DOI: 10.7860/JCDR/2022/59855.17199

Original Article

Microbiology Section

Analysis of Factors Hindering the Measles Elimination among Children at a Tertiary Care Hospital in South India

NIRMALA CHERUKURI[1], SRIVIDYA YERUVA[2], USHA RANI THOTA[3], KARUNYA KARNABATHULA[4]

ABSTRACT

Introduction: Measles is a highly infectious acute viral disease that can lead to serious complications and death. Effective immunisation coverage for measles will play a pivotal role in its elimination strategy. So, the global commitment, strengthening of health infrastructure and effective vaccine coverage are essential to achieve a world that will be free of measles.

Aim: To assess the factors associated with the occurrence of measles and to determine the factors responsible for non compliance to measles vaccination.

Materials and Methods: A cross-sectional study was conducted in the Department of Paediatrics at Niloufer Hospital, Hyderabad, India, during the period from October 2019 to March 2020 among the children clinical diagnosed with measles. The patients were evaluated for fever, rash, respiratory and other clinical symptoms associated with measles. History of measles vaccination and vitamin A administration were taken. Blood samples of patients were collected and measles specific IgM antibody detection test was done by Enzyme-linked Immunosorbent Assay (ELISA). Data was statistically analysed and presented as numbers and percentages were calculated.

Results: Among 129 children, clinically diagnosed with measles, the predominant age group of children affected was 1-6 years 68 (52.71%). Overall, 38 (29.5%) were vaccinated and 85 (65.9%) were unvaccinated during routine immunisation schedule. Measles-Containing Vaccine (MCV) coverage during Supplementary Immunisation Activities (SIAs) was also very limited (19.3%). Out of 129 cases, 121 (93.7%) were confirmed positive by measles IgM ELISA, 5 (3.8%) samples gave equivocal results and 3 (2.3%) were negative for the test.

Conclusion: Inspite of the availability of effective and inexpensive measles vaccine for decades, vaccination coverage remains inadequate across the globe. So, effective implementation of vaccine services and monitoring of its surveillance system are needed for eradication of measles.

Keywords: Enzyme-linked immunosorbent assay, Rash, Supplementary immunisation activities, Vaccination, Vitamin A

INTRODUCTION

Measles, a febrile illness can cause serious complications and death. It is one of the world's most contagious viral diseases [1]. In 2018, worldwide, more than 140000 people died from measles despite of the safe and cost-effective vaccine, mostly among children under the age of five. World Health Organisation (WHO) accelerated immunisation activities to decrease measles-related morbidity and mortality since 2000 [2]. Though, measles burden is not completely reduced due to gaps in immunisation, they saved millions of lives by preventing life-threatening complications such as bronchopneumonia and subacute sclerosing panencephalitis by giving momentum to the measles elimination programme. The world has taken the oath to eliminate measles in almost all the WHO regions by 2020 [3,4], which still remained unaccomplished may be due to inadequate vaccine delivery system to provide measles vaccine properly to persons in need and measles immunisation with single-dose has been unsuccessful in eliminating measles.

Vaccine failures due to interference of maternal antibody may be primary cause of continued circulation of the virus. Improved protection afforded by two doses of measles vaccine is well-documented in many countries where two-dose schedules have been implemented strictly for years [5]. So, missing second dose may be one of the reasons for vaccine failure. Eradication of measles is feasible because of the presence of several key elements, including humans as the only reservoir for the virus, wide access to diagnostic facilities that can rapidly detect measles-infectious persons and availability of highly safe and effective Measles-Containing Vaccines (MCVs). One of the major complications of measles is pneumonia. Measles is particularly dangerous in children with vitamin A deficiency. Various studies found that vitamin A megadoses (200,000 international units) on each day for two days lowered the number of deaths from measles in hospitalised children with pneumonia under the age of two years. Two doses of vitamin A are not too expensive, and are not likely to produce adverse effects [6].

Global commitment to establishment of good public health infrastructure and implementing policies that can overcome access barriers and enhance vaccine coverage is very much essential to achieve a world free of measles [1]. To assess the factors associated with the occurrence of measles and to determine the factors responsible for non compliance to measles vaccination.

