
Original Article

Incidence of *Adenovirus* Diarrhea in Children under 6 years Referred to the Pediatric Emergency and Clinic of Ghaem Hospital, Mashhad, Iran

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ABSTRACT

Background and Aim: *Adenovirus* is the leading etiological agent among the causes of acute diarrhea in infants and young children and the second cause of diarrhea in children by age of 4 years. However, there isn't an accurate statistic for the frequency of adenovirus diarrhea in our area. So we decided to perform a study on the incidence of adenovirus in acute diarrhea.

Materials and Methods: In this study, the incidence of adenovirus infection was studied in 200 children less than six years of age who were suffering from acute gastroenteritis between March 2008 and July 2009 in Mashhad, Iran. Adenovirus antigen was detected by Latex Agglutination Test (Rotascreen) method.

Results: Adenovirus was detected in 2% of the stool samples that were collected from children. The frequency of adenovirus infection was significantly higher among patients 12-24 months of age (75%) than children of more than 30 months (25%) old. The highest rate of adenovirus antigen detection was observed among 12-24 months of age group. The peak incidence was in winter and autumn.

Conclusion: Adenovirus is an important and common agent in causing gastroenteritis in children less than 6 years of age. Adenovirus is more dangerous than rotavirus; there is no need to use antibiotics for treating these children. We should recognize the agent in order to cure the patients with conservative actions.

Iranian J Pediatr Soc 2010; 2(2): 70-74

Keywords: Adenovirus, Agglutination, Diarrhea

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

INTRODUCTION

Viruses are one of the most important causes of gastrointestinal problems all over the world and infect especially children under 5 years of age in the third world and even developed countries. Next to *Rotavirus*, one of the microorganisms causing acute diarrhea especially in infants and children is *Adenovirus*.

According to the demographics, 3-5% of all respiratory infections and diarrhea in the United State of America (USA) and a higher number in developing countries are because of *Adenovirus*. Although *Adenovirus* is less prevalent than *Rotavirus* in causing acute diarrhea, its complications is very dangerous in children under 5 years of age.

In United States of America around 72% of the admitted patients to the hospitals were children under 2 years and 90% of hospitalized patients are less than 3 years old. In USA the peak incidence of adenoviral diarrhea is between November and May, which starts in Southwest and extends to Northeast.

Adenovirus infection in children is associated with a variety of clinical manifestations and disease syndromes with different degrees of severity. Most of these infections can not be diagnosed based upon clinical criteria alone (1). Stool specimens from 872 children less than 7 years of age attending the Children's Medical Center in Tehran, Iran with gastroenteritis were tested for the presence of Adenovirus (Ad) types 40 and 41; the results of which were 3.3% Ad 40 and 3.4% Ad 41, respectively (2). Adenovirus is the second most common cause of viral gastroenteritis in hospitalized patients (3).

Moreover, it seems that infection with *Adenovirus* is an important hygienic issue in our country. Identifying the accurate rate of prevalence and incidence of this virus is of particular importance, as it will help us with our future programming for the correct control and choosing specific treatment methods for the

disease in special seasons and the time of adenovirus epidemic.

MATERIALS AND METHODS

Acute diarrhea is defined as the abrupt onset of abnormally high fluid content in the stool *i.e.* more than the normal value of approximately 10 ml/kg/d (3). In this study increase in defecation volume, watery and semi-watery defecation and defecating more than several times in a day according to the previous medical history of the patient, was defined as acute diarrhea.

This study was performed on 6 year old children with diarrhea that had referred to the Clinic and Pediatric ward of Ghaem Hospital between March 2008 and July 2009. The stool samples were taken once from these children. Fresh stool assessment was done by microscopic examination and finding WBCs and RBCs. In addition, the stools were cultured in order to check bowel pathogens. After taking smears and culturing, the samples were kept in -20 °C for assessing the existence of adenovirus antigen. As we know the usage of agglutination test is a fast and easy way for identifying adenovirus antigen in stools, we decided to use M80 Adenoscreen kit made by Microgen Company.

According to the kit instruction, in order to achieve a suspension of 10% density, 0.1 gr of stool was dissolved with 1 cc solvent. Afterwards, the product was put in a centrifuge with 1000 gm for 10 min. Then 50µL of superficially translucent liquid collected with pipette was put on a surface of a special round plate and one drop of test solution (M80a) and a drop of control solution (M80b) were added and all samples were mixed with a particular stick. Finally the plate was put in a Shaker machine for 2 min until the needed reaction happened. The positive result would be confirmed if agglutination reaction was seen only in test solution (M80a) [without the same reaction in control solution (M80b)], and if the reaction was not seen in both of them, the test would be assigned as negative.

