Evaluation of Vulnerable age Group of Measles and its Outcome in Under Five Children

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Abstract:

***Background**: Measles continues to be a major public health problem worldwide, with a high mortality and morbidity. Unvaccinated young children are at highest risk of measles and its complication including death.*

***Objectives:** To assess the vulnerable age group of children for measles under five years of age and also to evaluate the demographic profile, common clinical complication, seasonal variation and outcome of measles among children of Bangladesh.*

***Materials and Methods:** This Retrospective observational study was done in the Infectious disease's hospital, Dhaka during the period of July 2018 to June 2019.The data, were collected, compiled and analyzed.*

***Result**: During the study period, a total of 74 confirmed measles cases were selected. Among them, 0-<6-month age group were 21.62%, 6 months to <9 months were 40.54%, 9 months to <15 months were 9.46% and 15 months to <60 months were 28.38%. Highest number of measles cases were admitted in February (14.9%), March (16.2%) and April (14.9%) which are mainly the spring and early summer and lowest in winter. Most common complications of measles were pneumonia and diarrhea.*

***Conclusion:** Children below nine month of age who did not reach the vaccination age were found most vulnerable for measles. Occurrence of measles found predominantly in spring and early summer. Pneumonia and diarrhea are the common complications.*

***Key words**: Measles, under 5 children, vulnerable age group, vaccination status, seasonal variation, complication, outcome.*

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Introduction:

Measles is a highly contagious, serious disease caused by measles virus. More than 140,000 people died from measles in 2018- mostly children under the age of 5 years, despite the availability of a safe and effective vaccine.[1] Abu Bakr Muhammad ibn Zakariya Al-Razi (860-932) or Rhazes– a Persian philosopher and physician, in the 10th century A.D. described measles as a disease that is "more dreaded than smallpox."[2] Virus is spread by coughing and sneezing, close personal contact or direct contact with infected nasal or throat secretions and it remains active and contagious in the air or on infected surfaces for up to two hours.[3] Characteristic findings of measles are the presence of high fever, enanthem, cough, coryza, conjunctivitis, and a prominent exanthema. Common complications of measles are pneumonia, bronchiolitis, diarrhea, acute otitis media, febrile seizure, measles encephalitis, tuberculosis. Morbidity and mortality from measles are greatest in individuals younger than 5 years of age (especially <1 yr. of age).[4] According to WHO estimation during 2000-2018, immunization against measles alone saved around 23 million lives, resulted in a 73% drop in measles death. By November 2019, case numbers had tripled compared with the same period in the previous year.[5] A study in Uganda in 1999-2001showed that 64% of all measles cases were among children <5 years of age.[6] Unvaccinated young children are at highest risk of measles and its complications, including death.[1] Infants in different

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countries who are too young to receive MCV1 (first measles containing vaccine) as recommended by their national immunization schedule remain at high risk of contacting measles.[7-9] A surveillance study suggested that between 2013 and 2017, 12% of all measles cases reported to the WHO were infants who were too young to be vaccinated.[7] Vaccinating young infants with a MCV between 6 and 9 months of age could reduce measles-related morbidity and mortality, and is recommended in high-risk areas, such as those with measles outbreaks.[10] Though vaccination program against measles is successfully ongoing in Bangladesh and Estimated coverage with the first MCV dose (MCV1) increased from 74% in 2000 to 94% in 2016.[11] In 2019, 11633 suspected measles cases were reported officially of which fifteen percent(15%) were under nine month of age.[12] The current immunization schedule in Bangladesh recommends a routine first dose of measles vaccine at complete of nine months.[13] So a large number of children below 9 month are remaining outside of vaccine coverage make them vulnerable to measles. The aim of the study was to assess the vulnerable age group of children for measles under five years of age and also to evaluate the demographic profile, common clinical complication, seasonal variation and outcome of measles.

Material and methods:

This retrospective observational study was done in the Infectious disease's hospital, Dhaka during the period of July 2018 to June 2019. The measles cases were searched for and were identified from the hospital records. This study included all confirmed measles cases of under five years of age who admitted in the hospital during the study period. Confirmed measles case was defined when a case that meets the case definition and has laboratory confirmation of measles infection (measles specific Ig M) and/or isolation of virus in a clinical sample by WHO accredited national laboratory.[12] Suspected measles case was defined when a person presenting with acute febrile illness accompanied by rash and anyone of the following three symptoms - cough, coryza and conjunctivitis.[12] For the laboratory confirmation of presence of measles-specific IgM antibodies and/or isolation of virus, blood sample and/or urine/ naso-pharyngeal swab of suspected measles cases were sent and tested in the laboratory of IPH, Dhaka with collaboration of WHO and results were documented. The individual case notes of all confirmed measles cases of under five years were studied. Demographic profile, date of admission and discharge, clinical features, co-morbidity, complication and outcome were noted on a standard case record form. Ethical permission was taken from local ethical committee along with consent of parent or caregiver of the study children.