MATERIALS AND METHODS

A cross-sectional prospective study was conducted in the Department of Paediatrics, Niloufer Hospital, Hyderabad, India. Consecutive child aged one month to 12 years with clinical history suspected of measles admitted to the Department of Paediatrics for a period of six months from October 2019 to March 2020 were enrolled in the study. This study was approved by Institutional Ethical Committee (IEC/OMC/M.NO.50 (ACAD)/77). Written informed consent was taken from each case included in the study.

Inclusion criteria: All the children aged one month to 12 years with history of fever, rash and respiratory symptoms suggestive of clinical measles of both sexes admitted to the Department of Paediatrics, during the study period was included in the present study.

Exclusion criteria: Children with dengue, Epstein-Barr virus infection, children with rash and jaundice and other exanthematous illnesses not suggestive of measles and those who did not give consent were excluded from the study.

Study Procedure

All 129 children were physically examined and detailed history was collected from patients and also from their medical records regarding their clinical symptoms, past clinical history, measles vaccination status-whether the vaccine was taken or not, the number of measles vaccine doses received, the reasons for not taking the vaccine, the status of mass Measles-Rubella (MR) vaccination campaigns conducted in their vicinity, history of vitamin A supplementation. The investigations and treatment were carried out as per the Institution's protocol. Blood samples were collected from all the children clinically suspected of measles and serum was separated and tested for measles-specific IgM antibody detection by Enzyme-linked Immunosorbent Assay (ELISA) according to the manufacturer's instructions. These tests used Enzygnost, Anti-measles Indirect ELISA kit (Siemens), with the amount of blood needed for each test being 3-5 mL, and the interpretation of the results were as follows:

>0.3=positive,

<0.2=negative, and

0.2 to <0.3=equivocal.

IgM ELISA detection is most sensitive 4-28 days after the rash onset [7]. Laboratory results and outcomes of all those children were obtained and the results were analysed.

STATISTICAL ANALYSIS

Descriptive statistical analysis was done and data was presented as numbers and percentages were calculated.

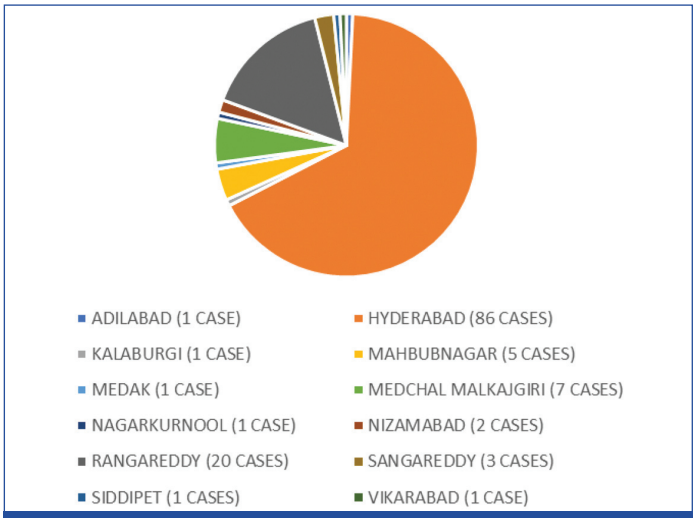
RESULTS

Demographic details like age, gender distribution and detailed history of rural, urban background, religion and vitamin A supplementation among 129 study participants is shown in [Table/Fig-1]. Among 129 measles cases in the present study, majority affected were males 76 (58.91%) and 1-6 years age group children 68 (52.71%). Measles cases were predominantly seen among children from urban areas 115 (89.14%) than that of rural.

Characteristics	Number (n)	Percentage (%)
Gender		
Male	76	58.91%
Female	53	41.08%
Age		
0-12 months	55	42.63%
1-6 years	68	52.71%
7-12 years	6	4.65%
Religion		
Hindus	31	24.03%
Muslims	97	75.19%
Not found	1	0.77
Setting		
Rural	14	10.85%
Urban	115	89.14%
Vitamin A		
Received	68	52.71%
Not received	61	47.28%
Number of patients-clinician suspects measles		
Yes	127	98.44%
No	2	1.55%

[Table/Fig-1]: Demographic characteristics of measles cases (N=129).