RESULTS

Among 200 cases which were assessed in this study, 4 cases (2%) were adenovirus positive. In regards to the importance of age distribution, necessary examinations were done. The majority of infected cases (3 of the 4 adenovirus positive cases) were seen among children under 24 months old (75%). The highest number was seen among children between 12 and 24 months and the lowest number was seen in children older than 4 years (Table 1).

In this study patient's smears were examined according to their inflammatory factors. In this part of the study the criteria for assigning "the positive smear" was observation of 5 or more than 5 RBCs or WBCs in stool smear (Table 2).

In this study probable correlation between the incidence rate of adenovirus infection and different seasons of a year were examined (Table 3). In a survey of different seasons of year, incidence rate of adenovirus infection in autumn and winter was 50%. According to these findings, a significant difference between autumn and winter with other seasons was observed.

DISCUSSION

Prevalence of enteric adenovirus (in 1420 stool samples) from children with diarrhea in four Brazilian cities had 1.55% positive adenovirus agglutination in stool. In our study we had the same results. Types 40 and 41 of *Adenovirus* are more virulent in causing acute gastroenteritis than respiratory infection (4).

In a Sudanese study with stool examination of 3 groups (50 healthy children, 50 healthy adults, and 50 adults suffering from diarrhea) *Adenovirus* was detected by PCR and percent of positive sample in these groups were reported 50%, 18%, and 25%, respectively (5). In Imanzadeh and co worker's study in Mofid Children's hospital (Tehran), frequency of *Adenovirus* in acute diarrhea was reported as 1.5% (6).

Adenovirus infections are common and induce enteric disease more than respiratory infection in children. These infections usually are self-limited and diagnosed by many methods (7). *Adenoviruses* are a big family of enter viruses that include 51 serotypes in 6 groups. Enteric adenovirus types 40 and 41 induce diarrhea in 97% of the cases (8).

In a study from Taiwan conducted on 64 adenovirus positive sample stools of patients, 1.6% patients had bloody diarrhea and 57% of them were hospitalized (9). Gastroenteritis symptoms such as diarrhea, vomiting and abdominal pain (cramp) occur more in winter (10).

In assessing the existence of inflammatory factors (more than 5 RBC or WBC/hpf) no significant results were found ($p < 0.01$). This result confirmed the fact that adenovirus is one the reasons of non-inflammatory diarrhea (9,10).

Seventy percent of adenoviral positive cases had inflammatory factors, which can be interpreted in this way that there were other intestinal pathogens and simultaneous infections as well. This research claimed that the incidence

Table 1. Frequency distribution of patients with positive adenovirus according to age (month)

Age groups (months)	No. of patients	No. of adenovirus positive	Percent of adenovirus positive
0-5.9	30	0	0
6-11.9	36	0	0
12-23.9	44	3	1.5
24-47.9	53	0	0
48-72	37	1	0.5
Total	200	4	2

Table 2. Frequency distribution of patients in regards to inflammatory smear

Percent	No. of patients with RBC in stool	Percent	No. of patients with WBC in stool	No. of WBC/hpf in stool (count in the microscopic field)
89.5	170	91.5	183	0-5
6.5	13	5	10	5-15
4	8	3.5	7	>15
100	200	100	200	Total

Table 3. Distribution of adenovirus positive patients in different seasons

Seasons	Examined cases	Positive cases	Percent of positive cases
Spring	50	0	0
Summer	50	0	0
Autumn	49	2	2
Winter	51	2	2
Total	200	4	4

of adenoviral infection in breast-fed infants less than 12 months is less than the other groups. This confirms the highest rate of adenoviral infection that could be found in infants being formula fed alone or plus breast milk.

Moreover, there is a probable reason that the proteins in powdered or pasteurized milk can reduce the amount of antibody absorption. These kinds of antibodies which are in breast milk can play a protective role against infectious agents. Enterovirus and adenovirus are common in infancy, causing mostly asymptomatic infections. In a study from Norwegian infants *Enterovirus* was found in 11.3% and adenovirus in 11% of stool samples (11).

CONCLUSION

Adenovirus is an important and common agent in causing gastroenteritis in children less than 6 years of age and is more dangerous than *Rotavirus*. Meanwhile there is no need to use antibiotics for treating these children and we should recognize the agent to cure the patients with conservative actions.

ACKNOWLEDGEMENT

This work (research plan with code 86408) was supported by a grant from Mashhad University of Medical Science. We thank Mr. Habibullah Taghizadeh who helped us in performing this research.

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