

Occurrence of Ophthalmological Infections among Patients with COVID-19

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ABSTRACT

Since the emergence of COVID-19 in Wuhan city in China, it represents a major challenge to ophthalmologists in their daily clinical practice. Patients with COVID-19 can presented with different ophthalmological infections and manifestations, conjunctivitis is the commonest as well as other features such as lid swelling, tearing, discharge, ocular pain, tearing and red eye. The aim of this study was to identify the ophthalmological infections among patients with COVID-19 in an attempt to understand how likely the eye Infections is spread among these patients. Also to address any difference in these symptoms compared to non-COVID (control) individuals presented with eye infections. This study included 256 cases; of them 142 were positives for COVID-19 and 114 were not. Eye infections reported among various age groups (one to more than 60) years. The data about (age, residency, vaccination, symptoms, chemotherapy, infection type), in addition, the differences between males and females show that the females are more likely to get infected with COVID-19 and Eye infections. The main manifestations of eye infection reported among COVID-19 patients were ocular pain which is the more frequent followed by tearing and congestion. Other findings including red eye, lid swelling and discharge were less frequent. The most prevalent type of eye infection among COVID-19 patients was conjunctivitis, which was 17.6%. Rate of vaccinated patients was low. The main treatment administered for eye infection was topical antibiotics while small proportion of the patients required combined systemic and topical antibiotics.

Keywords: COVID-19, SARS-CoV-2, Ophthalmological Infections, Manifestations

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1. INTRODUCTION

The SARS-Cov-2 virus was officially named by the World Health Organization (WHO) on February 2020 as a cause of COVID-19 and one month later, the WHO declared a global pandemic status of the disease due to widespread of the virus worldwide. However, SARS-CoV-2 virus is marked as a highly pathogenic coronavirus compared to earlier forms of SARS-CoV in 2002 and 2012 [1]. Clinical symptoms of COVID-19 include fever, cough, fatigue, and symptoms of gastrointestinal infection. The elderly and those with underlying health conditions are the most susceptible to infection. COVID-19 primarily affects the respiratory system, with its greatest impact on the alveolar epithelium (simple squamous epithelium). Damage to alveolar epithelial cells is considered the main cause of acute respiratory distress syndrome [2].

Despite there are several epidemiological measures for preventing the spread of infectious, the eyes and conjunctival mucosa have not received sufficient attention as a potentially relevant route of infection and entry of the virus into the respiratory tract, this raised concerns that respiratory diseases could be transmitted through ocular secretions [3] Therefore, it is crucial to understand the basic anatomy and physiology of the eye for understanding eye diseases and conditions. Structurally, the eyeball includes exposed parts of the eye such as the palpebral conjunctiva, which lines both eyelids internally, and the ocular conjunctiva, which covers the cornea (iris and pupil) externally. Due to its moist environment, the ocular conjunctiva forms a mucosa, which includes the epithelium and underlying connective tissue [4]. Conjunctivitis has been documented as a common disease of bacterial and viral etiology and has been described in association with coronavirus infection, causing inflammation and vasculitis suggest that the novel coronavirus can infect and reinfect the respiratory tract through the conjunctiva as a potential route of infection from the conjunctival sac and acinar cells of the lacrimal gland, via the nasolacrimal duct to the nasal cavity, through the presence of the ACE2 receptor [5,6]

Ocular infections may lead to distressing symptoms, such as pain, redness, itching, blurred vision and discomfort. Several pathogens can impact distinct parts of the eye. Consequently, the treatment varies according to the type of eye infection. Although some ocular infections, may resolve spontaneously, others can be severe and may result in irreversible vision loss.

Different microorganisms and viruses can cause ocular infections; the more frequent one is the viral, followed by bacterial and less commonly the fungal eye infections. Eye infections may result from viruses, bacteria, or, less frequently, fungi. However, the viral infection is more common in adults while bacterial infection is more in children. Types of eye infections, their symptoms, and treatment methods are varied accordingly [7,8].

Manifestations of eye infection can be unilateral or bilateral where the patients may feel a sensation of an object in the eye, itching, pain, sensitivity to light, eyelid tenderness, continuous tearing and other symptoms. Also patient may have discharge (yellow, green or clear), some patients may have fever, swollen lymph nodes, swollen eyelid [8,9].

Studies conducted in Italian hospitals suggest that viral ocular involvement may occur at the onset of COVID-19 infection and that the virus can replicate in the conjunctiva, representing a potential source of infectivity. The exact pathophysiology of ocular transmission of the virus remains incompletely understood, although there is evidence that SARS-CoV-2 is detected in ocular secretions; therefore, it is worthwhile to consider the virus's ocular tropism and its potential to cause localized ocular disease [10]. Therefore, the present study aimed to determine the main ophthalmological infections among covid-19 patients.

2. METHODOLOGY

This study conducted between 8th February 2022 to 29th March 2022 and included patients with COVID-19 and eye infections where their PCR was positive, the total number of cases was (142) individual were taken from the epidemiological ward of Al-Shefaa General Hospital and Al Mawani teaching Hospital, patients of all age groups and both genders were included. Additionally, a total of 114 individual who did not have COVID-19 were included as control group and they were almost matched for the COVID-19 group. Data about each patient were reported in questionnaire paper for each individual participant (cases and controls), which included (age, gender, residency, vaccinations status), in addition, the clinical findings which involve having COVID-19 or not, the chemotherapy they take, and symptoms they did have that related to eye infection including lid swelling, red eye, tearing, congestion, discharge and ocular pain.

