

Viral Aetiology of Acute Respiratory Infections in Children in North India

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Summary

Two hundred and thirty children clinically diagnosed as suffering from acute respiratory infection were tested for four major groups of viral aetiological agents, i.e. influenza para-influenza, respiratory syncytial virus (RSV) and adenoviruses using indirect immunofluorescence technique. At least one of the respiratory viruses was identified in 51 (22 per cent) specimens, which included influenza A in 6 (3 per cent), influenza B in 3 (1 per cent), para-influenza type 1 in 3 (1 per cent), para-influenza type 3 in 13 (6 per cent), RSV in 11 (5 per cent) adenovirus in 12 (5 per cent), and dual virus infections in 3 (1 per cent) cases. Maximum number of virus identification was noted in children below 1 year of age, particularly infection with RSV followed by para-influenza and adenoviruses. Value of rapid diagnosis by indirect immunofluorescence technique is stressed.

Acute respiratory infection (ARI) is one of the major causes of morbidity and mortality in young children. About 2.2 million deaths due to ARI occur throughout the world every year. In developing countries the rates are considerably higher particularly during infancy and early childhood.¹ Acute respiratory illnesses are a heterogenous group of complex aetiologies and clinical manifestations.^{2,3} Viruses are associated with more than half of the acute respiratory illnesses in developed nations and 17–25 per cent of ARI, in developing countries.^{4,5}

In general, respiratory syncytial virus (RSV), para-influenza, influenza, adenoviruses, and mycoplasma pneumoniae are associated with 90 per cent cases of acute lower respiratory infections (ALRI).

There have been only few studies on the viral aetiology of ARI from India.^{6–11} Most of these studies have used virus isolation or serological evidence for virus infection which takes 3–7 days for virus isolation and needs convalescent sera for serological diagnosis. Indirect immunofluorescence assay (IFA) is a simple specific and sensitive method which can provide the laboratory confirmation of the virus on the same day.¹² We report viral aetiology in various ARI syndrome using IFA as a tool for rapid diagnosis.

Material and Methods

The study comprised 230 children presenting with ARI over a period of 11 months (February 1987 to

December 1987) who presented at the outpatient clinics and inpatient wards of the Department of Pediatrics, G.M. & Associated Hospitals. Children recruited into the study were between the age of 7 days and 5 years, and had presented within 7 days of onset of their illness. Cases of upper respiratory tract infections (URTI) were selected by a random sampling method. An attempt was made to include all the consecutive cases of ARI admitted in indoor wards. A standard clinical record was maintained for all the cases.

Nasopharyngeal secretions (NPS) were collected in a mucus extractor from all the cases by the method as described by Gardner and McQuillin.¹² Two millilitres of cold minimum essential media (MEM) were added and the specimen transported on ice to the Virology Section of the Department of Microbiology. Slides were prepared, stained, and examined under fluorescence. Standardized technique¹² and quality control reagents (Wellcome Diagnostics, England) were used.

Observation and Results

Clinical data of the cases—93 outpatient and 137 inpatients are shown in Table 1. Both URTI and LRTI were most common during infancy with decreasing trend in later age.

Fever was noted in most of the cases of acute respiratory viral disease. High grade pyrexia was less marked for RSV infection. Nasal discharge was a prominent feature in adenovirus, para-influenza type 1 and influenza A virus infections while it was less marked with RSV. Increased respiratory rate was an important indicator of severity of respiratory viral

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TABLE 1
Age distribution of major ARI syndromes

| Clinical category | Total no. | Age groups | | | |
|-------------------|-----------|------------|---------|---------|---------|
| | | 0-1 yr | 1-2 yrs | 2-3 yrs | 3-5 yrs |
| URTI | 62 | 19 | 17 | 10 | 16 |
| LRTI | 168 | 85 | 42 | 25 | 16 |
| croup | 15 | 6 | 7 | 2 | — |
| bronchitis | 10 | 3 | 3 | 4 | — |
| bronchiolitis | 37 | 31 | 5 | 1 | — |
| Pneumonia | 106 | 45 | 27 | 18 | 16 |
| Total | 230 | 104 | 59 | 35 | 32 |

disease. Majority of patients with RSV infections had a respiratory rate greater than 70/min (in 73 per cent) while nearly half (46 per cent) the cases of para-influenza type 3 had such a high rate. Chest indrawing was noted in 90 per cent of cases with RSV infections. Rhonchi were present in 72 per cent of cases with RSV and 46 per cent of cases with para-influenza type 3 infections.

In 51 cases (22 per cent) at least one of the respiratory viruses was identified. Virus identification was more (25 per cent) often in LRI than in URI (16 per cent). Commonly identified viruses in LRI were RSV, para 3 and adeno, while influenza A was the most common virus in URI. Out of 11 patients suffering from RSV, 10 were less than 1 year old, while 7 out of 13 of para 3, and 5 out of 12 of adeno belonged to this age group (Table 3).

