

Detection of Adenovirus Among a Sample of Hemodialysis Patients in Baghdad city

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KEYWORDS

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ABSTRACT

Background: Adenovirus is a DNA virus that was identified in the 1950s from cases of atypical pneumonia in military recruits. Most of the elevated serotype group has been isolated from People who are immunocompromised. While most viral infections are self-limiting, those that affect people with impaired immune systems can be significantly more hazardous and occasionally fatal. Due to increased rates of viral infection, individuals whose renal function has reached its end are suffering from impaired immune responses. The instant study was designed to detect the infection with adenovirus among HD patients in Baghdad city. Objective: To detect of adenovirus in hemodialysis (HD) patients. Methods: In this cross-sectional study, a total of ninety samples patients on maintenance HD attending the Dialysis centers of Al-Kadhimiya Educational Hospital and Al-Yarmouk Teaching Hospital and Al-Shu'ala General Hospital in the period from November 2023 to March 2024. Using enzyme linked immunosorbent assay (ELISA) kit, serum samples were examined for the existence of adenovirus-specific immunoglobulin (IgG) and conformation by using molecular polymerase chain reaction (PCR). Results: Out of 90 hemodialysis patients, the seropositive result for adenovirus-IgG was 41 (68.33). While 16 (26.67) patients were positive by PCR with significant difference ($p \leq 0.01$). In addition, 22 (36.67%) patients were males and 19 (31.67%) were females. Conclusions: Patients undergoing HD are susceptible to adenovirus infection, the sero-prevalence of adenovirus in patients considered as risk factor.

1. Introduction

Adenoviruses are members of the Adenoviridae family belong to the genus Mastadenovirus. The virus was first isolated from human adenoids, which is where the name came from. Adenoviruses are non-enveloped viruses with an icosahedral nucleocapsid containing a double-stranded linear DNA [1]. Transmission can occur via inhalation of aerosolized droplets, direct conjunctival inoculation, fecal–oral spread, or exposure to infected tissue or blood [2]. Common symptoms of adenovirus 37 venereal infection, which was initially found in prostitutes, include cervicitis and urethritis. Adenovirus 11 and, less frequently, adenovirus are the causes of hemorrhagic cystitis, which primarily affects young males. 21. Adenoviruses generally establish asymptomatic continuous infection of the renal and may be shed in the urine for months or years. This is observed particularly in immunocompromised individuals, such as renal transplant recipients [3]. Adenovirus infections in immunocompromised people can arise from original infections or endogenous reactivation. Infections can be acquired de novo or via reactivation of latent virus from the recipient or the transplanted organ [4]. This study focused on identifying of adenovirus infection among hemodialysis patients.

2. Methods And Discussion

Study design and setting

This is a face-to-face interview-based cross-sectional study conducted in Baghdad, Iraq, from November 2023 to March 2024. Ninety hemodialysis patients were recruited for the study.

Inclusion and exclusion criteria

The study included hemodialysis patients aged 21 years from November 2023 to March 2024, in Baghdad, Iraq. We excluded kidney patients who are not undergoing dialysis.

Data collection and outcome measurements

The interview was conducted by the same researcher among participants, with clarification of any question that seemed unclear to make the answer more accurate.

Ethical consideration

The Medical Research Ethics Committee at the College of Medicine/University of Tikrit obtained ethical approval. We solely used the data for the purposes of this study. We obtained written informed consent from the participants.

Statistical analysis

All data were analyzed using SPSS (Ver.28) (IBM) program and GraphPad Prism (Ver. 8). The statistical analyses were performed using analysis of variance (ANOVA) and independent t-test as appropriate by calculating least significant difference (LSD) to obtain a p-value. Data were presented as Mean \pm S.E. and a p-value $p < 0.05$ was considered significant.

3. Results and discussion

The study included 60 HD patients and 30 control group. Table 1 displays the characteristics of the study sample. 22 (36.67%) were males and 19 (31.67%) were females with no significant difference

Table 1: Sex distribution of hemodialysis patients infected with adenovirus.

Adenovirus (n:60)	HD patients			
	Male		Female	
	No.	%	No.	%
Total positive	22	36.67	19	31.67
Negative	11	18.33	8	13.33
Total	33	55	27	45
<i>P. value</i> * = 0.35 NS				

Regarding the result of PCR, there were 16 (26.67%) of patients positive for adenovirus, while 3 (30%) of the control group were positive for adenovirus, with highly significant difference (Table2).

Table 2: Detection of adenovirus polymerase chain reaction.

Adenovirus DNA (PCR)	HD patients		Control group		<i>P. value</i>
	No.	%	No.	%	
Positive	16	26.67	3	30	<0.001**
Negative	44	73.33	7	70	
Total	60	100	10	100	

Of the 60 HD patients 41 (68.33%) were seropositive for adenovirus IgG antibody, while among control group all samples were negative for adenovirus IgG antibody, with highly significant difference (Table 3).