District wise distribution of measles cases in the present study is shown in [Table/Fig-2]. Maximum number of measles cases in Telangana are from Hyderabad (86 cases) and Ranga Reddy district (20 cases). Clinical presentations of 129 measles cases in the present study is shown in [Table/Fig-3]. Fever 129 (100%) and maculopapular rash 128 (99.2%) were seen in almost all the cases. Among 129 study participants, 85 (65.9%) were unvaccinated with MCV1 and 89 (68.9%) remained unvaccinated with MCV2. Overall 85 (65.9%) children did not receive, even single dose of measles vaccine [Table/Fig-4].



[Table/Fig-2]: District-wise distribution of measles cases.

Clinical features	Number (n)	Percentage (%)
Maculopapular rash	128	99.2%
Fever	129	100%
Cough	115	89.1%
Coryza	102	79.1%
Conjunctivitis	76	58.9%
Joint pain	2	1.6%

[Table/Fig-3]: Clinical presentation of measles cases.

Vaccination status	Number (n)	Percentage (%)
Vaccinated	38	29.5%
Unvaccinated	85	65.9%
Unknown	6	4.7%
MCV1 coverage		
Vaccinated	38	29.5%
Unvaccinated	85	65.9%
Unknown	6	4.7%
MCV2 coverage		
Vaccinated	20	15.5%
Unvaccinated	89	68.9%
Unknown	20	15.5%
MCV coverage during SIAs		
Vaccinated	25	19.3%
Unvaccinated	55	42.6%
Unknown	49	37.9%

[Table/Fig-4]: Measles vaccination status.
Total number of Measles cases received atleast single dose of measles vaccine

Measles IgM ELISA was performed on blood samples of 129 clinically suspected measles cases. Test gave 5 (3.8%) equivocal and 3 (2.3%) negative results. This may be due to early sample collection before production of IgM antibodies in patients body [Table/Fig-5].

Result	Number (n)	Percentage (%)
Positive	121	93.7%
Equivocal	5	3.8%
Negative	3	2.3%

[Table/Fig-5]: Measles IgM ELISA Results.

DISCUSSION

Measles can affect the children under the age of five years most commonly. It is a highly infectious viral illness associated with fever and rash which may lead to serious complications like pneumonia and encephalitis, that may lead to death [8]. The transmission of Measles Virus (MeV) infection is mainly by aerosolised secretions found on upper respiratory tract mucosal surfaces. Although large proportions of the Measle disease cases are self-limiting still mortality rates are high [9]. Measles is persistently endemic in advanced, developing and underdeveloped countries in spite of the availability of vaccine for over many years [8]. In the year 2015, India accounted for over one-third of measles deaths and was included in the global campaign for elimination by the year 2020. Immunisation campaigns for all children aged nine months to 15 years and case-based surveillance are part of the elimination strategy [10]. Implementation of key strategies like sensitisation of front-line workers, increasing search for active cases, reporting network expansion, rapid response to outbreaks and establishing harmonious linkages between measles elimination and other public health issues, such as health systems strengthening and emergency preparedness and response. Collaborations between the Governments, partners and the community at every level to clear immunity gaps is important. WHO-National Polio Surveillance Project teams have supported the Government of India in strengthening MR surveillance system and immunisation across states and union territories to attain and maintain high population immunity. This is pivotal for elimination. India has done it before. India will do it again [2].

In the present study, 68 children in the age group of 1-6 years were significantly affected by measles (52.71%) followed by infants 55 (42.63%) compared to older children. The findings were comparable with the studies by Husada D et al., and Kumari PL and Kutty AM [7,11] with 60% and 38.3% of measles-affected children highest between 1-6 years. In contrast, older children i.e, 6-12 years (44.8%) and infants (41.4%) were more commonly affected in Sindhu TG et al., study [10]. In this study, majority of cases were boys 76 (58.91%) which was in accordance with various other studies [8-10]. About 89% of measles cases in current study were urban population, it may be because in recent times people living in urban slum areas have increased rapidly and immunisation coverage and living conditions in poor urban communities are low compared to people living in rural areas. But, today even the occurrence of measles can be easily found in rural areas and with lower socio-economic class [11]. It is hypothesised that vitamin A deficiency is a risk factor for severe measles infection in children, so the administration of vitamin A reduces the risk of complications from measles [12]. In present study, 52.71% of children received vitamin A along with the measles vaccine. In comparison more children, around 84% received vitamin A in Husada D et al., study [7], implicating the need for improving the coverage of vitamin A in authors' area. Fever (100%), maculopapular rash (99.2%) are the most common clinical presentations of measles cases in the present study which is in accordance with the study by Husada D et al., [7]. In contrast, in Hırfanoglu T et al., cough (97.5%) and conjunctivitis (72.2%) were the most common clinical presentations in measles cases [13]. In a study, by Bhowmik E et al., the fever (38%) was found to be most common symptom followed by rashes [14].

