
Original Article

Diagnosis of the *Adenovirus*, *RSV*, and *Influenza Virus* by Rapid Detection Test (Immunochromatography) in Children with Acute Respiratory Infection

Mitra Barati, Mahshid Talebi-Taher, Samileh Noorbakhsh, Farideh Ebrahimi Taj, Azardokht Tabatabaei

Pediatric Infectious Diseases Research Center, Tehran University of Medical Sciences, Tehran, Iran

ABSTRACT

Background and Aim: Respiratory tract infection is one of the important causes of deaths in children especially in developing countries. The most common viral respiratory tract infections are Respiratory Syncytial Virus (RSV), Adenovirus and Influenza viruses. Our objective was to identify the frequency of Adenovirus, RSV, and Influenza viruses in patients with acute respiratory tract infection in a teaching hospital.

Materials and Methods: A prospective cross sectional study was carried out during 12 months on 160 children of up to 14 years of age. The nasopharyngeal secretions were analyzed with chromatography method.

Results: A total of 160 patients with upper respiratory tract infection with a mean age of 61.5 months were evaluated; 57.5% were boys and 42.5% were girls. Influenza A virus, RSV, and Adenovirus were detected in 7 cases (4.4%), 9 cases (5.7%), and 10 cases (6.3%), respectively. Sore throat in RSV infection, cough, petechiae on palate and vomiting in Influenza infection and cervical adenopathy in Adenovirus infection were more prevalent.

Conclusion: Adenovirus was the most prevalent virus. We need a more sensitive test to detect viruses properly as a cause of upper respiratory tract infection in children.

Iranian J Pediatr Soc 2010; 2(2): 79-83

Keywords: Adenovirus, Influenza virus, RSV, Upper respiratory tract infection

Corresponding author: Mahshid Talebi Taher, M.D., MPH

Address: Hazrat Rasool Akram Hospital, Niyayesh Street, Sattarkhan Avenue, Tehran, Iran

Tel: +98-21-66516049

E-mail: m-talebitaher@tums.ac.ir

Received: November 2009; **Accepted:** February 2010

INTRODUCTION

Respiratory tract infection is one of the important causes of deaths in children especially in developing countries (1). The most common viral respiratory tract infections are *Respiratory*

Syncytial Virus (RSV), *Adenovirus* and *Influenza* viruses. *RSV* is the major cause of lower respiratory tract illness in young children. *RSV* effectively spreads and essentially all persons have experienced infection by this agent within the first few years of life (2).

Malek Nejad et al studied 145 patients with respiratory symptoms in 3 teaching hospitals in

Tehran. Nasopharyngeal secretions were analyzed with Direct Immunofluorescence (DIF) test using monoclonal antibody. RSV was the causative agent for 38.6% of the cases (3). Noorbakhsh et al performed a study on upper respiratory tract infection; they concluded that *RSV* was the causative agent for 23% of the cases (4).

The diagnosis of *RSV* infection is often made on the basis of clinical and epidemiologic findings. A specific diagnosis may be made by viral isolation, by one of the rapid diagnostic tests or by serology (like EIA or Chromatography methods). Sensitivity of rapid test is 80-98% in children (2).

Adenoviruses have capacity to cause acute infections of the respiratory system and conjunctivae. Primary infection with an *Adenovirus* usually takes place in the first few years of life, and most of the population has experienced infection with one or more adenovirus serotypes by the end of the first decade (5).

Tabatabaei et al conducted a case-series study on 96 children of up to 5 years old. The nasopharyngeal secretions were obtained to detect *Adenovirus* by Immunofluorescent Antibody (IFA) method. The frequency of *Adenovirus* respiratory infection was 10.4%; most commonly occurred in children aged less than 1 year and in autumn. Cough and rhinorrhea were the most common signs (90%) and fever was the most common symptom (100%) (6).

A diagnosis of adenoviral infection is on clinical criteria. A definitive diagnosis rests on visualization of the virus by electron microscopy. Adenovirus antigens can be detected in sputum, nasopharyngeal washes, or throat swabs by EIA or immunofluorescence (5).

