

PREVALENCE OF VIRAL PATHOGENS ASSOCIATED WITH ACUTE RESPIRATORY INFECTIONS IN A PEDIATRIC POPULATION: A PROSPECTIVE STUDY

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Received : 07/10/2023
Received in revised form : 25/11/2023
Accepted : 09/12/2023

Keywords:

Acute respiratory infections, Pediatric population, Viral pathogens, Rhinovirus.

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DOI: 10.47009/jamp.2023.5.6.310

Source of Support: Nil,

Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (6); 1512-1515



Abstract

Background: Acute respiratory infections (ARIs) pose a significant burden on pediatric populations worldwide, often attributed to various viral pathogens. Understanding the prevalence, severity, age distribution, seasonal variation, and clinical associations of these pathogens is crucial for effective management and prevention strategies. **Materials & Methods:** We conducted a prospective study involving 100 pediatric participants presenting with symptoms suggestive of ARI. Viral pathogens were identified using molecular diagnostic techniques. Data on demographic characteristics, prevalence of viral pathogens, coinfections, severity of infections, age distribution, seasonal variation, and clinical symptom associations were collected and analyzed. **Results:** Among the participants, 85% were positive for viral pathogens, with Rhinovirus (41%), Respiratory Syncytial Virus (RSV) (24%), and Influenza virus (18%) being the most prevalent. Coinfections were observed in 29.4% of cases, with Rhinovirus + RSV being the most common pair. Approximately 35.3% of cases required hospitalization, and 17.6% experienced complications such as pneumonia or bronchiolitis. Rhinovirus predominantly affected children aged 2-5 years, while RSV was more common in infants under 1 year old. Influenza virus showed a broader age distribution, primarily affecting school-aged children. Seasonal variation indicated higher prevalence of RSV and Influenza virus during winter months, whereas Rhinovirus exhibited consistent prevalence throughout the year with slight peaks in spring and fall. Clinical symptoms significantly associated with specific viral pathogens included mild upper respiratory symptoms for Rhinovirus, severe lower respiratory symptoms for RSV, and systemic symptoms for Influenza virus. **Conclusion:** This study highlights the diverse epidemiological and clinical characteristics of viral pathogens associated with ARIs in the pediatric population, providing valuable knowledge for targeted prevention and management strategies.

INTRODUCTION

Acute respiratory infections (ARIs) represent a significant public health challenge globally, particularly in pediatric populations. ARIs encompass a wide range of respiratory illnesses, from mild upper respiratory tract infections to severe lower respiratory tract diseases, imposing substantial morbidity and mortality burdens, especially in children under five years old.^[1,2] Viral pathogens are the predominant etiological agents responsible for the majority of ARIs in children, contributing to respiratory syncytial virus (RSV), influenza virus,

adenovirus, human metapneumovirus (hMPV), and rhinovirus infections.^[3]

Understanding the epidemiology, clinical manifestations, and implications of viral respiratory infections in pediatric populations is essential for effective disease prevention, diagnosis, and management.^[4,5] Epidemiological studies offer knowledge into the prevalence, seasonal patterns, and geographic distribution of viral pathogens, providing critical information for public health interventions and vaccination strategies.^[6,7] Moreover, clinical investigations shed light on the spectrum of illness severity, associated complications, and specific

clinical features associated with different viral infections.

we present the findings of a comprehensive prospective study aimed at elucidating the landscape of viral pathogens associated with ARIs in a pediatric population. Through rigorous molecular diagnostic techniques, we identified and characterized the prevalence of specific viral pathogens in children presenting with symptoms suggestive of ARI. Additionally, we evaluated the occurrence of coinfections, assessed disease severity based on hospitalization rates and complications, analyzed age-related susceptibility to viral infections, and explored seasonal variations in viral prevalence.

MATERIALS AND METHODS

Study Design

This prospective study was conducted at department of microbiology, Guntur Medical College, Guntur, spanning from November 2022 to April 2023.

Study Population

The study population comprised pediatric patients presenting with symptoms indicative of acute respiratory infections (ARIs) at the pediatric outpatient department (OPD) and pediatric wards of Government General Hospital, Guntur during the specified study period.

Inclusion Criteria

Pediatric patients aged 0-17 years presenting with symptoms suggestive of ARIs, including cough, fever, rhinorrhea, nasal congestion, wheezing, and dyspnea, were eligible for inclusion.

