

Frequency and Distribution of Viruses Causing Acute Lower Respiratory Tract Infection Among Under-Five Children in Dhaka City

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Abstract: Acute lower respiratory tract infection is a common disease among the under five children. The purpose of the present study was to see the frequency and distribution of viruses causing acute lower respiratory tract infection among under-five children. This cross-sectional study was conducted in the Department of Virology at Bangabandhu Sheikh Mujib Medical University, Dhaka from July 2002 to June 2003 for a period of one year. The children with the age group of below five (5) years presented with the clinical manifestations of acute lower respiratory tract infection (ALRI) who were visited or were admitted to Dhaka Medical College Hospital (DMCH), Dhaka were selected as the study population. Nasopharyngeal aspirates were collected. Viruses were detected by cell line culture and direct immunofluorescence method. The study was carried out among 100 children aged from newborn to 60 months with acute lower respiratory tract infection (ALRI). The highest rate (47.6%) of isolation was obtained among children between 0 to 5 months of age followed by 6 to 12 months of age group (23.80%). There was a significant reduction in the number of cases in older children in 25 to 60 months of age group. Out of 57 patients, 12 were positive for respiratory viruses in the case of a male, while 43 of specimens from a female, 9 were positive. The most common virus isolated from the under-five children was a respiratory syncytial virus which was 20(95.2%). Adenovirus was isolated in only 1(4.8%) case. No other viruses were found in this study. In conclusion, the most common virus isolated from the under-five children is respiratory syncytial virus. Adenovirus is also found.

Keywords: Viruses, Acute Lower Respiratory Tract Infection, Under Five Children

1. Introduction

Acute respiratory tract infection is an important reason of death among children throughout the world. It is one of the leading causes of morbidity and mortality among children in low-income countries [1]. An estimated 6.5 million children below 5 years of age die each year due to acute respiratory tract infections [1]. The majority of deaths due to respiratory

tract infections are caused by acute lower respiratory tract infection (ALRI) [2]. It has been estimated that four million children in developing countries die each year from pneumonia [3]. In rural areas of Bangladesh, a child below 5 years experiences two to three episodes of ALRI each year. ALRI is also the principal cause of hospitalization among children in both urban and rural areas [4]. It has been estimated that ARI is a major cause of death among children

aged <5 years where approximately 50,000 children annually die from pneumonia in Bangladesh [5]. ARI and pneumonia accounted for hospitalization of 40% of 17,815 children aged <5 years during 1997–2001 at five primary level public health care facilities in rural Bangladesh [6].

Most of the known risk factors for pneumonia such as malnutrition, low birth weight, poor air quality, lack of exclusive breastfeeding and crowding are prevalent in Bangladesh [7]. Though the ARI burden is well recognized, there is limited information about the etiology-specific incidence of hospitalization for ARI from rural Bangladesh where 70% of the nation's population lives [8]. Respiratory viruses cause a variety of human infections, ranging from the common cold to life-threatening pneumonia. Over 200 strains of the virus can cause respiratory disease [9]. The majority of severe viral respiratory infections are caused by relatively few viruses, primarily parainfluenza virus types 1, 2 and 3, respiratory syncytial virus (RSV), influenza A and B viruses, and adenovirus [10].

A number of laboratory techniques can be used for the diagnosis of respiratory viruses but they differ in sensitivity, cost and time. Virus isolation in cell culture is sensitive and detects a broad spectrum of viruses [5]. Numerous rapid antigen detection systems which are very sensitive and specific are available for the diagnosis of respiratory tract infections [6]. The purpose of the present study was to see the frequency and distribution of viruses causing acute lower respiratory tract infection among under five children

2. Methodology

This cross-sectional study was conducted in the Department of Virology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from July 2002 to June 2003 for a period of one (01) year. Children of both sexes with the age group of under 5 years of age presented with the clinical manifestations of acute lower respiratory tract infection (ALRI) who were visited or were admitted to Dhaka Medical College Hospital (DMCH), Dhaka were enrolled in the study. Informed verbal consent was taken from the parents. A detailed history was recorded in a preformed questionnaire. Nasopharyngeal aspirates were collected from the pediatric in-patient and outpatient department of Dhaka Medical College Hospital (DMCH) Dhaka, Bangladesh. The laboratory works were performed in the department of Virology at BSMMU and the cell line culture of respiratory viruses was performed in the Institute of Public Health (IPH), Mohakhali, Dhaka. Children accepted for this study were <5 years old and had symptoms of a cough and one or more of the following: Respiratory rate more than 50/min, chest retraction, wheezing, stridor, cyanosis, rales, fever, inability to feed, history of illness less than 7 days. Isolation of respiratory viruses was performed by inoculation of the specimen in HEP-2 cell line and identification of respiratory viruses by direct fluorescence antibody technique. The numerical data obtained from the study were analyzed and significance of difference was estimated by using the statistical methods. Data were

expressed in percentage as applicable. Comparison between groups was done by Chi-square test. Probability less than 0.05 was considered as significant.

3. Results

The study was carried out among 100 children aged from newborn to 60 months with acute lower respiratory tract infection (ALRI). The highest rate (47.6%) of isolation was obtained among children between 0 to 5 months of age followed by 6 to 12 months of age group (23.80%). There was a significant reduction in the number of cases in older children in 25 to 60 months of age group. The difference between the rate of isolation of respiratory viruses in the 0 to 5 months age group and that in the age group 6 to 60 months was significant ($P < 0.05$). Viral infection was more common in 0 to 5 months of age group. χ^2 test done between (0-5) month and (6-60) months of age group. The χ^2 value was obtained from the test was 3.92, p -value = <0.05 , a result was statistically significant (Table 1).

