



Recent Measles (Rubeola) Outbreak in India and its A typical Presentation

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Abstract

Background: Measles, one of the most infectious human diseases, can lead to severe illness, lifelong complications, and death. In 2021, measles claimed the lives of an estimated 128,000 people, predominantly children under the age of five. This translates to approximately 350 measles-related deaths each day or more than 14 deaths every hour.

Methodology: The study included all reported cases of measles in children under 15 years old throughout the study period. Measles diagnosis relied on clinical symptoms such as fever, maculopapular rash, cough, coryza, and conjunctivitis. Complicated cases were admitted, treated appropriately, and their outcomes were recorded.

Results: From January 2022 to March 2023, a total of 230 measles cases were recorded at the Department of Pediatrics, JNMCH. Among them, 160 (69.56%) were male, and 70 (30.43%) were female. Out of the total cases, 70 (30.43%) were children under 10 months, 110 (47.82%)

were aged between 10-60 months, and 50 (21.3%) were between 60-156 months. Regarding measles vaccination, only 90 (39.13%) cases had received both doses, while 90 (39.13%) had received only one dose, and 50 (21.3%) had not received any dose. Measles-associated complications were observed, with pneumonia being the most frequent complication, affecting 110 (47.82%) cases. Other complications included hepatitis-30 (13.14%), acute gastroenteritis-30 (13.14%), pharyngitis and nasopharyngitis-40 (17.39%), meningoencephalitis-10 (4.34%), and acute renal failure-10 (4.34%). Additionally, 20 children (8.69%) suffered from severe acute malnutrition, and 20 (8.69%) of the total measles cases resulted in death, primarily due to pneumonia and acute renal failure.

Conclusion: Measles remains a significant problem in remote, impoverished regions with low vaccination rates, especially among rural and nomadic communities. Complications are more likely to occur in measles patients who have inadequate immunization and suffer from malnutrition. In this study about 30% of affected children are below 10 months of age, significant portion of children were having hepatic and renal complication and approximately 40 % of affected children had received 2 doses of measles vaccine.

Keywords- Measles, Rubeola, Pediatric, Vaccination, Complications

Introduction-

Measles, commonly known as rubeola, is an acute febrile viral infection that may be prevented and is very infectious. Particularly on the continents of Africa and Southeast Asia, it continues to be a major source of mortality and morbidity worldwide. Despite the existence of a reliable vaccination, it causes over 100,000 fatalities yearly. (1) It is also known as 10-day measles or red measles. (2) In 2021 measles still killed an estimated 1,28,000 people – mostly children less than five years of age. That means approximately 350 dies from measles related complications each day, or more than 14 deaths every hour. (3) Measles is a viral disease that affects people all over the world and is extremely contagious. The measles virus (MV), which is the disease-causing agent, belongs to the genus Morbillivirus in the family Paramyxoviridae and spreads by respiratory route. (4) The infection is characterized by a temperature ($>104^{\circ}$ Fahrenheit), malaise, cough, coryza, and conjunctivitis, followed by exanthem. 90% of those who are susceptible will get the disease after exposure. According to estimates, the contagious period lasts from 5 days before the rash appears to 4 days after. (5) A primary cause of death, particularly among children ≤ 5 years of age, measles is still present across the world. Because of disparate surveillance methods and possible underreporting, it is challenging to acquire precise estimates of the global occurrence.

Over two million people died each year from measles before the vaccination was developed. Beginning in the 1960s, the measles vaccine became widely available, which immediately decreased related death rates and changed the global distribution of the illness. (6) The measles virus is extremely contagious and spreads through direct contact with infected respiratory secretions or by coughing aerosols. The range of clinical signs and consequences associated with measles virus infection may be explained by the measles virus spreading due to viremia and the concomitant infection of endothelium, epithelial, monocyte, and macrophage cells. The disease starts with a prodromal phase of fever, cough, and coryza after an incubation period of almost 2 weeks. Patients may have an enanthem that lasts for roughly 48 hours and is characterized by Koplik spots, which are 1-3 mm whitish, greyish, or bluish

