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ADENOVIRUS AS A CAUSE OF ACUTE RESPIRATORY DISTRESS IN CHILDREN IN WASIT PROVINCE

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Abstract:

Background:

Human adenovirus (HAdV) is commonly associated with acute respiratory distress syndrome (ARDS) in children, especially children younger than 5 years.

Objectives:

This study conducted detection respiratory adenovirus that causing acute respiratory distress in children in Wasit Province.

Materials and Methods:

The current study included 100 children (aged 1–5 years) clinically with viral chest infections admitted to the hospital. out of 100 samples, 49 samples were positive for the presence of adenovirus.

Throat swab samples were collected. data was collected through the utilization of a prearranged questionnaire, which was used to conduct interviews with Study samples families. also, the gathered information included: Age, Sex, Living area, Primary or Secondary infection. the identification of adenovirus was detected using conventional PCR technology

Result:

The result included 49 children were infected with adenovirus, including 26 males (53.1%) and 23 females (46.9%). 37 (76%) of infected people were less than 3 years old, while 12 (24%) were between 3 and 5 years old.

Regarding place of residence, 18 (36.7%) of patients resided in urban areas, while 31 (63.3%) resided in rural areas.

Conclusions:

The study concluded that adenovirus infection is an important cause of virus-associated acute respiratory distress syndrome. the males are more susceptible to respiratory infections than females. In addition, younger children, especially those under 3 years old, have more severe adenovirus infection than other ages. The study revealed that patients who live in the rural are more severity infection with adenovirus than those who live in the urban.

Keywords: adenovirus, acute respiratory, children.

Introduction

Human Adenovirus (HAdV) is that may affect many organs, such as the airway, lungs, and eyes. HAdV is responsible for infections primarily in younger children, as they have a deficiency in humoral immunity [1].the infection is transmitted through inhalation of virus-containing droplets that are suspended in the air as an aerosol [2]. adenovirus infection can be detectable year-round [3].

HAdV infection is frequently associated with Acute Respiratory Infection (ARI) is a prevalent factor contributing to illness and death in children [4]. HAdV infections mostly affect the respiratory tract, accounting for about 5–7 % of respiratory diseases in young infants. Specific diseases, epidemiological situations, and demographic risk groups are associated with specific HAdV species and serotypes[5].

HAdV infections usually appear as mild to moderate in severity [6]. respiratory disease that presents a risk to life, which is associated with HAdV infections, primarily affects young children, older adults, and those with significantly weakened immune systems [7].

Adenoviral respiratory infections may manifest as upper respiratory tract infections (URTI), tonsillitis, bronchitis, and pneumonia. although most adenoviral respiratory infections are generally of mild to moderate severity resulting in a variety of symptoms such as sore throat, rhinitis, fever, bronchitis, and pneumonia. [8][9].

Human adenoviruses (HAdVs) contribute to around 5% to 11% of bronchitis cases [10]**.**bronchitis is the medical term for inflammation of the bronchi, which are the big airways responsible for transporting air to the lungs [11].

Adenovirus also causes a bronchiolitis disseminated disease of the lower respiratory tract characterized by inflammation and obstruction of the small airways in the lungs [12], and between 5% and 18% of infants suffer from bronchiolitis. a large number of cases of bronchiolitis eventually develop into pneumonia. early childhood adenoid bronchiolitis can have fatal consequences or lead to significant long-term lung damage and chronic disease [10].

In children, adenoviral infection is the leading cause of post-infectious bronchiolitis obliterans[13].the prognosis of bronchiolitis obliterans is generally unfavourable due to permanent pulmonary fibrosis and airway blockage.[14].

Adenoviruses are a type of pathogenic organism that can cause community-acquired pneumonia (CAP). they account for approximately 5% of adult CAP infections. adenovirus pneumonia resulting in death is infrequent among individuals with a healthy immune system [15]. specifically, there has been an increasing incidence of outbreaks and isolated instances of viral pneumonia in individuals with a healthy immune system, leading to a significant mortality rate among those with severe cases of adenovirus pneumonia [16].