Table 1. Distribution of Infected Children with Respiratory Viruses According to Their Age Group ($n=100$).

Age	Virus Culture		Total	P value
	Positive	Negative		
0 to 5 months	10(47.6%)	20(25.3%)	30(30.0%)	0.05
6 to 12 months	5 (23.8%)	28(35.4%)	33(33.0%)	
13 to 24 months	3 (14.3%)	12(15.2%)	15(15.0%)	
25 to 60 months	3(14.3%)	19(24.1%)	22(22.0%)	
Total	21(100.0%)	79(100.0%)	100(100.0%)	

*Chi-square test was performed corrected by Fisher's Exact Test.

Out of 57 patients, 12 were positive for respiratory viruses in the case of the male, while 43 of specimens from the female, 9 were positive (Table 2).

Table 2. Gender Distribution of infected children with respiratory viruses ($n=100$).

Gender	Virus Culture		Total	P value
	Positive	Negative		
Male	12(57.1%)	45(57.0%)	57(57.0%)	0.98
Female	9(42.9%)	34(43.0%)	43(43.0%)	
Total	21(100.0%)	79(100.0%)	100(100.0%)	

*Chi-square test was performed corrected by Fisher's Exact Test.

The most common virus isolated from the under-five children was the respiratory syncytial virus which was 20(95.2%). Adenovirus was isolated in only 1(4.8%) case. No other viruses were found in this study (Table 3).

Table 3. Distribution of Virus According To Clinical Manifestation ($n=21$).

Virus Name	Frequency	Percentage
RSV	20	95.2
Influenza virus	0	0.0
Parainfluenza virus	0	0.0
Adenovirus	1	4.8
Total	21	100.0

4. Discussion

Viral respiratory tract infections are the most common diseases affecting humans throughout the world. More than 5 million children under the age of 5 years' experience lower respiratory infections [11]. Respiratory syncytial virus (RSV), influenza A and B viruses and human parainfluenza virus (HPIV) type 1, 2 and 3 cause about 80% to 90% of viral LRIs [12]. Respiratory syncytial virus (RSV) is a leading cause of acute lower respiratory tract infections in infants and young children and is responsible for nearly 50% of all bronchiolitis and 25% of all pneumonia cases during early months of life. It occurs at a frequency of more than four times compared to other respiratory viruses [13].

A comparable rate of detection of respiratory viruses was reported from a study conducted in New Haven, USA, where respiratory viruses were detected in 367 (23.97%) out of 1531 children with LRTI [14]. Respiratory syncytial virus is the most frequent agent of acute lower respiratory tract disease in young infants. In the present study, RSV was responsible for the highest number of viral infections. Thus, among the total 21 respiratory viruses detected 20 (95.23%) were RSV. A finding was reported by Rahman *et al* [1] from a study conducted in Dhaka where they have detected 103(78.0%) RSV. Hijazi *et al* [15] also detected 168 (73%) RSV among the total 230 respiratory viruses isolated from children with LRTI, from a study in Kuwait. In the current study of 100 children of less than 5 years old, 78% were in 0 to 24 months age group. Viral infection was more common in this group than in the group of children aged 25 to 60 months. Thus among the 78 patients in the age group of 0 to 24 months, respiratory viruses were detected in 18(23.1%) while respiratory viruses were detected only in 3(13.6%) of 22 children who were aged 25 to 60 months. Similar observation was been reported in several studies [11, 12, 13]. They reported that the rates of viral shedding in children aged 0 to 24 months and 25 to 60 months were 24.5% and 12.5%, respectively. From the current study, it appeared that children aged 0 to 5 months were the most susceptible age group for ALRI. Thus among 30 children in this age group, 10(33.3%) had the respiratory virus infection. Nasreen *et al* [4] reported that highest rate of viral shedding occurred in 37(27.0%) among 137 infants of 0-5 months of age.

Children included in this study the proportion of boys and girls from whom respiratory virus was isolated or detected 21.05% and 20.9% respectively. There is no significant difference between boys and girls with respiratory tract infection nor there do any difference in virus isolation or detection. Studies conducted in children in a number of countries had shown a rate of detection of respiratory virus ranged from 19 to 51.9%. Forgie *et al* [16] reported 19.0% prevalence of the respiratory virus in rural children in Gambia. Rudan *et al* [5] reported 51.9% prevalence of the respiratory virus in Filipino children. Guerrier *et al* [17] reported 49.0% prevalence of the respiratory virus in Cambodian children and Feng *et al* [18] reported 29.0% prevalence from a study in children in China. In the present

study, the rate of respiratory virus isolation from children of acute respiratory tract infection was 21%. Thus it was evident that prevalence found in the present study was also within the range of prevalence from these studies. It is obvious that the RSV is the most commonly isolated virus and Hacimustafaoglu *et al* [19] have reported a similar result in Turkey. This study included only children who were brought to the hospital, the sample biased toward more severe cases of ALRI and was not representative of all cases in the community. The most important outcome of this study was the detection of viruses in children with ALRI.

5. Conclusion

In conclusion, the most common virus isolated from the under-five children is respiratory syncytial virus. Adenovirus is also found. No other viruses were found in this study. Influenza and parainfluenza virus are not detected in this study; however, these viruses are also responsible for ALRI.

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