There are several diagnostic tests for influenza infection. Virus isolation or detection of viral antigen in respiratory secretions is the technique of greatest utility in the setting of acute illness. A variety of techniques have been employed to

speed the process like QuickVue Influenza A+B test (7). In this test, a sample of respiratory secretions is treated with a mucolytic agent and then tested with a dipstick, in which reaction with specific antibody results in a color change. Simmerman showed the sensitivity and specificity of QuickVue test (to detect influenza virus) as 77% and 96%, respectively (8).

There are few virological surveillance systems for respiratory viral infections among children in developing countries. The objectives of this study were to determine the etiology of upper respiratory tract infection in children by rapid test, and identify the most common clinical manifestations.

MATERIALS AND METHODS

In this descriptive cross-sectional study, all 3 month-15 year old children with the diagnosis of upper respiratory tract infection that had referred to Hazrat Rasool Akram hospital during 12 months (2007) were studied.

All personal information, clinical manifestations (fever, cough, vomiting, diarrhea, sore throat, abdominal pain, conjunctivitis, cervical lymphadenopathy, petechial lesions on palate), and other necessary data were recorded in special data sheets.

Later, 480 Nasopharyngeal (NP) swab specimens (3 NPs for each patient) were taken from patients with acute upper respiratory tract infection by physicians in clinic. Each swab was put in sterile tubes filled by 0.5-1 cc sterile water. Immediately after delivery, clinical samples were screened for *Influenza* viruses, *Adenoviruses* and *RSV* by Influenza A & B Respi-Strip C-1012 Coris Bioconcept, Adeno-Strip C-1002 coris and RSV-Strip C-1006 coris. In chromatography method the positivity of test was interpreted by changing color.

All the data were brought out from the data sheets and analyzed by the special statistical software (SPSS-13). The analyzed results were

presented in the form of descriptive and analytical statistics.

RESULTS

During the study period, a total number of 160 children were visited in clinic; 57.5% of patients were males. In regard to age 17.7% were younger than one year, 39.2% were 2 years to 5 years old, 27.8% were 6 years to 10 years old, and 15.5% were older than 11 years. Table 1 shows their clinical manifestations.

Rapid test were positive in 26 (16.25%) patients including 7 cases (4.4%) *Influenza A* virus, 9 cases (5.7%) *RSV*, and 10 cases (6.3%) *Adenoviruses*.

The median age of patients with influenza infection was 82 months. There was a significant relation between positivity of test for influenza virus and cough, vomiting, and petechial lesions on palate (p value <0.05).

The median age of patients with *Adenovirus* was 83 months. There was a significant relation between cervical adenopathy and positivity of test (p value <0.03).

The median age of patients with *RSV* infection was 54 months. Statistical difference was found between *RSV* infection and sore throat (p value <0.05).

DISCUSSION

Acute respiratory tract infections of viral origin are a cause of pediatric consultations and hospital admission.

Artiles-campelo et al conducted a study to investigate the etiology of acute respiratory tract infection in children in Spain; 1957 nasopharyngeal washings were collected from 1729 children. A rapid antigen detection method was performed in every sample to identify *RSV*. *RSV* was detected in 769 children (74.5%). Other viruses identified in order of frequency were *Para influenza* viruses, *Rhinoviruses*, *Adenoviruses*, *Influenza* viruses, *Enteroviruses*, and *Corona* viruses. They concluded respiratory viruses are responsible for a large number of acute respiratory tract infection cases in children in Spain (9).

Tsai and his colleagues studied respiratory viral infections among pediatric inpatients and outpatients in Taiwan and *RSV* was isolated in 1.7%. They concluded *RSV* is the second cause of upper respiratory tract infection in admitted children (10).

