

Original Research Article

doi: <http://dx.doi.org/10.20546/ijcmas.2016.502.009>

Respiratory Syncytial Virus – Detection, Prevalence and Usefulness in Clinical Management: A hospital based study

Kiran Yadav¹, VG Ramachandran¹, Shukla Das¹ and Dheeraj Shah²

¹Department of Microbiology, UCMS & GTB Hospital, Delhi, India

²Department of Pediatrics, UCMS & GTB Hospital, Delhi, India

*Corresponding author

ABSTRACT

Keywords

Respiratory syncytial virus, Respiratory tract infection, Reverse Transcription Polymerase Chain Reaction

Article Info

Accepted:

09 January 2016

Available Online:

10, February 2016

Acute respiratory tract infections (ARTIs) play a major role in hospitalizations of children, and *Respiratory syncytial virus* (RSV) is well recognized as the most important pathogen causing ARTI. This study aimed to evaluate the epidemiological and clinical patterns of RSV infection in children hospitalized for lower respiratory tract infections (LRTI) in tertiary care hospital in East Delhi, India. A nasopharyngeal aspirate was obtained for detection of RSV in all cases. Sociodemographic data, clinical signs, diagnosis and hospital admissions were documented. Total 130 cases with LRTI between 2 months to 5 years of age were included in the study. Flocked nasal swabs samples were processed for detection of RSV virus by both rapid antigen detection method and RT-PCR. RSV infection was found in 14 out of 130 patients (10.8%). Among the 14 children with RSV infection, nine patients (90%) were under 12 months of age. The main clinical manifestations of RSV infection were chest wall retraction (100%) and wheezing (78%). This study indicates that RSV is an important cause of respiratory tract infection in infants and young children and the imperative need for rapid and reliable screening test to detect RSV infection for avoiding unjustified use of antibiotics.

Introduction

Viruses are the most frequent etiological agents of acute respiratory infections, and are responsible for significant morbidity and mortality in children (Costa *et al.*, 2006). *Respiratory syncytial virus* (RSV) is well recognized as the most important pathogen causing acute respiratory disease in infants and young children, mainly bronchiolitis and pneumonia (Oliveira *et al.*, 2008). Influenza viruses' type A and B (FLU A/B),

parainfluenza virus (PIV), *adenovirus* (ADV), and *human metapneumovirus* (hMPV) are other important viral etiologic agents of acute lower respiratory tract infections (ALRTI) (Costa *et al.*, 2006).

RSV infection is associated with significant disease burden in infants and young children in terms of hospitalization, related complications, and even mortality

(Robinson *et al.*, 2008). Identification of the etiologic agents of ALRTI and monitoring their trends, in a particular setting, provide important inputs to improve patient management, guide antimicrobial utilization and implement infection control measures.

The epidemiology of RSV has not been studied adequately in India. The objective of this study was to describe the epidemiology and clinical characteristics of ALRTI caused by RSV among a group of Indian children below 5 years of age admitted to or attending a tertiary care hospital in East Delhi, India.

Materials and Methods

This cross-sectional study was conducted in Department of Pediatrics and Microbiology in University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi from August 2011 - February 2012. The study was approved by the Institutional Ethical Committee and informed consent was taken from the guardians of patients before collection of samples. A detailed questionnaire was filled for each patient including relevant clinical history.

We recruited one hundred and thirty children (130) less than five years of age presenting with ALRTI attending the pediatric outpatient department and ward of our hospital with signs and symptoms of ALRTI.

A case of pneumonia was defined following WHO definitions, as a child with cough and difficult breathing or tachypnea (50 breaths per minute or more in a child aged 2-11 months or 40 breaths per minute or more in a child aged 12-59 months) and if the patient exhibits lower chest in-drawing or stridor, he/she will be diagnosed as a case of severe pneumonia (Wardlaw *et al.*, 2006). Those who were not fast breathing were diagnosed

as a case of wheezing associated lower respiratory tract infection (WALRI).

The presence or absence of RSV was confirmed by performing a rapid antigen detection test based on enzyme immunoassay in nasopharyngeal secretion (Binax NOW RSV test) (Jonathan, 2006) and also amplified by 1 step - Reverse transcriptase polymerase chain (RT-PCR) using the following RSV G- protein specific primers with an expected band size of 287bp using forward Primer- (nt542-564, 5'-3' GCAGCAACAATCCAACCTGCTGG) and reverse Primer- (nt806-828, 5'-3' ATCGGAGGAGGTTGAGTGGAGGG) (Yadav *et al.*, 2014). Risk factors such as gestational age less than 32 weeks at birth, and chronic lung disease were determined. Clinical outcomes such as average hospital stay, admission to the pediatric intensive care unit, mechanical ventilation requirement, and mortality were assessed in high-risk patients.