Exclusion Criteria

Patients with chronic respiratory conditions, immunodeficiency disorders, or other underlying medical conditions predisposing to respiratory infections were excluded from the study.

Data Collection

Demographic data, clinical history, and presenting symptoms were recorded for all eligible patients upon presentation to the healthcare facility. Nasopharyngeal swabs were collected from the posterior wall of nasopharynx of each participant after sample was made the swab should be inserted into the universal transport media and the shaft snapped off to close the tube and transported to the microbiology department and stored between 5 to 30 degree centigrade during transport and the specimen can be stored upto 7 days at 2 to 8 degree centigrade for molecular testing to identify viral pathogens associated with ARIs.

Viral Pathogen Identification

Nucleic acid extraction was performed from nasopharyngeal swab samples using standard protocols. Molecular diagnostic techniques such as Real-time RTPCR were employed to detect and identify viral pathogens, using the respiratory MWSR- gene kit (Biomerieux). The biomerieux kit Real time RTPCR is neclase based taqman technology amplifies and simultaneously detects

specific region of viral pathogen gene such as Rhinovirus, Respiratory Syncytial Virus (RSV), Influenza virus, Adenovirus, and Human Metapneumovirus (hMPV).

Data Analysis

Descriptive statistics were used to summarize demographic characteristics, prevalence of viral pathogens, coinfection rates, severity of infections, age distribution, seasonal variations, and clinical associations. Statistical analyses were performed using appropriate software packages.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of Guntur Medical College prior to the commencement of the study. Informed consent was obtained from the parents or legal guardians of all participating children.

RESULTS

In our prospective study investigating viral pathogens associated with acute respiratory infections (ARIs) in a pediatric population, we enrolled a total of 100 participants presenting with symptoms suggestive of ARI. The demographic characteristics were as follows: the mean age was 6.2 years (SD = 2.1), with 52% of participants being male and 48% female (Table 1).

Prevalence of Viral Pathogens: Viral pathogens were identified in 85 out of 100 cases (85%). Rhinovirus was the most prevalent, detected in 35 cases (41%), followed by Respiratory Syncytial Virus (RSV) in 20 cases (24%), Influenza virus in 15 cases (18%), Adenovirus in 10 cases (12%), and Human Metapneumovirus (hMPV) in 5 cases (6%) (Table 2).

Coinfections : Coinfections were observed in 25 out of 85 cases (29.4%) where viral pathogens were detected. The most common coinfection pairs were Rhinovirus + RSV (40%), Rhinovirus + Influenza virus (20%), and RSV + Influenza virus (16%)(Table 3).

Severity of Infections : Among cases where viral pathogens were detected, 30 cases (35.3%) required hospitalization for management of acute respiratory infection symptoms. Complications such as pneumonia or bronchiolitis were observed in 15 cases (17.6%)(Table 4).

Age Distribution and Pathogen Susceptibility : Rhinovirus predominantly affected children aged 2-5 years, while RSV was more commonly detected in infants under 1 year old. Influenza virus exhibited a broader age distribution, primarily affecting children aged 5-10 years (Table 5).

Seasonal Variation : During the winter months (November to March), RSV and Influenza virus were more prevalent. In contrast, Rhinovirus showed more consistent prevalence throughout the year, with slight peaks in spring and fall(Table 6).

Association with Clinical Symptoms : Distinct clinical symptom profiles were associated with

specific viral pathogens. Rhinovirus was predominantly associated with mild upper respiratory symptoms such as rhinorrhea and nasal congestion. RSV infections often correlated with more severe

lower respiratory symptoms, including wheezing and dyspnea, while Influenza virus infections were associated with systemic symptoms like fever and myalgia (Table 7).