Severe adenovirus pneumonia (SAP) is challenging to identify in the early stages due to ambiguous clinical signs. This is mostly because children have an immature immune system, particularly in terms of humoral immunity[17].

Severe adenovirus respiratory infection is more likely to occur in those who are younger than 7 years old and have a history of chronic disease [18][19]. this study was prepared and his aim was to detect human adenovirus causing acute respiratory distress in children admitted in Wasit Governorate.

Methodology

The research was carried out on pediatric patients diagnosed with severity of viral respiratory infection (VRI), aged between 1 and 5 years, who were hospitalized. a province-wide case-control study was undertaken in Wasit province. The samples collected in Al-Zahraa Teaching Hospital, Al-Karama Teaching Hospital, and Al-Kut Hospital for maternity and Children in the period between December 2023 and

February 2024. the study included 100 patients have clinically with viral chest infections admitted to the hospital, appeared 49 patients showed positive results for the presence of adenovirus. throat swab sample was obtained from each participant and detection of presence of virus by standard conventional PCR (Figure 4).

Statistical analysis:

The statistical software SPSS version 26 and Microsoft Office Excel 2010 were used to analyze the current study's data. an independent sample t-test was used to examine the variance in means between the two groups, assuming the variable follows a normal distribution.

Ethical approval

The required ethical clearance was received from the hospital's ethics committee, along with the permission of the patients. Prior to sample collection, all patients were thoroughly informed and given the option to grant their permission for the purposes of testing and publishing of findings.

Results

1. Frequency distribution of patients with adenovirus according to age groups

The present study included 49 patients with adenovirus. patients < 3 years comprised 76.0%, more than patients ≥ 3, 23%. Figure 1

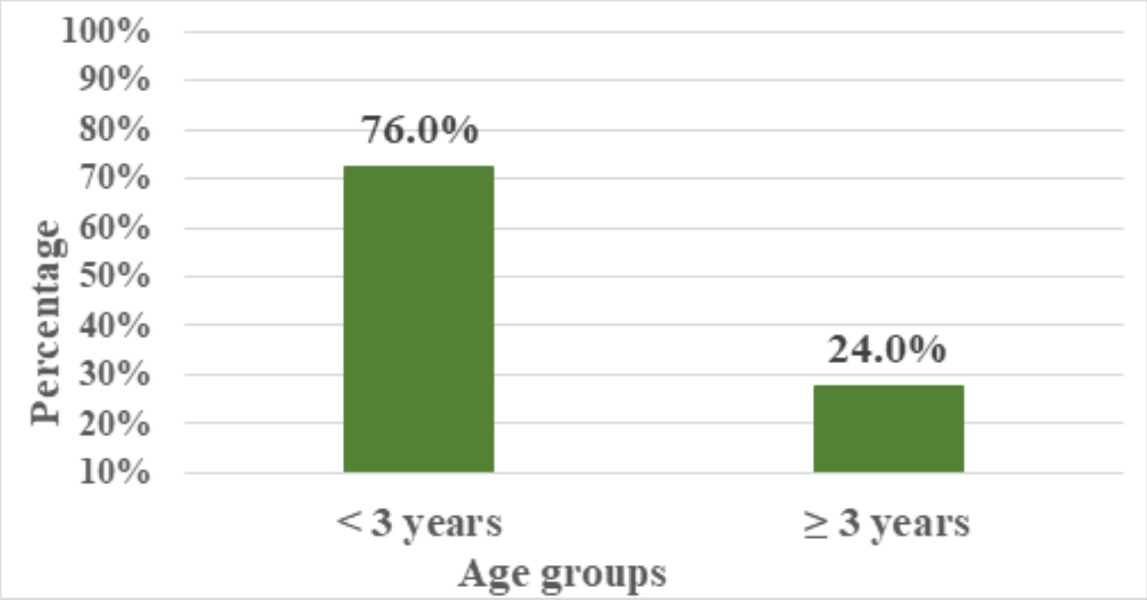


Figure (1) Distribution of patients according to age groups

2. Frequency distribution of patients with adenovirus according to sex

In the current study showed the male positive to adenovirus infection 53.1%. this is relatively higher than that of females, whose percentage was 46.9 is shown in Table 1.