Carballal reported *RSV* as the most common cause of upper respiratory tract infection in children. Nasopharyngeal aspirates were investigated for *RSV*, *Adenovirus*, *Para influenza*, and *Influenza A* and *B* by indirect immunofluorescence in 1275 children under 5 years of age

Table 1. Clinical manifestations in patients with upper respiratory tract infection

Clinical manifestation	Patient (%)	<i>Influenza</i> (%)	<i>Adenovirus</i> (%)	<i>RSV</i> (%)
Fever	77.4	100	80	77.8
Sore throat	66	71.4	70	33.3
Abdominal Pain	16.4	28.6	20	11.1
diarrhea	10	0	10	22.2
Vomiting	15.7	42.9	10	33.3
Cough	37.4	0	20	55.6
Cervical adenopathy	13.8	0	40	11.1
Pharyngeal exudate	27	42.9	30	0
Petechiae	5.7	28.6	10	11.1
Conjunctivitis	1.9	0	10	0

in Argentina. Viruses were detected in 399 patients (32%). *RSV* was observed in 25.3% of the samples, *Adenoviruses* were detected in 2.5% of the cases, *Para influenza* in 2.2%, *Influenza A* in 2.1%, and *Influenza B* in 0.2%. Compared with other viruses, the higher *RSV* frequency was statistically significant ($p < 0.000$) (11).

Lin conducted a study on respiratory viral infections among pediatric outpatients in northern Taiwan. A total of 910 specimens were collected and 365 specimens (40%) were positive for at least 1 virus and included 81 *Enterovirus*, 73 *Adenovirus*, 58 *Influenza B* virus, 54 *Influenza A* virus, 48 *CMV*, 25 *HSV-1*, 7 *Para influenza*, 3 *RSV* and 16 mixed viruses. The results of this study demonstrated that *Adenovirus* and *Enterovirus* were the two most common viruses isolated from pediatric outpatients with acute, febrile upper respiratory tract infection, and a child older than 5 years of age with acute febrile upper respiratory tract infection is likely to be a case of influenza (12).

Al-Hajjar et al studied patients suffering from respiratory tract infection in Saudi-Arabia. Of the 256 isolates, *RSV* accounted for 73 (28.5%), *Adenoviruses* for 70 (27.3%), *Influenza* virus for 61 (23.8%), *Enterovirus* for 30 (15.2%), and *Para influenza* for 13 (2.3%) (13).

A prospective study was carried out in children with acute respiratory tract infection in India. *RSV*, *Influenza*, *Para influenza* and *Adenoviruses* in nasopharyngeal aspirates were detected by DFA. They concluded *RSV*, *Influenza A* and *Para influenza* virus 3 were important causes of acute respiratory tract infection among children in rural communities in India (14).

In our study *Adenovirus* was the major cause of acute respiratory tract infection, but we determined the cause of acute respiratory tract infection by chromatography method only for 3 kinds of viruses; thus we cannot conclude which virus is the major cause of acute respiratory tract infection in children properly.

Results from several studies reveal the major cause of respiratory tract infection in different parts of the world is not same and it depends on several factors like age and upper or lower respiratory tract infection, for example. The frequency of *RSV* in lower respiratory tract infection is more than upper respiratory tract infection (15), or there is a reverse relation between age and *Adenovirus* infection. Renia showed *Adenovirus* is common in children younger than 14 months (16).

In our study male patients were more than females; this result is comparable to another study carried out in Iran (3,4) where most of the patients were 1 to 5 years old. The most common symptoms in our patients with *RSV* infection were fever and cough like other studies (4,10). Tabatabaei showed cough and rhinorrhea as the most common signs and fever as the most common symptom in *Adenovirus* infection (6). In our study fever, sore throat and cervical adenopathy were the most common signs.

Our results showed in patients with influenza infection the most common symptoms were fever and sore throat. Usually, myalgia and headache are the most trouble-some symptoms, and severity is related to the height of fever.

CONCLUSION

The most common viruses isolated from NPs were *Adenovirus*, but we need a more sensitive method to determine the cause of upper respiratory tract infection in children.

ACKNOWLEDGEMENT

We thank the staff of Pediatric Infectious Diseases Research Center affiliated to Iran University of Medical Sciences for their assistance.