elevations with an erythematous base that are commonly found on the buccal mucosa on the side opposite the molar teeth. The measles exanthem appears 2-4 days after the onset of fever and is characterized by an erythematous, maculopapular, blanching rash that classically starts on the face and progresses cephalocaudally and centrifugally to affect the neck, upper trunk, lower trunk, and limbs. The exanthematous phase also exhibits lymphadenopathy, high fever (peaking 2-3 days after the rash first appears), significant respiratory symptoms, including pharyngitis, and nonpurulent conjunctivitis. (7) Measles is linked to a brief but severe immunosuppression that makes people more vulnerable to opportunistic infections. This frequently causes problems such subacute sclerosing panencephalitis (SSPE), acute disseminated encephalomyelitis (ADEM), keratitis, pericarditis, and otitis media. During a measles infection, thrombocytopenia, leukopenia, and T cell cytopenia may be seen. (8) Radiography of the chest may show interstitial pneumonitis. Reticuloendothelial giant cells may be visible in lymphoid tissue biopsy samples taken prior to the development of the exanthem. (9) Measles IgG antibody levels significantly increased between acute and convalescent titers, and a serum IgM antibody test for the disease was positive. Measles virus isolation in culture or reverse transcription polymerase chain reaction (RT-PCR) detection of measles virus RNA may show large cells with inclusions. (10) There is no specific antiviral medicine that has been approved for the management of measles; instead, supportive care is used. Ribavirin has, however, been the subject of trials. In SSPE, isoprinosine has been employed. Vitamin A can be useful in some circumstances. Antipyretics, fluids, and the management of bacterial superinfections like bacterial pneumonia and otitis media are all part of supportive care. Treatment for further problems, such as seizures and respiratory failure, might also be required. (11) Scientists warn that India is likely to miss its goal of eradicating the illness by 2023 as public health officials scramble to contain a measles outbreak in the country. According to the World Health Organization, India has 12,773 cases of measles this year as of November, making it the country with the greatest outbreak in 2022. (12)

We conducted this study in the Department of Pediatrics, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, to learn more about the measles' unusual presentation, immunization coverage, complications, and mortality among pediatrics cases of the disease.

Methods: The study was conducted at the Department of Pediatrics, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, from January 2022 to March 2023. All pediatrics cases of measles reported at the hospital during the study period were included. Measles diagnosis was made by pediatricians based on detailed history, examination, and the presence of fever (101°F or higher), maculopapular rash, along with cough, coryza, and conjunctivitis. Cases with complications were admitted and treated accordingly. Pneumonia was diagnosed following the guidelines of the World Health Organization (WHO) and radiological evidence of pulmonary involvement. Involvement of the central nervous system was determined if the child exhibited irritability, lethargy, decreased consciousness, seizures, or any neurological deficits. Increased liver enzymes, more than double the normal values, were considered indicative of liver involvement. Serum creatinine levels were systematically assessed to rule out acute renal failure. Nasopharyngitis was diagnosed based on symptoms such as runny nose, sneezing, headache, and fatigue, accompanied by fever or high fever. Pharyngitis was diagnosed by the presence of a red throat, swollen tonsils, white discharge, swollen lymph nodes, and fever above 38.5 degrees Celsius. Corneal xerophthalmia was

diagnosed by the appearance of triangular patches of foam, whitish, opaque deposits typically near the limbus of the bulbar conjunctiva. Nutrition status was assessed and categorized as mild, moderate, or severely malnourished based on National Centre for Health Statistics (NCHS) charts. Demographic data, vaccination status, contact history, nutrition status, clinical presentation, complications, and laboratory findings, including Complete Blood Count (CBC), Renal Function Test (RFT), Liver Function Test (LFT), Arterial Blood Gas Analysis (ABG), Serum Electrolytes, Oxygen Saturation (O₂), and Chest X-ray were recorded. Supportive treatment was provided according to the situation, and outcomes were documented.

Result:

A total of 230 measles cases were recorded at the Department of Pediatrics at JNMCH from January 2022 to March 2023. Among the cases, there were 160 (69.56%) males and 70 (30.43%) females. Approximately 70 (30.43%) children were under 10 months old, 110 (47.22%) were between 10 and 60 months old, and 50 (21.73%) were between 60 and 156 months old. The reported measles cases came from both urban and rural areas, with 180 (78.26%) cases originating from rural areas and 50 (21.73%) cases from urban areas. Out of the 230 cases, only 90 (39.13%) had received both doses of measles vaccination, while the remaining 90 (39.13%) were partially vaccinated with only one dose, and 50 (21.73%) had not received any dose. The parents or guardians were interviewed to understand the reasons for not vaccinating, and their responses indicated a lack of information and ignorance. Among the cases, 30 (13.04%) had a history of contact with measles-infected individuals. Malnutrition reduces individuals' immunity and increases mortality. In our study, 20 (8.69%) children had severe acute malnutrition, 80 (34.8%) had moderate acute malnutrition, 70 (30.43%) had mild malnutrition, and 60 (26.08%) had no malnutrition. The majority of cases experienced fever for 5 days (120 cases, 52.17%), followed by 90 cases (33.93%) with fever lasting 8-10 days, and 20 cases (8.69%) with fever persisting for up to 15 days. Rashes appeared on the first day in 60 cases (26.08%), the second day in 40 cases (17.39%), the third day in 50 cases (21.73%), the fourth day in 40 cases (17.39%), the fifth day in 20 cases (8.69%), and the eighth day in 20 cases (8.69%).