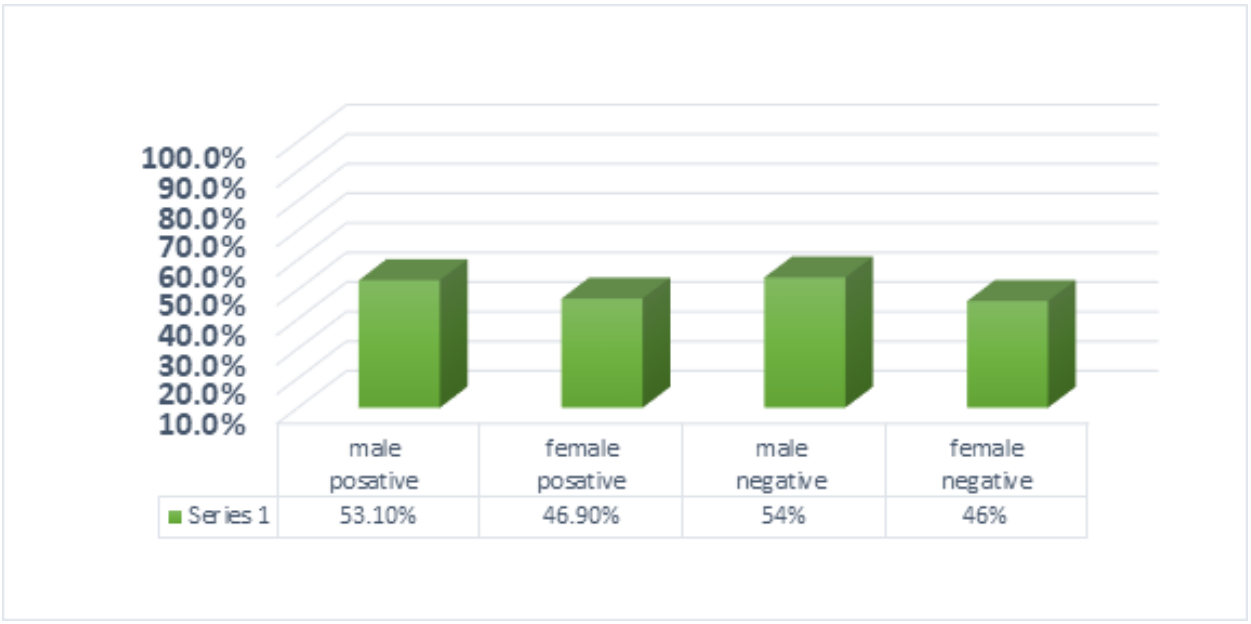


Figure (2) Distribution of positive to adenovirus and negative subject according to sex

3. Distribution of patients with adenovirus infection according to residency

The study appeared distribution of patients infected with adenovirus infection according to residency as the percentage of patients residing in the rural areas accomplish 63.3 %, which is higher than the percentage of patients living in urban areas, 36.7%. figure (3)

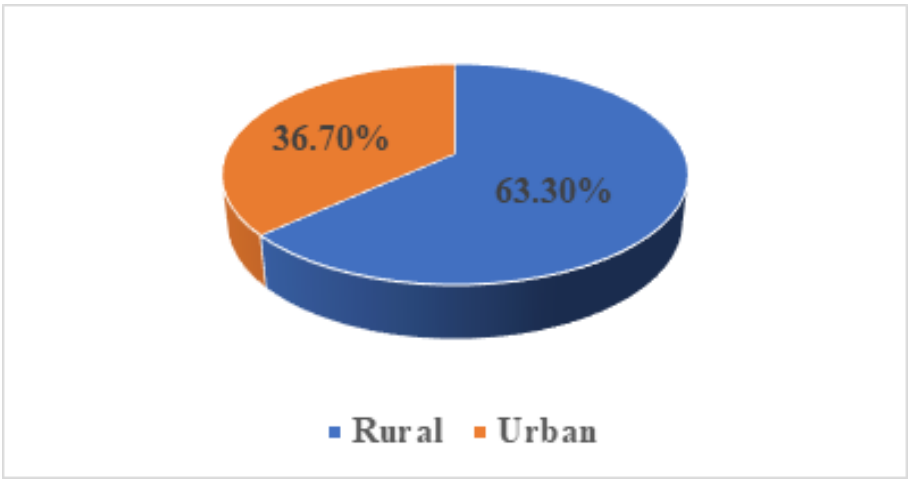


Figure (3) A pie chart illustrating the distribution of patients with adenovirus infection according to residency