A descriptive analysis of the population was undertaken.

Results and Discussion

The total number of patients included in the study was 130 children that met the inclusion criteria. The primary diagnoses of the patients included: pneumonia in 48.0%, bronchiolitis in 30.8%, and WALRI in 20.8%. The RSV test was positive in 14 patients, which corresponds to an incidence of 10.8% in the general study population (Table 1).

In this study, RSV infection could be demonstrated in much higher percentage of patients with bronchiolitis. Almost 22 percent (9/40) RSV positivity observed in patients who had been clinically diagnosed as bronchiolitis, 6.34 percent (4/63) in pneumonia and 3.7 percent (1/27) in

WALRI. Bronchiolitis was the clinical diagnosis of patients with RSV infection.

In the present study, RSV could be demonstrated in much higher percentage (72%) in age group 2-6 months. An increased prevalence of RSV has been observed in the age group 2-6 month (21.27%) compared to age group 7-12 months (5.76%) and 13-60 months (3.22%) (Table 2). This association was statistically significant using Fisher's Exact test ($P \leq 0.05$).

In children with RSV infection, cough was the leading symptom (71%) followed by coryza (57 %) and fever (57%). Evidence of lower respiratory tract infection were chest wall retraction (100%), wheezing (78%) and cyanosis (14%) (Table 3). The clinical outcomes for children infected with RSV were good in general.

During the study, we observed a rise in RSV infection towards winter season. Out of the total RSV positive patients, 13 were detected in Nov–Feb months (winter) compared to only 1 detected in Aug-Oct (monsoon). RSV infection peaked in December (winter) (Fig.1).

The Prevalence of RSV infection in Nov-Feb was 13.97 percent compared to 2.7 percent during Aug-Oct. This association of RSV infection with seasonal variation was statistically not significant using Fisher's Exact test ($P > 0.05$).

Viral infections are considered to be the most important cause of lower respiratory tract infections (LRTI). They are responsible for significant mortality and morbidity in children. RSV is one of the most frequent etiological agents causing LRTI, especially among young infants (Cabello *et al.*, 2006; Pecchini *et al.*, 2008). Furthermore there is

mounting interest in the hypothesis that RSV infection in the early childhood is an important risk factor for the subsequent development of recurrent wheezing and asthma (Piedimonte *et al.*, 2000). RSV shows no prejudice toward country or climate but does have a particular preference for very young in every area of the world (Carolin *et al.*, 1998).

During this study, RSV was detected in 10.76% of all included Subjects studied. Similar results have also been documented in other studies (Loscertales *et al.*, 2000, Stensballe *et al.*, 2002) although the prevalence of RSV in India is said to be 17-32 percent (Maitreyi *et al.*, 2001, John *et al.*, 1991). In our survey, we observed that RSV is almost equally distributed among males and female children. Most of the children who tested positive for RSV had bronchiolitis and the highest number of positive samples of RSV was from patients less than one year old. In most of the studies on children with bronchiolitis and pneumonia, RSV has been found to be involved in higher proportion of bronchiolitis compared to pneumonia (Chattopadhyaya *et al.*, 1992, Gardner, 1973). This tendency towards the younger age affliction, in RSV infections has been reported by other studies (Iwane *et al.*, 2006, Costa *et al.*, 2004). The clinical features of children with RSV positive samples observed in our study were similar to those of previous reports (Cabello *et al.*, 2006; Pecchini *et al.*, 2008). Cough and coryza were the main clinical manifestations of RSV infection. The clinical pattern of RSV infection included bronchiolitis in 22.5% of cases, pneumonia in 6.34% and WALRI in 3.7%. RSV infection was more common in children who came from more densely populated areas than other areas. Increased risk was particularly associated with greater numbers of members living in one family.

