. The serology proved IgM positive for measles. Symptoms frequency also supported the laboratory diagnosis. All the case patients identified belonged to the older age group, meaning thereby, there was obvious shift to the higher age group (6 years to 17 years) with no complications or fatality thereof. This may be because of the over 95% routine vaccination coverage. However, Sri Lanka, Latin America**19**, Romania**19** and South Korea**20** experienced outbreaks of measles in spite of sustained high coverage with single-dose vaccination strategy.

It is critical to recognize that no supplementary immunization activities during a measles outbreak were done, nor the vitamin A supplementation was instituted as the affected areas are not far away from the block health authorities. The cold chain was observed and maintained from District Head Quarter to PHC to sub-centers and its villages, in under prescribed temperature of +2 to +8°C. However, there were few shortcomings like improperly maintained temperature log book at primary health centre, Charri and repeated opening and closing of the vaccine carriers during the sessions needed attention. At present, there was no fixed rapid response team in function. There was lack of trained persons in specimen collection and transportation. Logistics for specimen collection is not available.

The index case identified in the Jathrear village was reported on 26th Sept., 2006. The outbreak started in Jathrear village and spread to the other villages, one incubation period after the local festival Sayar (16th Sept., 2006) at Kuthanna village (where the measles outbreak was ongoing) in which the people visit the relatives and exchange food preparations. Houses were scattered and usually found in small clusters of two to four units. Most of the houses of the villages are made of the mud and a minority-semi pucca. Traditional beliefs about measles do not
foster healthy behaviors in the population like the intake of the medicines suppresses the disease and VANNAN bush movement on the patient's body as part of the traditional treatment before or with modern medicines forms the mainstay. The affected children are to be kept huddled in the houses only; the diet intake should be reduced to the minimum with heat producing Seul diets or Sarson smoking to the patients and seek the blessings of Goddess after recovery from measles21. That is why, very less number of the patients have reported to sub centre Sarah.

Despite the >95% high coverage in Shahpur block (104% to 113%) and those of the affected villages under sub centre Sarah, (80% to 100%), inter epidemic interval was more & the number of the cases are sporadic.23 The outbreak is due to the progressive accumulation of a small number of susceptible children in the community over the years (Table 1). Such accumulations are typically caused by the combination of the measles vaccine efficacy that does not reach 100% and children left unimmunized each year. Retrospective cohort study conducted during these outbreaks in the different villages generated evidence sufficient to suggest that the efficacy of the vaccine (84.4%) was within the anticipated level thereby warranting the requirement of the 2nd dose opportunity for the measles to develop the herd immunity.23-24

Limitations:

1) Recall bias could have occurred with respect to recollection of immunization of the children of the area. (2) Sero-surveillance in the study area could not be carried out due to funds and time constraints.

CONCLUSION:

An outbreak of measles was confirmed clinically, epidemiologically and serologically in highly immunized area giving a shift towards the higher age group, i.e., 5-17 years.

Absence of Supplemental Immunization Activities (SIA) and Vitamin A supplementation.

Traditional beliefs and barriers mainly in marginalized families formed the mainstay of the treatment part.

Defective practices of the cold chain system that could affect the effectiveness of the vaccine.

Medical human resource available was untrained with inadequate logistics support and supply.

Less documentation of immunization by personal cards especially in the outreach areas.

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<td>Attack rates of measles by age and vaccination status, in Jathar, Batherur and Gujjar villages of Shahpur block, District Kangra, Himachal Pradesh, India, 2006.</td>
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RECOMMENDATIONS
On the basis of investigation we proposed a number of recommendations:
1. Go for the 2nd dose opportunity of the measles vaccination in highly immunized areas.
2. Provide vitamin A supplementation to the cases and SIA to the susceptible.
3. IEC activities should be addressed towards modifying the help seeking behavior of mothers in the district, especially in the measles affected areas.
4. Refresher trainings to the workers of the affected areas for proper cold chain maintenance;
5. Ensure availability of the logistics for specimen collection and transportation;
6. Document immunization coverage using personal cards and identify outreach strategies to cover remote villages in district Kangra.

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