Table 1. Characteristics of Measles cases

Characteristics	Cases (N=230)	Percentage
Gender-		
Male	160	69.56%
Female	70	30.43%

Age-		
<10 months	70	30.43%
10-60 months	110	47.82%
60-156 months	50	21.73%
Residence-		
Urban	50	21.73%
Rural	180	78.26%
Vaccination status-		
Fully vaccinated	90	39.13%
Partially vaccinated	90	39.13%
Unvaccinated	50	21.73%
History of contact-		
Present	30	13.04%
Absent	200	86.95%
Nutrition status-		
Severe acute malnutrition (SAM)	20	8.69%
Moderate acute malnutrition (MAM)	80	34.78%
Mild malnutrition	70	30.43%
Healthy	60	26.08%
Duration of fever-		
Last for 5 days	120	52.17%
Last for 8-10 days	90	39.13%
Upto 15 days	20	8.69%
Appearance of rashes-		
On 1 st day	60	26.08%
On 2 nd day	40	17.39%
On 3 rd day	50	21.73%
On 4 th day	40	17.39%
On 5 th day	20	8.69%
Seen upto 8 th day	20	8.69%

After reviewing the laboratory findings, it was observed that 100 (43.47%) cases had hemoglobin (HB) concentrations below the normal reference range, and 100 (43.47%) cases had slightly elevated total leukocyte counts. The differential leukocyte count was within the normal limit. Renal function tests (RFT) were abnormal in 120 (52.17%) cases, with increased serum creatinine levels detected in 60 (26.08%) cases. In liver function tests (LFT), direct bilirubin was slightly elevated in 170 (73.91%) cases, while indirect bilirubin remained within the normal limit. Aspartate aminotransferase (AST) levels were doubled in 140 (60.08%) cases, alanine transaminase (ALT) was slightly elevated in 40 (17.39%) cases, and alkaline phosphatase (ALP) was within the normal limit. The Glasgow Coma Scale showed a normal score of 15. Arterial blood gas analysis (ABG) parameters, including pH, p(O₂), and p(CO₂),

were all within the normal range. Electrolyte levels, including sodium (Na), potassium (K), and calcium (Ca), were within normal values. Chest X-rays (PA view) revealed extensive patchy consolidation in 20 (8.69%) cases, diffuse interstitial infiltrates in 60 (26.06%) cases, peripheral infiltration in 30 (13.04%) cases, and normal findings in 80 (34.78%) cases. Oxygen saturation was below 90 in 20 (8.69%) cases, below 95 in 80 (34.78%) cases, and within the normal range in the remaining 60 patients. Decreased oxygen saturation was primarily corrected by using nasal prongs to reach an adequate level.

Complications of measles were more common in inadequately vaccinated and malnourished children. The most frequent complication observed was pneumonia, which occurred in 110 (47.82%) cases, followed by hepatitis in 30 (13.14%) cases, acute gastroenteritis in 30 (13.14%) cases, pharyngitis and nasopharyngitis in 40 (17.39%) cases, meningoencephalitis in 10 (4.34%) cases, acute renal failure in 10 (4.34%) cases.

Table-2, Complications of measles

Complications	Cases (N=230)	Percentage
Pneumonia	110	47.82%
Hepatitis	30	13.14%
Acute gastroenteritis	30	13.14%
Pharyngitis, Nasopharyngitis	40	17.39%
Meningoencephalitis	10	4.34%
Acute renal failure	10	4.34%

Treatment included intravenous fluids (IVF) and antibiotics such as Augmentin, Ceftriaxone, Meropenam, Vancomycin, Amikacin, and Cefotaxime. The outcomes of the treatment were recorded. Out of the total 230 measles cases, 10 (4.34%) resulted in fatalities due to complications, primarily pneumonia and acute renal failure. Additionally, 20 (8.69%) cases were lost to follow-up, while the remaining 200 (86.95%) cases were discharged.

Discussion:

Measles is a highly contagious infection with significant morbidity and mortality. Prior to the introduction of the measles vaccine in 1963 and widespread vaccination, major epidemics occurred approximately every 2-3 years, resulting in an estimated 2.6 million deaths each year. India has experienced the recent world's largest outbreak of measles, with 172 confirmed outbreaks and a total of 12,589 cases reported from October 2021 to September 2022 (4).

Various studies have shown that females are more prone to measles. In a study conducted at a tertiary healthcare center involving 254 patients, it was observed that there was a preponderance of female children (54.02%) compared to male children, as reported by Anant Ganpath Bendale, Rajendra Namdeo Patil et al. (19). However, in our study, the majority of cases were males (69.56%) compared to females (30.43%).