Table.1 Distribution of Patients with LRTI According to Age and Clinical Diagnosis

Age group (months)	Bronchiolitis (40) n* (%)	Pneumonia (63) n (%)	#WALRI (27) n (%)
2- 6	29 (72.5)	15 (23.8)	3 (11.11)
7- 12	11 (27.5)	26 (41.26)	15 (55.55)
13- 60	-	22 (34.92)	9 (33.33)

wheezing associated lower respiratory infection

* percentage

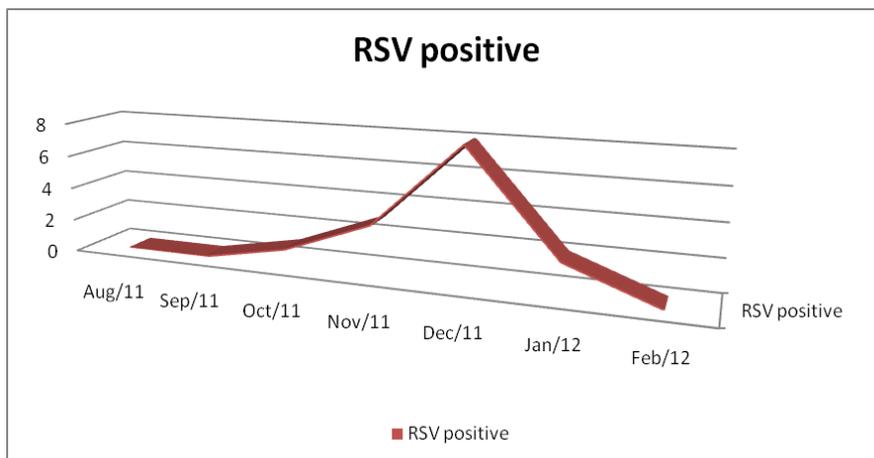
Table.2 Prevalence of RSV Infection in Different Age Group (n= 130)

Virus	Age group 2-6 months (n= 47)	Age group 7-12 months (n= 52)	Age group 13-60 months (n= 31)	Significance
Prevalence of <i>Respiratory Syncytial virus</i>	10 (21.27%)	3 (5.76%)	1 (3.22%)	$P \leq 0.05$

Table.3 Symptoms and Signs Observed in Patients with RSV Infection

Symptoms and sign	Patients	Percent
Cough	10	71
Coryza	8	57
Fever	8	57
Tachypnea	14	100
Wheezing	11	78
Cyanosis	2	14

Fig.1 Frequency of RSV Infection in Children Reporting with LRTIs



RSV infections occur primarily as annual outbreaks, with peaks during winter months. RSV is responsible for a large number of hospital admissions during winter and spring (Frak *et al.*, 1999) and as we observed in this study, high prevalence (13.97 percent) of RSV infection was in the time period from Nov-Feb and peaked during month of December.

There were certain limitations in our study. One of the limitations was that although more than 100 children presented the criteria for inclusion in this study, samples from the first 100 patients were collected, due to the limit imposed by processing and storage of samples. The second limitation was that we did not look for all of the respiratory viral agents in our patients. Further we also did not investigate the bacterial infection in depth to accurately identify the need for antibiotic administration. Numerous studies have shown, the occurrence of a secondary or concurrent bacterial infection in hospitalized children with RSV lower respiratory tract disease is <1% (Bloomfield *et al.*, 2004). Unfortunately, the unjustified use of antibiotics increases the risk of development of antimicrobial resistance.

The present study findings supports the imperative need for rapid and reliable screening test to detect RSV infection for avoiding unjustified use of antibiotics and also to reinforce implementation of infection control precautions among hospitalized patients, when diagnosis of RSV infection etiology is established. A better understanding of the epidemiology of respiratory viral infections may be purposively used for timely, specific antiviral therapy, prophylaxis, and vaccination. Future prospective surveillance over an extended period is needed to accurately identify the epidemiology of respiratory viral infections for translating

hospital and field data into clinical management effective companion.

References

- Bloomfield, P., Dalton, D., Karleka, A., Kesson, A., Duncan, G., Isaacs, D. 2004. Bacteraemia and antibiotic use in respiratory syncytial virus infections. *Arch Dis Child.*, 89: 363-367.
- Cabello, C., Manjarrez, M.E., Olvera, R., Villalba, J., Valle, L., Paramo, I. 2006. Frequency of viruses associated with acute respiratory infections in children younger than five years of age at a locality of Mexico City. *Mem Inst Oswaldo Cruz.*, 101(1): 21-4.
- Carolin, breese, hall. Respiratory syncytial virus in figin cherry w.b sanders co. Philadelphia 1998 P: 2048.
- Chattopadhyaya, D., Chatterjee, R., Anand, V.K., Kumari, S., Patwari, A.K. 1992. Lower respiratory tract infection in hospitalized children due to *respiratory syncytial (RS) virus* during a suspected epidemic period of RS virus in Delhi. 1992. *J Trop Pediatr.*, 38(2): 68-73.
- Costa, L.F., Yokosawa, J., Mantese, O.C., Oliveira, T.F., Silveira, H.L., Nepomuceno, L.L., et al. 2006. Respiratory viruses in children younger than five years old with acute respiratory disease from 2001 to 2004 in Uberlândia, MG, Brazil. *Mem Inst Oswaldo Cruz.*, 101:301-6.
- Frak, W.M. et al. 1999. Severity of illness models for respiratory syncytial virus associated hospitalization. *Respiratory and critical care medicine.*, 159(4).
- Gardner, P.S. 1973. *Respiratory syncytial virus* infections. *Postgrad Med J.*, 49: 788-91.
- Iwane, M.K., Edwards, K.M., Szilagyi, P.G., Walker, F.J., Griffin, M.R., Weinberg, G.A., et al. 2004. Population-based surveillance for hospitalizations