Measles is endemic in many countries in spite of the availability of vaccine for over 60 years. Immunisation with two-dose of vaccine was introduced in India in 2010. The protection level varies from person to person and also the antibody levels decrease over time so immunisation with two doses will help in combating this problem. The important obstacle to the elimination of measles is suboptimal immunisation in both developing and developed countries, parental resistance to vaccination, doubts about the protective efficacy of the vaccine, problems with the cold chain or vaccine administration and movement of the people between endemic and non endemic places [8].

In present study, 38 (29.5%) measles cases received atleast a single dose of measles vaccine, 85 (65.9%) were unvaccinated and the vaccination history of 6 (4.7%) remains unknown. It is in accordance with Sowe A et al., study [15] in which more than half (53.6%) of the confirmed cases have unknown vaccination status, 24% of cases were vaccinated and in Husada D et al., study [7] majority of measles cases were unvaccinated 64 (85.3%). The second dose of measles vaccine (MCV2) coverage in the current study was very low (15.5%). The MCV2 increases immunity in children who have not received MCV1 and protect those who did not seroconvert after the first dose. In studies of revaccination among preschool children, who did not develop immunity after the first dose, nearly 95% of them were found to develop protective immunity after the second dose. Two-dose vaccination coverage is most important to prevent measles transmission [16]. MCV coverage during SIAs in the present study, was only 19.3% approximately. Though, measles vaccine coverage by SIA can attain higher coverage than routine immunisation, countries with weaker health systems have rarely approached the levels that would be needed to eliminate it. So, vaccination programs should be more frequently and effectively conducted to improve vaccine coverage [17].

In the present study IgM ELISA was performed on blood samples of 129 suspected measles cases, 121 (93.7%) cases were positive for IgM, 5 (3.8%) gave equivocal results and 3 (2.3%) were negative for IgM. According to WHO, 30% of measles cases may show anti-measles IgM test results negative if the blood tests were performed, as early as the third day since the first symptom appeared because IgM antibodies may have not been established by that time. If the blood tests were performed later that is, when the samples were taken on the seventh day of illness, all cases (100%) showed positive results [7].

Limitation(s)

The day of blood sample collection for IgM antibody testing is very important for an accurate laboratory diagnosis of measles. Samples collected as early as third day, may give equivocal or false negative results, even in clinically evident measles cases.

CONCLUSION(S)

The study concluded that, low and ineffective vaccination coverage was the key factor that is hindering measles elimination. Proper implementations of immunisation programme and measles preventive strategies are essential to achieve the goal of measles elimination, at the earliest. Long-term follow-up studies are needed for getting insight into obstacles in the path of measles prevention and eradication.

Acknowledgement

Authors are thankful to Head of the Department of Paediatrics, Niloufer Hospital, and all the faculty, residents and laboratory personnel for their contribution in providing care to the patients involved in the study and for their help and inputs given for the present study.

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PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Paediatrics, Niloufer Hospital, Hyderabad, Telangana, India.
2. Assistant Professor, Department of Microbiology, Niloufer Hospital, Hyderabad, Telangana, India.
3. Professor and Head, Department of Paediatrics, Niloufer Hospital, Hyderabad, Telangana, India.
4. Postgraduate Student, Department of Paediatrics, Niloufer Hospital, Hyderabad, Telangana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Srividya Yeruva,
Flat No. 106, Jaganatha Residency, Besides Apollo Hospital, Hyderguda,
Hyderabad, Telangana, India.
E-mail: drsrividya84@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Sep12, 2022
- Manual Googling: Sep 23, 2022
- iThenticate Software: Nov 14, 2022 (22%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Aug 25, 2022**
Date of Peer Review: **Oct 06, 2022**
Date of Acceptance: **Nov 16, 2022**
Date of Publishing: **Dec 01, 2022**