Results:

A total of 74 confirmed measles cases of under five years were admitted in the hospital during the study period. Out of 74 patients, highest number of patients were 6 months to <9 months age group 30(40.54%), lowest number were 9 months to <15 months age group 7(9.46%) and 15 months to <60 months age group were 21(28.38). Male-female ratio of the patients was almost equal (52.7% vs 47.3%). Maximum number of patients 65 (87.8%) were from urban area (Table-I). Regarding vaccination status, majority of the patients (46, 62.16%) were below 9 months of age and were not reached the vaccination age. Seven (9.46%) cases were 9 months to below 15 months age group, among which 3(4.05%) cases were vaccinated and 4(5.41%) cases were un-vaccinated. 21 (28.38%) cases were 15 months to 5 years age group of which 6(8.11%) patients were vaccinated and 15(20.27%) were un-vaccinated (Figure-1). All measles cases who were admitted in hospital had at least one or more complications of measles or comorbidity. Most common complications were pneumonia (78.37%), then Diarrhoea18(24.3%), mouth ulcer/ glossitis 15 (20.3%), purulent discharge from eye 14(18.9%), discharge from ear 2(2.7%), convulsion/ encephalitis 3(4.05%). Other complications were 11(14.9%) (Table-II). Malnutrition was the common co-existing morbidity (12.16%). Other co-morbidity were congenital heart diseases (6.76%), childhood asthma (5.42%), Mumps (2.7%) (Table-III). Measles cases were admitted all over the year. Highest number of measles cases were admitted in February (14.9%), March (16.2%) and April (14.9%) which are mainly the spring and early summer. Lowest numbers of the patients were admitted in December-January which is winter season and June-July- August which is Monsoon in Bangladesh (Figure-2). Death rate was 1.35 % (1/74) of the complicated measles cases (Table-IV).

Table I

Demographic profile of the study patients (n=74)

Demographic profile	No. of patients (%)
Age in month	
0 - <6 months	16 (21.62)
6 months - <9 months	30 (40.54)
9 months - <15 months	7 (9.46)
15 months - <60 months	21 (28.38)
Gender	
Male	39 (52.7)
Female	35 (47.3)
Residence	
Urban	65 (87.8)
Rural	9 (12.2)

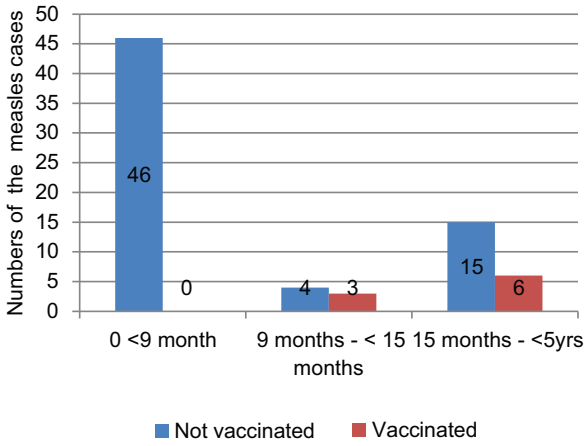

Figure-1. *Distribution of the confirmed measles cases according age and vaccination status.*

Table II

Complications of measles of hospital admitted patients (n=74)

Complications	No. of patients (%)
Pneumonia	58 (78.37%)
Diarrhoea	18 (24.3%)
Mouth ulcer/Glossitis	15 (20.3%)
Purulent discharge from eye	14 (18.9%)
Discharge from ear	2 (2.7%)
Convulsion/ Encephalitis	3 (4.05%)
Others	11 (14.9%)

Table III

Co-morbidity of the study patients (n=74)

Co-morbidity	Number of patients
Malnutrition	9 (12.16%)
Childhood asthma	4 (5.42%)
Mumps	2 (2.70%)
ASD	2 (2.70%)
VSD11.4	1 (1.35%)
PDA	1 (1.35%)
Patent foramen ovale1	1 (1.35%)

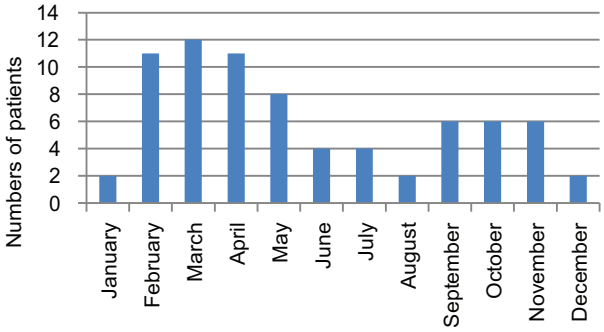

Figure-2: *Seasonal variation of the study patients*

Table IV

Distribution of the study patients by outcome (n=74)

Outcome	Number of patients (%)
Improved and discharged	67(90.55)
Discharged on request/referred	6(8.1)
Death	1(1.35)

Discussion:

Although during recent years, there has been a significant reduction in the incidence rate of measles infection,[14] the world experienced a measles resurgence in 2018 and 2019, resulting in significant numbers of cases and deaths, and reversing the gains made towards regional elimination goals.[15] Unvaccinated young children are at highest risk of measles and its complication including death.[1] An analysis of the epidemiology of measles in infants younger than 6 months was conducted by the U.S. CDC and WHO using case-based measles surveillance data from 2011 to 2016. It showed that Out of a total of 390,522 confirmed measles cases of all ages, 16,953 (4.3%) were among infants <6 months. Age-specific incidence was highest among 6-8

months-olds, followed by 9-11-month-olds.[16] Our study among <5 years old children showed, out of 74 confirmed measles cases, highest number of cases (30, 40.45%) were in 6-<9 months age group and 21.62% were in <6 months age group.[16] After 9 months of age when vaccine introduced, measles incidence was reduced. To reduce the incidence of measles and associated deaths and to achieve regional elimination goal, the Government of Bangladesh has adopted various strategies include achieving high coverage with the first dose of the measles vaccine; intensive surveillance appropriate case management; and implementation of catch-up measles vaccination campaigns (including administration of vitamin A) for children aged 9 months to 10 years. Children below 9-month age are remaining outside of vaccine coverage. In the year 2019 and 2020, fifteen percent (15%) of the total measles cases were among under 9 months age group in Bangladesh.[12] Hence, the exact age of children when measles vaccine should be introduced is debatable among most developed nations, where measles-related morbidity/mortality is rare in infants; these nations prefer an older age (12–15 months) for vaccination, so that any interference from maternal antibodies can be neutralized.[17] The national institute for public health and environment, Netherlands conducted a systematic literature review of the immunogenicity, effectiveness and safety of measles vaccination among < 9 months of age in 2015. It was suggested that administering MCV1 to infants younger than 9 months of age is immunogenic, effective and safe. Although humoral immunogenicity among<9 months is somewhat lower than >9 months age group. Meta-analysis also suggested that administering MCV1 to infants younger than 9 months followed by additional MCV doses (1 or 2) results in high seropositivity, vaccine effectiveness, and T-cell responses, which are independent of the age at MCV1, supporting the vaccination of very young infants in high-risk settings.[18,19] Based on this meta-analysis and other evidence, SAGE working group on Measles and Rubella (WHO)has concluded that countries are experiencing measles outbreaks with high incidence in children younger than 9 months of age, an age group in which measles can be severe. They recommended that in the following situations, a supplementary dose of MCV should be given to infants from 6 months of age: 1. during a measles outbreak; 2. during campaigns in settings where the risk of measles among infants <9 months of age remains high; 3. for internally displaced populations and refugees; 4. for individual infants at high risk of contracting measles; 5. for infants known to be HIV-infected or exposed. MCV administered before 9 months of age should therefore be considered a supplementary dose and recorded on the child's vaccination record as "MCV0" unless the country has data showing high seroconversion when vaccination is carried out before 9 months of age.[20] In a study in Ethiopia showed, most of the measles cases were in country side.[21] But in our study, most of the patients (65, 87.8%) were from urban area. One of the probabilities of this, the hospital is situated in Dhaka city which is a densely populated city especially slum area where health hygiene is poor and possibility of measles virus transmission is high.

A study in Merseyside, England showed that among confirmed measles cases, 23% were under one year of age who were too young to be vaccinated. Above 12 months of age group of confirmed cases, 16% of patient got one doze of vaccine and 3.34% of patients got two dozes vaccine.[22] Another study in Messina, Italy showed that 95% of measles cases were not vaccinated. In our study among under 5 years age group, 46 (62.16%) patients were under nine month of age who were too young to be vaccinated. Nine (12.16%) patients were vaccinated who were above 9 months of age.[23] Measles is seen in every country in the world and maintain their pandemic role through the very high infectivity and prolonged prodromal phase with a long period of preclinical viral shedding. Annual measles outbreaks typically occur in late winter and early spring in temperate climates.[24] In Ethiopia, seasonal pattern of occurrence of measles has been observed over the years, with increased number of measles cases during the late-early part of the year (December to February).[21] Another study in Baltimore showed, the peak incidence varied between January and May and the minimum incidence between August and October.[25] In our study, Measles cases were admitted in all over the year. Highest numbers of case were found in spring and early summer. Lowest number of cases was found in winter and Monsoon.

Measles is an important cause of serious complications and death. Pneumonia is the most

frequent severe complication, and croup, diarrhea, and malnutrition precipitated by measles contribute to mortality.[26] Unvaccinated young children are at highest risk of measles and its complications.[1] The risk of death among patients is usually 0.2%, but it can rise to 10% in those with malnutrition and other immunodeficiency disorders.[14] A study in Kenya showed, the overall case fatality rate for children below 5 years was 12.6% and among children below 9 months, 24%.[27] Our study was conducted among the hospital admitted measles cases and all of them had complications. Among the study patients, one (1.35%) patient died due to severe pneumonia with malnutrition. This study was done in one center with a small number of samples. A Multicenter large-scale study may be done to evaluate the situation of the country.

Conclusion:

Measles is a highly contagious, serious but vaccine preventable disease. Children below nine months age who did not reach the vaccination age for measles are most vulnerable for measles. Peak seasons for measles are spring and early summer. Although Pneumonia and diarrhea are the common complications, encephalitis and death also occur.

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