Table (1): Demographic characteristics of patients positive of Adenovirus infection and Negative of Adenovirus according to results of conventional PCR examination for *Adenovirus*:

Characteristic	Patients positive of Adenovirus *n* = 49	Negative of Adenovirus *n* = 51
Age (years)		
Range	1-5	1-5
< 3, *n* (%)	(76%) 37	62%)(32
≥ 3, *n* (%)	24%)12 (	38%)(19

sex		
Male, *n* (%)	(53.1 %)26	54%) (28
Female, *n* (%)	(46.9 %)23	46%)(23
Residency		
Urban, *n* (%)	36.7 %)18 (	48%)(24
Rural, *n* (%)	63.3 %)31 (	52%)(27

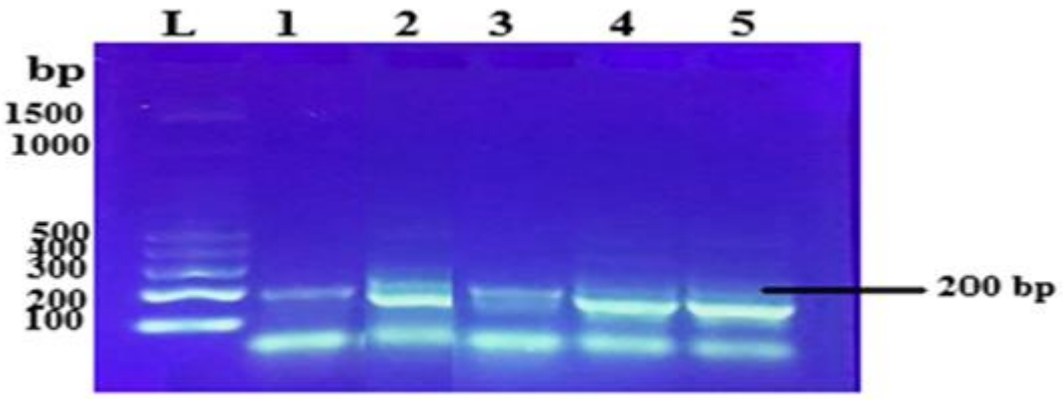


Figure (4): Agarose gel electrophoresis image that showed PCR product analysis of specific gene for detection *Adenovirus*. L (Marker ladder 1500-100bp). Lane (1-5) Showed some positive *Adenovirus* specific gene at 200bp product size.

Discussion

Adenoviruses may affect people of all age groups, but young children, usually aged between 6 months and 2 years, are most susceptible [20].in the current study, it appears that most of the enrolled patients have adenovirus were less than 3 years old, accounting for 76% while enrolled 24% for The patient's ages range from 3 to 5 years. the results showed that adenovirus infections mostly impact young children, particularly those who are under the age of 5. More specifically, this result agreement with a specific study discovered that children who were under the age of 5 constituted the largest portion of cases testing positive for adenovirus, with 87.64% of cases falling within this age range [24] , Lower respiratory tract infections, including bronchiolitis and pneumonia, which are often linked to adenovirus infections, are more common in children less than 2 years old . [21] . The fact that younger children, especially those less than 2 years old, need more time in the hospital after contracting respiratory adenovirus [22].

According to the scientists, infants aged 0 to 12 months are more susceptible to illnesses since their immune system is not fully developed or weakened it can also be affected [23]. Additionally, research from Uganda highlighted a significant association between age and HAdV infections, with 98% of positive cases occurring in children aged 5 years and below [24].