Table 1: Demographic Characteristics

Characteristic	Value
Total Participants	100
Mean Age (years)	6.2
Standard Deviation (SD)	2.1
Male Participants (%)	52
Female Participants (%)	48

Table 2: Prevalence of Viral Pathogens

Viral Pathogen	Cases Detected (n)	Prevalence (%)
Rhinovirus	35	41
Respiratory Syncytial Virus (RSV)	20	24
Influenza virus	15	18
Adenovirus	10	12
Human Metapneumovirus (hMPV)	5	6

Table 3: Coinfections

Coinfection Pair	Cases (n)	Percentage of Coinfections (%)
Rhinovirus + RSV	10	40
Rhinovirus + Influenza virus	5	20
RSV + Influenza virus	4	16

Table 4: Severity of Infections

Severity Indicator	Cases (n)	Percentage (%)
Hospitalization	30	35.3
Complications	15	17.6

Table 5: Age Distribution and Pathogen Susceptibility

Viral Pathogen	Age Group
Rhinovirus	2-5 years
RSV	Under 1 year old
Influenza virus	5-10 years old

Table 6: Seasonal Variation

Season	Prevalent Viral Pathogens
Winter (Nov-Mar)	RSV, Influenza virus
Spring and Fall	Rhinovirus

Table 7: Association with Clinical Symptoms

Viral Pathogen	Associated Symptoms
Rhinovirus	Rhinorrhea, Nasal Congestion
RSV	Wheezing, Dyspnea
Influenza virus	Fever, Myalgia

DISCUSSION

Overview of Findings

This study provides valuable knowledge into the epidemiology and clinical characteristics of viral respiratory infections among pediatric patients presenting with acute respiratory infections (ARIs) at Guntur Medical College Hospital. The findings shed light on the prevalence, severity, age distribution, seasonal variation, and clinical associations of viral pathogens implicated in ARIs, offering important implications for disease management and prevention strategies.^[8,9]

Prevalence of Viral Pathogens

Our study revealed a high prevalence of viral pathogens among pediatric patients with ARIs, with

Rhinovirus, Respiratory Syncytial Virus (RSV), and Influenza virus being the most commonly identified pathogens. This finding is consistent with previous studies highlighting the prominent role of these viruses in pediatric respiratory infections.^[10] The high prevalence highlights the importance of targeted diagnostic testing and vigilant surveillance to effectively manage and control viral respiratory infections in pediatric populations.

Coinfections and Disease Severity

The occurrence of coinfections, particularly Rhinovirus + RSV coinfections, observed in our study highlights the complexity of viral respiratory infections and their potential impact on disease severity. Coinfections have been associated with increased disease severity and healthcare

utilization.^[11] In our study, a subset of patients required hospitalization, with complications such as pneumonia or bronchiolitis observed in a notable proportion of cases. These findings emphasize the need for clinicians to consider the possibility of coinfections and assess the severity of illness promptly to initiate appropriate management strategies.

Age Distribution and Seasonal Variation

Our study revealed variations in the susceptibility to specific viral pathogens based on age groups, with Rhinovirus predominantly affecting children aged 2-5 years and RSV being more common in infants under 1 year old. Influenza virus exhibited a broader age distribution, primarily affecting school-aged children. Seasonal variation analysis demonstrated higher prevalence of RSV and Influenza virus during the winter months, whereas Rhinovirus showed consistent prevalence throughout the year with slight peaks in spring and fall.^[12] These findings highlight the importance of age-specific preventive measures and targeted vaccination strategies, particularly during peak viral seasons.

Clinical Associations

The association of specific clinical symptoms with viral pathogens provides valuable knowledge into the clinical manifestations of different viral respiratory infections. Rhinovirus was predominantly associated with mild upper respiratory symptoms, whereas RSV was correlated with more severe lower respiratory symptoms such as wheezing and dyspnea.^[13] Influenza virus was associated with systemic symptoms like fever and myalgia. These clinical associations aid in timely diagnosis and targeted management of viral respiratory infections in pediatric patients.^[14]

Implications and Future Directions

The findings of this study have important implications for healthcare providers, public health officials, and policymakers in implementing evidence-based interventions to reduce the burden of viral respiratory infections in pediatric populations. Future research directions may include longitudinal studies to further elucidate the natural history of viral respiratory infections, evaluation of the effectiveness of vaccination strategies, and investigation of novel therapeutic interventions to mitigate disease severity and transmission

CONCLUSION

This study offers a thorough understanding of the epidemiology and clinical features of viral respiratory infections in pediatric patients with acute respiratory infections. The results emphasize the significance of continuous monitoring, precise diagnostic procedures, and evidence-driven interventions for the efficient management and prevention of viral respiratory illnesses in children.

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