Table 3: Adenovirus IgG seropositivity rates in study groups

Adenovirus IgG	HD patients		Control group		P-value
	No.	%	No.	%	
Positive	41	68.33	0	0	<0.001**
Negative	19	31.67	30	100	0.0018**
Total	60	100	30	100	

Of the 60 HD patients 41 (68.33%) were seropositive for adenovirus IgG antibody, while among control group all samples were negative for adenovirus IgG antibody, with highly significant difference (Table 4)

Table 4. Association of adenovirus seropositivity and polymerase chain reaction results with age groups

groups	Positive	Negative	Positive	Negative
21-40 No.	2	24	14	8
years %	10.53%	47.05%	23.33%	42.10%
41-60 No	11	23	21	8
years %	57.89%	45.09%	35%	42.10%
61-80 No	6	4	6	3
years %	31.58%	7.84%	10%	15.78%

The study indicated that 36.67% of patients infected with adenovirus were males and 31.67% were females. The result was non-significant ($P>0.05$). The current study was in agreement with another study in Kirkuk displayed that no significant difference was found between male and female patients with adenovirus infection in HD patients [5]. Other study also showed that no association exists between adenovirus viremia and sex [6]. AL-Mousawi *et al* [7] reported that slightly difference was noticed in the distribution of adenovirus in males than females, however, the difference was not significant ($p=0.740$). Another study took place in Erbil Governorate on pediatric patients found no significant relation between males and females in patients with adenovirus infection [8]. Another study conducted in four Sub-Saharan African nations also revealed no distinction between patients infected with the D-adenovirus species [9]. Ganapathi *et al* [10], revealed that there was no significant gender difference among patients with adenoviral infection who had renal failure. The current study demonstrated that the rate of adenovirus infection (Adv Ab by ELISA) in hemodialysis patients was 68.33% comparing with 0% of the control group. The result was highly significant ($p<0.001$). Genetic analysis of adenovirus by PCR was determined using the primers from region of adenovirus, showed that 26.67% of HD patients had adenovirus DNA (+ve PCR). The result was highly significant ($p<0.001$). The spectrum of an adenovirus infection in immunocompromised hosts can vary from shedding without symptoms to a deadly severe illness [11]. For transplant recipients, acute necrotizing tubulointerstitial nephritis is the most severe and lethal form of adenovirus-induced urinary tract infection. [12]. Adenoviral infection-related transplant complications include hydronephrosis [13]. Hemorrhagic cystitis was the most common adenovirus symptom in a retrospective investigation involving 206 patients [14]. The current study with agree with other study in Kirkuk city, who was found that 71% of HD patients had adenovirus comparing with 12% of the control group had adenovirus with highly significant relation ($p<0.01$) [5]. Other study in Najaf

documented that 66.6% was the overall prevalence of adenovirus in Iraqi HD patients with highly significant relation ($p < 0.001$) [15]. On the other hand, Echavarria *et al* [16] reported that adenovirus infection was detected in 28.57% of patients with stem cell transplantation by PCR technique and there was non-significant difference ($p > 0.05$). Watcharananan *et al* [17] who found that results among 17 examined patients before and after transplantation. Of the 17 patients, 13 (76.5%) presented adenovirus early, more than 3 months after transplant with highly significant relation ($p < 0.002$).

The organ involved in the patient's underlying illness is related to a type of adenovirus infection. [18]. Less than 23% of adult patients who have undergone kidney, heart, or liver transplants have been reported to have an adenovirus; however, A prolonged infection is not linked to organ rejection, and the symptoms of an infection tend to be insignificant. Furthermore, severe and even lethal consequences have been noted [19]. The present results revealed that the highest rate of adenovirus infection (35%) was found within the age group 41-60 years followed by those within the age group 21-40 years (23.33%). Other study in Iraq found that the highest rate of adenovirus infection was recorded among HD patients who belonged to the age group ≥ 40 years [6]. Hadi *et al* [5] discovered that individuals under 40 had the highest viral infection rate (28.48%), followed by patients over 50 (25.32%). A study also showed that an association exists between adenovirus viremia and age ($P < 0.05$). At the same time, other study in China, was reported that patients positive for adenovirus were 43.4 %, 34% and 22.6 % in the age groups ≤ 29 years, 30-49 years and ≥ 50 years respectively, p value was significant 0.023 [7].

other studies revealed that the average age (54.93 ± 19.04 years). Florescu *et al* [20] found the high median of adenovirus infection occurred in 47 years old males [21]. Zekavat *et al* [22] indicated that among adult group kidney transplant patients, there was an elevated rate of adenovirus infection. These differences in age groups may be explained by the patients' immune systems or by previous infections that occurred before the development of chronic impairment. Older patients will likely have weakened immune systems. The spectrum of an adenovirus infection in immunocompromised hosts can vary from shedding without symptoms to a deadly severe illness [11]. The most severe and lethal form of adenovirus-induced UTI in patients of transplants is acute necrotizing tubulointerstitial nephritis [12]

Study limitations

The limitations of the study include the lack of follow-up by women to determine the time needed for MC changes to return to normal and the relationship between the time of receiving the vaccine and the menstrual phase was not taken into consideration.

Conclusion

High rates of adenovirus antibody was recorded in HD patients compared with healthy control, 26.67% of Iraqi HD patients who were adenovirus-Ag positive by PCR. The highest rate of adenovirus infection was found in HD patients within the age group 41-60, highest percentage of adenovirus infections were found in males comparing with females.

Conflict of interests

No conflict of interests was declared by the authors.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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