Overall viral aetiology was confirmed in 41 per cent of cases of bronchiolitis, 33 per cent of cases of croup, and 19 per cent cases of pneumonia. Association between the clinical diagnosis and viruses identified is shown in Table 2.

Two-thirds (10 out of 15) cases of bronchiolitis had RSV infection while remaining cases had para 3. Para 1 and adenovirus were the main viruses for croup,

while adenoviruses in eight cases followed by para 3 in five were identified out of 20 cases of pneumonia with positive virological tests.

Discussion

The reliability of rapid diagnosis of viral infections by immunofluorescence using cells from nasopharyngeal secretions is already established.¹³⁻¹⁵ Demonstration of the presence of virus at the site of illness means that the virus is associated with that illness and is almost certainly the causal agent, particularly in the respiratory tract where influenza, RSV, and para-influenza viruses are seldom if ever found without illness.¹²

In the present series viruses were identified in 22 per cent of cases of ARI. Other studies from southern and eastern parts of India have reported it in 17 and 12 per cent cases.^{8, 11} An earlier study from this region has reported virus isolation in 32 per cent of cases,⁹ while other studies from Kuala Lumpur¹⁶ and Cali Columbia⁴ identified the causative virus in 29 per cent and 20 per cent of cases, respectively. A recent report from six different European countries by European group of Rapid Virus Diagnosis¹⁵ found viral aetiology in 25 per cent cases which is similar to the one in the present study.

Our findings of para-influenza as the commonest viral pathogen is of notable interest and is similar to other Indian reports^{8, 9, 11} while others from developed countries^{2, 4} did not show such a high incidence.

In our study the incidence of adenovirus infections was higher (5 per cent) than reported by others^{11, 17, 18} and is similar to an earlier report from this region.⁹

Three patients in this study had dual virus infections. All had LRTI and were less than 6 months of age. Dual virus infection is also reported by various other workers.^{16, 19}

The clinical manifestations in acute respiratory virus infections were similar to the studies done in temperate climates.^{5, 14} Furthermore, it has been

TABLE 2
Clinical diagnosis and viruses identified

| Clinical diagnosis | Total no. | Viruses | | | | | | | | Total identification No. (%) |
|--------------------|-----------|---------|--------|---------|---------|-----|-------|---------------|---------------|------------------------------|
| | | Inf. A | Inf. B | Para. 1 | Para. 3 | RSV | Adeno | Para. 1 + RSV | Para. 3 + RSV | |
| URTI | 62 | 4 | 1 | 1 | 2 | — | 2 | — | — | 10 (16.0) |
| LRTI | 168 | 2 | 2 | 2 | 11 | 11 | 10 | 1 | 2 | 41 (24.8) |
| Croup | 15 | — | — | 2 | — | — | 2 | 1 | — | 5 (33.3) |
| Bronchitis | 10 | — | — | — | 1 | — | — | — | — | 1 (10.0) |
| Bronchiolitis | 37 | — | — | — | 5 | 8 | — | — | 2 | 15 (40.5) |
| Pneumonia | 106 | 2 | 2 | — | 5 | 3 | 8 | — | — | 20 (18.8) |
| Total | 230 | 6 | 3 | 3 | 13 | 11 | 12 | 1 | 2 | 51 (22.17) |

TABLE 3
Age distribution of respiratory virus infections

| Virus | Age groups | | | | | Total n=230 |
|---------------|-----------------------|-----------------------------|-----------------|-----------------|-----------------|----------------|
| | 0-6 months n=48 | 7 months to 1 yr n=56 | 1-2 yrs n=59 | 2-3 yrs n=35 | 3-5 yrs n=32 | |
| Inf. A | 1 | — | 3 | 1 | 1 | 6 |
| Inf. B | — | — | — | 2 | 1 | 3 |
| Para. 1 | — | 1 | 2 | — | — | 3 |
| Para. 3 | 4 | 3 | 3 | 1 | 2 | 13 |
| RSV | 6 | 4 | 1 | — | — | 11 |
| Adeno | 2 | 3 | 4 | 1 | 2 | 12 |
| Para. 1 + RSV | 1 | — | — | — | — | 1 |
| Para. 3 + RSV | 2 | — | — | — | — | 2 |
| Total | 16 | 11 | 13 | 5 | 6 | 51 |
| Percentage | 33.0 | 19.6 | 22.0 | 14.3 | 18.8 | 22.17 |

noted that mean highest degree of fever in bacterial ($39.3 \pm 0.7^\circ\text{C}$) infections does not statistically differ from viral infection ($39.2 \pm 0.6^\circ\text{C}$).¹⁴ Mean duration of fever before admission to the hospital also did not show any difference in viral or non-viral infections (1.8 ± 1.7 days and 1.8 ± 2.0 days).

The value of rapid diagnosis of virus infection in the management of small infants and children is being stressed by many workers as the differentiation between viral and bacterial infection may not be possible by clinical and usual laboratory parameters.^{20, 21} Immunofluorescence assay is a specific and sensitive test that can provide laboratory confirmation on the same day.¹² It may have implications regarding less common use of antibiotics and shorter duration of hospital stay.

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