According to the CDC, measles is more likely to occur in children up to 5 years of age and in

adults over 20 years old (5). Generally, measles is not commonly seen in children under 9 months of age. However, in our study, 30.43% of the cases were below the age of 10 months, which is uncommon. The majority of cases were in the age group of 10-60 months (47.82%), followed by 21.73% of cases in the 60–156-month age range.

In our study, the majority of cases belonged to rural areas (78.26%). Despite the availability of safe and effective measles vaccines and government efforts to accelerate immunization activities, there are still many children who are either partially vaccinated or unvaccinated. In our study, an equal number of cases were fully vaccinated (39.13%) and partially vaccinated (39.13%), while 21.73% of the cases were unvaccinated. A history of contact with measles was present in 13.04% of the cases.

Malnutrition decreases the immunity of the individual and enhances mortality. In our study mostly the cases were of moderate acute malnutrition (MAM) with 34.78% of the total cases followed by mild malnutrition -26.08% and severe acute malnutrition (SAM)- 8.69%. The first symptom of measles is usually high fever which begins about 10-12 days after exposure to the virus and lasts for 4-7 days. (2) In our study fever lasts for 5 days in 52.17% cases, 8-10 days in 39.13% of cases and upto 15 days in 8.69% of the cases. After several days, a rash erupts, usually on the face and upper neck. Over about 3 days, the rash spreads, eventually reaching the hands and feet. The rash lasts for 5-6 days, and the fades. On average, the rash occurs 14 days after exposure to the virus. (3) In our study rash developed on the very first day of fever in 26.08% of the cases followed by 17.39%, 21.73%, 17.39%, 8.69%, 8.69% on 2nd, 3rd, 4th, 5th and upto 8th day respectively. After viewing the laboratory findings hemoglobin concentration less than reference normal range seen in 43.47% cases, total leukocyte counts slightly raised in 43.47% cases, differential leukocyte count is with in normal limit. Renal function test (RFT) deranged in 52.17% cases and increased serum creatinine level seen in 26.08%. In liver function test (LFT) direct bilirubin slightly raised in 73.91% cases and indirect bilirubin with in normal limit. Aspartate aminotransferase (AST) raised by double in 60.08% cases, alanine transaminase (ALT) slightly raised in 17.39% cases and alkaline phosphatase (ALP) is within normal limit. Glasgow coma scale having normal score of 15. In arterial blood gas analysis (ABG) pH, p(O₂), p(CO₂) are all with in normal limit. Electrolyte include sodium (Na), potassium (K), Calcium (Ca) having normal values. X-ray chest (PA view) showed extensive patchy consolidation in 8.69% cases, diffuse interstitial infiltrates in 26.06% cases, peripheral infiltration in 13.04% cases and in 34.78% chest X-ray was with in normal limit. Oxygen saturation below 90 in 8.69%cases, below 95 in 34.78% cases and rest 60 patient having oxygen saturation with in normal range. Decreased Oxygen saturation was corrected by mainly through nasal prongs to reach up-to the adequate level. Regarding the complications of measles ear infection and diarrhea are common complications reported in about one out of every 10 children. Pneumonia and encephalitis, are the severe complications. And subacute sclerosing panencephalitis (SSPE) is a very rare, but fatal disease develops 7-10 years after a person has measles. (20) In our study Pneumonia was the most frequent complication seen in 110 (47.82%) cases, followed by hepatitis-30 (13.14%), acute gastroenteritis-30 (13.14%), pharyngitis and nasopharyngitis- 40 (17.39%), meningoencephalitis -10 (4.34%), acute renal failure-10(4.34%). 10(4.34%) of the 230 total cases with measles died from complications, primarily pneumonia and acute renal failure. 20(8.69%) cases were lost to follow up. Rest 200(86.95%) discharged.

Conclusion: In remote areas with inadequate vaccination, particularly in rural regions, measles remains a serious issue. Insufficient measles immunization and malnutrition increase the risk of complications (morbidity and mortality) in measles patients. Our study revealed atypical presentations related to age and comorbidities. Although measles is typically rare in children younger than 9 months old and more common in children up to 5 years old, as well as in adults over 20 years old, we found that 70 (30.43%) of the cases in our study involved infants under 10 months old, which is considered uncommon. In terms of measles consequences, ear infections, and diarrhea affect approximately 1 in 10 children. However, more severe complications include encephalitis and pneumonitis. Additionally, approximately 7-10 years after a measles infection, a person may develop subacute sclerosing panencephalitis (SSPE), an extremely rare but fatal disease.

However, our study observed unusual complications, including 30 (13.14%) cases of hepatitis, 30 (13.14%) cases of acute gastroenteritis, 40 (17.39%) cases of pharyngitis and nasopharyngitis, 10 (4.34%) cases of meningoencephalitis, and 10 (4.34%) cases of acute renal failure. These complications differ from the typical ones that occur.

Conflict of interest- There is no conflict of interest.

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