

# Adenovirus and Bacterial Pathogens Isolated from Eye Infections

Sharmeen N. Majeed\*, Najat A. Zaman

College of Science, University of Kirkuk, Kirkuk, Iraq

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## ABSTRACT

**Background:** To performs an investigation of viral and bacterial conjunctivitis among conjunctivitis cases recorded at the Azadi Teaching Hospital from January through December 2019.

**Objective:** The present study was conducted to investigate the causes of viral and bacterial eye infections, which included inflammation of conjunctivitis.

**Methods:** A structured questionnaire containing demographic and clinical data was developed in order to collect data on the cases. Eye swab specimens were collected and detection of adenoviruses (AdVs) was performed by the SAS Rapid Adeno test, while bacteria were isolated and Identification by API 20E and vitek 2.

**Results:** Culture investigation showed that out of 130 samples, 58 (44.61) of them have showed positive bacterial growth, 53.44% male and 46.55% female, 72(55.38) samples have showed no bacterial growth. The most common bacteria isolated were *Staphylococcus aureus*, which showed a high occurrence of 19 (32.75%), While other bacteria were less than *S.aureus*. Out of 80 cases 30 cases were diagnosed with viral origin (63.33% male and 36.66% female).

**Conclusions:** SAS Rapid Adeno testing could identify the cause of viral conjunctivitis; this study is one of the very few studies on viral and bacterial conjunctivitis in Kirkuk City. These results demonstrate the need for a control program for outbreaks of viral and bacterial conjunctivitis.

**Keywords:** Adenovirus, Eye infection, Bacterial infection, SAS Rapid Adeno, Kirkuk.

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## INTRODUCTION

The most common infectious conjunctivitis is viral conjunctivitis caused by adenovirus.<sup>1</sup> AdVs are middle-sized, icosahedral, non-enveloped, double-stranded DNA viruses that can cause a wide range of diseases such as conjunctivitis, respiratory tract, gastrointestinal tract, and urinary tract, which vary in severity, depending on the serotype, many infections of the glandular virus are asymptomatic, and the virus may persist in the host, adenovirus is one of the leading causes of eye disease and are responsible for 65 to 95% of viral conjunctivitis worldwide.<sup>2</sup> Clinical manifestations epidemic conjunctivitis (EC), Pharyngoconjunctival fever.<sup>3,4</sup> Hospitals, especially ophthalmic units, schools, and nursing homes, are the most vulnerable transmission places<sup>5</sup> and personal hygiene is good to prevent infection.<sup>6</sup>

Bacterial conjunctivitis are the second most public reason of infectious conjunctivitis, with most uncomplicated cases determining in one to two weeks.<sup>7,8</sup> It is characterized by the occurrence of congestion of the veins, the presence of purulent secretions, the feeling of the presence of a foreign body in the eye, itching, and adhesion of the eyelids together. The chronic

type is harmless initially and lasts for a long time, as the infection extends to the eyelids: an inflammatory reaction in the lacrimal system or maybe a simple inflammation will occur. The most common causes of infection are *Staphylococcus aureus*, *Neisseria gonorrhoeae*, *Streptococcus pneumoniae*, *Corynebacterium diphtheriae*, *Moraxella lacunata*, and *Haemophilus influenzae*.<sup>9</sup>

Conjunctivitis is usually diagnosed on the basis of clinical symptoms; laboratory tests confirm the diagnosis. Laboratory tests include immunological methods, rapid immune detection through special test kits, PCR molecular diagnostic methods, and cell culture.<sup>1</sup>

SAS Rapid Adeno test is a laboratory qualitative test to identify all recognized adenovirus serotypes using different monoclonal antibodies. This method can assess pathogens' existence in minutes compared with other methods that take a long time to produce results.<sup>10</sup>

## METHODS

The rapid assay was conducted according to the manufacturer's instructions, and the results were interpreted by the presence or absence of visually detectable colored lines (Figure 1).

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\*Author for Correspondence: sharmeennajat@yahoo.com

A total of 130 clinical samples were collected from patients (specific viral and bacterial conjunctivitis according to the physician’s opinion and confirmed by cultures). Eye swabs were collected from patients with infected bacterial conjunctivitis by sterile swabs with transport media. Specimens submitted to the Diagnostic Microbiology Laboratory at Azadi Teaching Hospital from January through December 2019 for virology and bacteriology testing were evaluated using the SAS Rapid Adeno test (SAS scientific, USA), 30 adenovirus positive and 50 adenovirus negative samples obtained from 80 patients.

The sterile swab was rubbed on the inflamed area and cultured onto, MacConkey agar, blood agar, and chocolate agar media, they were aerobically incubated for overnight at 37 ° C. Positive growths were then subjected to the following procedure: Gram’s staining for differentiation between gram-positive and negative bacteria.<sup>11</sup> The API-20 E method identified all gram-negative bacteria; the procedure was carried out as suggested by the manufacturer’s instructions. (BioMérieux, France). Gram-positive bacteria were identified by vitek2 compact. VITEK-2 Compact represents advanced colorimetric technology for bacterial identification.

**Statistical Analysis**

The statistical analysis system (SAS 2010) was used in this study on the effect of the different factors in the studied traits. The differences between the means were compared with the least significant difference of LSD, and the percentages were compared with the Chi-square test.

**RESULT AND DISCUSSION**

Out of 130 samples, the positive bacterial growth for patients with ophthalmitis was 58, representing 44.61% of the total samples. At the same time, 72 samples gave a negative result representing 55.38%, which have shown no growth.