The absence of herd immunity and particular vaccine intervention increases the likelihood of widespread transmission and epidemic outbreaks, posing significant risks to public health [25]. [26] found is the Adenovirus pneumonia is a prevalent viral lung infection that primarily affects children. It is characterized by a distinct pattern of seasonal outbreaks, with a higher incidence between the winter and spring months in the southern areas of China. Increasing data indicates that adenovirus is responsible for approximately 5-10% of respiratory tract infections in children [27]. The global prevalence of infection has led to significant public health concerns due to its elevated rates of illness and death, particularly among individuals with weakened immune systems [28].

According the sex, in the present study the distribution of Adenovirus infection among male and female patients varied the percentage of males reached 53% while the female 46% the data shows that there is a varying male predominance among individuals who have tested positive for Adenovirus infections. this result similar result of [29] the research examined Adenovirus pneumonia in immunocompetent adults and found that the majority of patients were male, accounting for 80% of the cases. furthermore, in china a research investigating adenovirus-associated acute respiratory distress syndrome (ARDS) revealed that 78.57% of the patients with adenovirus-associated ARDS were males, highlighting the greater occurrence of this condition in men. Also, the study itself found conducted on pediatric patients with severe adenovirus pneumonia revealed a male to female ratio of 5:1 among those with severe and very-severe viral pneumonia [30] . additionally, a study on adenovirus infections in hospitalized children found that 63.8% of the patients were males, with adenovirus being less common compared to other respiratory viruses but still significant in terms of morbidity and mortality [31] . hence, while the precise percentages may vary slightly across various research groups, the statistics consistently demonstrate a greater occurrence of Adenovirus infection among male patients.

A research done in a Spanish country found that being male is considered a major risk factor for RSV. This vulnerability is influenced by the X chromosome, which contains several genes associated with both innate and adaptive immune activity. These genes consist of pattern recognition receptors (PRR) such as toll-like receptor (TLR) 7, TLR8, and interleukin 1 receptor associated kinase (IRAK-1). Because females have two copies of the X chromosome, their phenotypes demonstrate redundancy and variety. On the other hand, men have just one X chromosome, leading to a 5% decrease in heterozygous loci compared to females [32]. [33] propose that a lack of heterozygous loci may heighten the vulnerability to viral infections.

In the current study on respiratory adenovirus infections, it was found that a higher percentage of patients with rural residence, 63.3%, were affected compared to those residing in urban areas, accounting for 36.7% of the cases, these results are fully consistent with study conducted in Northern Vietnam during an outbreak of respiratory Human Adenovirus (HAdV) infections in children revealed that patients with rural residence accounted for 63.3% compared to 36.7% with urban residence [34] findings who observed greater incidence of viral respiratory infections in children under the age of 5 in rural areas compared to urban areas. this disparity in infection rates based on residential location highlights a potential link between living environment and susceptibility to respiratory adenovirus. Additionally, the study emphasized the importance of regular monitoring of circulating strains of adenovirus to better understand and manage outbreaks, especially in pediatric populations.

The potential correlation between air pollution and heightened morbidity in children due to respiratory illnesses [35]. Previous research has determined that benzene is the air contaminant that exhibits the highest predicting capability for RSV peak activity. the primary sources of air pollution caused by human activity are mobile and stationary combustion sources, which include traffic density, incinerators, industrial systems, and household heating. Experimental evidence has indicated that benzene induced toxic damage to the pulmonary airways is caused by pathogenic pathways. This damage leads to apoptotic alterations in the parenchymal components of the lungs [36]. the primary way in which most air pollutants cause harm is by directly acting as pro-oxidants for lipids and proteins, or by generating free radicals. This leads to oxidative stress and triggers inflammatory reactions [37] [38] .

Conclusion

human adenoviruses (HAdVs) can cause respiratory infections in children, especially those under 5 years of age and causes severe inflammation of the respiratory system that sometimes leads to serious consequences leading to hospitalization. the study found that males are more susceptible to severe infection with adenovirus than females, as it showed ages under 3 years are more severe than other ages.

The study showed that the residence plays a role in infection, as it was found that the infection rate for children in the rural is higher than for those who live in the urban.

The study recommended the need to consider that adenovirus is a virus that infects the respiratory system and causes serious consequences. Early and effective identification of the virus is crucial, as is intervention to prevent disease development and lower the death rate in severely infected patients.

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