REFERENCES

1. Berman S. Epidemiology of acute respiratory infections in children of developing countries. *Rev Infect Dis* 1991; 13(Suppl 6): 454-462.

2. Hall CB, McCarthy CA. Respiratory syncytial virus. In: Mandell GL, Bennett JE, Dolin R. *Principle and practice of infectious diseases*. 6th ed. USA: Elsevier Churchill Livingstone; 2005:2008-2026.
3. Malek-Nejad P, Erfani Y. Prevalence of respiratory tract infection due to respiratory syncytial virus in 145 children below 5 years old, from January to May, 1999 in Imam Khomeini, Markaz Tebbi and Bahrami hospitals. *Tehran Faculty Medicine J* 2001; 6: 66-71.
4. Noorbakhsh S, Rimaz Sh. The frequency and clinical manifestations of RSV infection in children with ARTI, Rasoul-e-Akram hospital. *Iran University of Medical Sciences J* 2004; 4(Suppl 2): 1051-1056.
5. Baum SG. Adenovirus. In: Mandell GL, Bennett JE, Dolin R. *Principle and practice of infectious diseases*. 6th ed. USA: Elsevier Churchill Livingstone; 2005: 1835-1841.
6. Tabatabaei P, Faghani A, Hashemi FB, Mamishi S, Siadati SA. Study of the frequency of adenovirus infections by immune-fluorescence antibody method in patients with acute respiratory tract infection. *Iranian J Pediatr* 2004; 2: 132-138.
7. Agoritsas K, Mack K, Bonsu BK, Goodman D, Salamon d, Marcon MJ. Evaluation of the Quidel QuickVue test for detection of Influenza A and B Viruses in the pediatric emergency medicine setting by use of three specimen collection methods. *J Clin Microbiol* 2006; 44(7): 2638-2641.
8. Simmerman JM, Chittaganpitch M, Erdman D, Sawatwong P, Uyeki TM, Dowell SF. Performance and new uses of rapid influenza testing in Thailand. *Int J Infect Dis* 2007; 11(2): 166-172.
9. Artiles-campelo F, Perez-Gonzalez Mdel C, Caballero-Hidalgo A, Pena-Lopez MJ. Etiology of acute viral tract infections in children from Gran Canaria, The Canary Islands (Spain). *Enferm Infecc Microbiol Clin* 2006; 24(9): 556-561.
10. Tsai HP, Kuo PH, Liu CC, Wang JR. Respiratory viral infections among pediatric inpatients and outpatients in Taiwan from 1997 to 1999. *J Clin Microbiol* 2001; 39(1): 111-118.
11. Carballal G, Videla CM, Espinosa MA, Savy V, Uez O, Sequeira MD, et al. Multicentered study of viral acute lower respiratory infections in children from four cities of Argentina, 1993-94. *J Med Virol* 2001; 64(2): 167-174.
12. Lin TY, Huang YC, Ning HC, Tsao KC. Surveillance of respiratory viral infections among pediatric outpatients in northern Taiwan. *J Clin Virol* 2004; 30(1): 81-85.
13. Al-Hajjar S, Akhter J, al Jumah S, Hussain Qadri SM. Respiratory viruses in children attending a major referral centre in Saudi Arabia. *Ann Trop Paediatr* 1998; 18(2): 87-92.
14. Broor S, Parveen S, Bharaj P, Prasad VS, Srinivasulu KN, Sumanth KN, et al. A prospective three-year cohort study of the epidemiology and virology of acute respiratory infections of children in rural India. *PLOS ONE* 2007; 2(6): e491.
15. Waber MW, Milligan P, Sanneh M, Awemoyi A, Dakour R, Schneider G, et al. An epidemiological study of RSV infection in the Gambia. *Bull World Health Organ* 2002; 80(7): 562-568.
16. Renia J, Ferres F, Gutierrez O, Ruiz de Gopegui E, González-Cárdenas M. Study of clinical and epidemiological characteristics of respiratory infections caused by adenovirus in a pediatric population (1997-2003). *An Paediatr (Barc)* 2004; 61(2): 137-142.