- associated with *respiratory syncytial virus, influenza virus, and parainfluenza viruses* among young children. *Pediatrics.*, 113(6): 1758-64.
- John, J.T., Cherian, T., Steinhoff, M.C., Simoes, E.A.F., John, M. 1991. Etiology of acute respiratory infection in children in tropical southern India. *Rev Infect Dis.*, 13(6): 463-9.
- Jonathan, N. 2006. Diagnostic utility of BINAX NOW RSV – an evaluation of the diagnostic performance of BINAX NOW RSV in comparison with cell culture and direct immunofluorescence. *Ann Clin Microbiol Antimicrob.*, 5: 13-8
- Loscertales, M.P., Roca, A., Ventura, P.J., Abacassamo, F., Dos Santos, F., Sitaube, M., et al. 2000. Epidemiology and clinical presentation of *respiratory syncytial virus* infection in a rural area of southern Mozambique. *Pediatr Infect Dis J.*, 21: 148-55.
- Maitreyi, R.S., Broor, S., Kabra, S.K., Ghosh, M., Seth, P., Dar, L., et al. 2001. Rapid detection of respiratory viruses by centrifugation-enhanced cultures from children with acute lower respiratory tract infections. *J Clin Virol.*, 16: 41-7.
- Oliveira, T.F., Freitas, G.R., Ribeiro, L.Z., Yokosawa, J., Siqueira, M.M., Portes, S.A., et al. 2008. Prevalence and clinical aspects of *respiratory syncytial virus* A and B groups in children seen at Hospital de Clínicas of Uberlândia, MG, Brazil. *Mem Inst Oswaldo Cruz.*, 103: 417-22.
- Pecchini, R., Berezin, E.N., Felicio, M.C., Passos, S.D., Souza, M.C., Lima, L.R., et al. 2008. Incidence and clinical characteristics of the infection by the *respiratory syncytial virus* in children admitted in Santa Casa de Sao Paulo Hospital. *Braz J Infect Dis.*, 12(6): 476-9.
- Piedimonte, G., King, K.A., Holmgren L.N. 2000. A humanized monoclonal antibody against *respiratory syncytial virus* (palvizumb) inhibits RSV induced neurologic mediated inflammation in rat airway. *Pediatric Research.*, 47: 351-6.
- Robinson, R.F. 2008. Impact of *respiratory syncytial virus* in the United States. *Am J Health Syst Pharm.*, 65(23 Suppl 8): S3-6, [Abstract]
- Stensballe, L.G., Trautner, S., Kofoed, P.E., Nante, E., Hedegaard, K., Jensen, I.P., et al. 2002. Comparison of nasopharyngeal aspirate and nasal swab specimens for detection of *respiratory syncytial virus* in different settings in a developing country. *Trop Med Int Health.*, 7(4): 317-21.
- Wardlaw, T.M., Johansson, E.W., Hodge, M. 2006. Pneumonia: the forgotten killer of children United Nation Children's Fund (UNICEF), World health organization (WHO), 2006.
- Yadav, K., Ramachandran, V.G., Das, S., Shah, D. 2013. One step RT- PCR for detection of *respiratory syncytial virus* in children with lower respiratory tract infection. *Res Rev: J Med Health Sci.*, 2(4): 49-53.

How to cite this article:

Kiran Yadav, VG Ramachandran, Shukla Das and Dheeraj Shah. 2016. Respiratory Syncytial Virus – Detection, Prevalence and Usefulness in Clinical Management: A hospital based study *Int.J.Curr.Microbiol.App.Sci.* 5(2): 86-91. doi: <http://dx.doi.org/10.20546/ijcmas.2016.502.009>