The current study shows that people infected with adenovirus were of both genders and Table 1 shows the infection rates for both genders. Out of 30 positive cases, the number of males infected with this virus was 19 (63.33%),



**Figure 1:** SAS Rapid Adeno test kits showing testing wells, sample (S), and control (C) lines.

while the infected females reached 11 (36.66%). And statistical analysis showed that there were highly significant differences between gender and infection with adenovirus at a probability level  $p \leq 0.01$ .

Moreover, bacterial conjunctivitis have shown that males were more infected than females (53.44%) for males and (46.55%) for females. Statistical analyses of the results have indicated that no significant differences were observed between males and females in bacterial eye infection susceptibility. As shown in Table 1.

Conjunctivitis is caused by an infectious agent (bacterial or viral) and bacterial conjunctivitis usually occurs in one eye, in contrast to viral inflammation, which often begins with one eye and is transmitted to the other.<sup>12</sup>

Levent *et al.*,<sup>13</sup> (2009) have found that the rate of males infection with adenovirus is higher than that of females, where the rate of infection in males (63%), while in females the rate of infection was (37%), this is consistent with the results of the current study.

For bacterial conjunctivitis, males were also more likely to be infected more than females; he attributed this to the fact that the boys are more mobile and tougher than females and thus more vulnerable to accidents of eye infections and others.

It was found through the current study that people who live in urban are more likely to be infected with viruses and bacteria. The rate of infection with adenovirus reached (63.33 %) for those living in the urban, while those living in rural areas have reached (36.33%). As for the percentage of bacterial infections, the infection rate in people living in urban was (77.58%), and the infection rate in people living in rural was (22.41%). Statistical analysis demonstrated the presence of high significant differences between the incidence of viral and bacterial eye infection and the area of residence at the probability level  $p \leq 0.01$ , as shown in Table 2.

The rate of bacterial infection in the city is higher than in villages. This is due to the widespread environmental pollution in all cities of the province in recent years and to congestion in housing and conductors as well as the collection of waste inside the cities unscientifically.<sup>14</sup>

In Table 3, when statistical analysis has been performed to the results, no significant differences were observed between the co-infection. We found that the percentage of people with co-infection relative to adenovirus + *S.aureus*, *S.epidermidis* (36.8%), and Adenovirus + *S.aureus*, *S.pneumonia* amounted to (26.3%) of 19 common samples taken from people with diseases in the conjunctiva of the eye. The external eye surface harbors

**Table 1:** Percentages of the gender of patients infected with viral conjunctivitis and bacterial conjunctivitis

Gender	Viral conjunctivitis		Bacterial conjunctivitis	
	NO	%	NO.	%
Male	19*	63.33	31 <sup>n.s</sup>	53.44
Female	11	36.66	27	46.55
Total	30	100%	58	100%
Statistical Analysis	*=0.01 Chi-Square = 3.805 p-value = 0.044		n.s = no significant Chi-Square = 0.007 p-value = 0.935	

**Table 2:** Relationship between areas of residence and eye infection

Areas of residence	Viral conjunctivitis		Bacterial conjunctivitis	
	NO	%	NO.	%
Urban	19**	63.33	45*	77.58
Rural	11	36.66	13	22.41
Total	30	100	58	100
Statistical analysis	**=0.05 Chi-Square = 12.214 p-value = 0.0004		*= 0.01 Chi-Square = 3.975 p-value = 0.046	

**Table 3:** Number and Percentage of positive and negative(bacteria and virus co-infection) detected in eye swabs.

Co-infection	Adenovirus + Bacteria type	Positive		Negative	
		No.	%	No.	%
Male	Adenovirus+S. <i>aureus</i> <i>S.epidermidis</i>	7	36.8%	4	21%
Female	Adeovirus+ <i>S.</i> <i>aureus</i> + <i>S.</i> <i>Pneumonia</i>	5	26.3%	3	15.7%
Statistical Analysis		n.s=no significant p-value 0.709 Chi-Square = 0.139			

commensal bacteria, such as the species *Staphylococcus*, which form the resident flora, the intraocular tissue is fairly immune-privileged and can be compromised by any organism that can penetrate the inside of the eye.<sup>15</sup> This co-infection was formed due to the presence of different bacterial types and the adenovirus that have synergistic relationships to cause the disease. The cause of the involvement of bacteria in disease events is the presence of viruses that provide appropriate invasion conditions in addition to weakening body immunity; the adenovirus is a prominent cause of ocular, respiratory, and digestive diseases that are common in healthy and immunocompromised children.<sup>13</sup>

## CONCLUSIONS

Patients with eye infections typically suffer from pain, blurred vision, and red-eye. Conjunctivitis is the most common eye infection and rarely threatens vision. There is a current and ongoing need for the rapid, accurate diagnosis of ocular infection. In the present study, the circulating adenovirus that causes conjunctivitis in Kirkuk, Iraq, between January through December 2019, was documented using SAS Rapid Adeno in which considered an accurate, efficient, and rapid means of diagnosing adenovirus, these data will be useful in predicting future outbreaks of adenovirus infection. The study showed that the percentage of male infections is higher than that of females. Those who live in urban are more likely to be infected than those who live in rural. The current study showed that *Staph aureus* is the common cause of conjunctival diseases, followed by *Staph epidermidis* with a ratio close to that of *Staph aureus*. Bacterial species causing Co-infection among themselves in the eyelid are *Staph aureus*, *S. epidermidis*, *S. pneumoniae* with Human adenovirus.

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