Statistical analysis was carried out using SPSS version 23, two way T test (student's T-test) and chi square to find out the statistical differences between variables accordingly and when applicable. Probability of error (P. value) of less than 0.05 was considered significant

3. RESULTS

A total 256 patients were enrolled in this study, of them 152 (59.4%) were females and 104 (40.6%) were males. Patients aged older than 60 years contributed for the higher proportion, (37.5%), among the 256 cases followed by those at the age 51-60 years, (28.9%), those aged 41-50 years (16.4%), it is observed that the proportion of patients increased with advancing age. Patients who lived in central regions contributed for 61.3% and the remaining 38.7% of the studied population lived in peripheral regions. This variation because the hospitals are closer central than peripheral regions. All these findings are shown in **(Table 1)**.

Regarding the vaccination status, only 72 participants (28.1%) got vaccinated, of them 33 (12.9%) received single dose and 39 (15.2%) received two doses while none received third doses, from other point of view, a significant difference was found in the vaccination status between males and females, where the rate of vaccinated women was 21.7% which is lower than that among men where the rate was 37.7%, (P. value<0.05) as shown in **(Table 2)**.

The higher rate of non- vaccinated patients may be due to the lack of awareness of the people about the vaccination and may have no desire to vaccinate. The distribution of the clinical ophthalmological manifestations of the studied group revealed that the most presenting symptom of eye infection in patients with COVID-19 is the ocular pain 104 from the total cases, tearing in 41 patients, then congestion with 23 cases, while 7 for red eye and 3 patients with lid swelling and 3 patients with discharge, (P.value = 0.0381), As shown in **(Table 3)**.

The distribution of types of eye infections reported among the studied groups revealed that Conjunctivitis was the more frequent (P. value<0.05), **(Table 4)**.

Regarding the treatment in most patients the topical antibiotic (eye drops and / eye drops + ointment) was the more frequently administered, in 60.5%, however, in 11 patients (4.3%) topical & Systemic antibiotic were administered, (P. value<0.05), **(Table 5)**

Table 1. Demographic characteristics of the studied group (N=256)

Variable	No.	%
Gender		
Male	104	40.6
Female	152	59.4
Age (year)		
1-10	7	2.7
11-20	13	5.1
21-30	5	2.0
31-40	19	7.4
41-50	42	16.4
51-60	74	28.9
>60	96	37.5
Residence		
Central	157	61.3
Peripheral	99	38.7
Total	256	100.0

Table 2. Vaccination status of the studied group according to gender

Vaccination status	Female		Male		Total	
	No.	%	No.	%	No.	%
Non vaccine	119	78.3	65	62.5	184	71.9
Vaccinated						
Vaccine 1st	16	10.5	17	16.3	33	12.9
Vaccine 2nd	17	11.2	22	21.2	39	15.2
Total vaccinated	33	21.7	39	37.5	72	28.1

Yates corrected Chi-square = 6.85, P. value = 0.008 significant

Table 3. Incidence of ophthalmological manifestations among the studied groups

Manifestation	COVID-19		Non-COVID-19	
	No.	%	Np.	%
Ocular pain	104	73.2	11	9.6
Tearing	41	28.9	57	50
Congestion	23	16.2	12	10.5
Red eye	7	4.9	36	31.6
Lid swelling	3	2.1	67	58.8
Discharge	3	2.1	61	53.5

*Chi square = 7.346, P. value = 0.001 significant

Table 4. Types of eye infections reported among the studied groups

Infection type	COVID-19 group		Non-COVID-19 group	
	No.	%	No.	%
Conjunctivitis	25	17.6	69	60.5
Eye stye	2	1.4	53	46.5
Chalazion	1	0.7	49	43.0
Viral Keratitis	1	0.7	62	54.4
Chi square= 8.921, P. value = 0.0392				

Table 5. Types of treatment for patients with eye infections

Treatment	No.	%	
Topical antibiotic	Eye drops	104	40.6
	Eye drop & Ointment	49	19.1
Topical & Systemic antibiotic	11	4.3	
chi square = 4.623, P. value = 0.0469 significant			

4. DISCUSSION

Since the emergence of COVID-19 in Wuhan city in China, it represents a major challenge to ophthalmologists in their daily clinical practice. Patients with COVID-19 can presented initially with conjunctivitis as the first presenting symptom of the disease [11] as well as other features such as lid swelling, tearing, discharge, ocular pain, tearing and red eye.

The present study documented that the main manifested symptoms of eye infection in individuals with COVID-19 were ocular pain which is the more frequent reported in 104 cases followed by tearing in 41 cases, congestion in 23 cases giving a rate of 73.2%, 28.9%, and 16.2%, respectively. Other findings were less frequent including red eye in 7 cases (4.9%), lid swelling in 2.1% and also discharge in 3 cases (2.1%). From other point of view, the most prevalent type of eye infection among COVID-19 patients in this study was conjunctivitis, which was reported in 25 cases (16 female and 9 males) with a total proportion of 17.6%, these findings consistent with previous study conducted by [5]. Conjunctivitis may arise at different stages of COVID-19 infection. In a previous study, Eman Al-Sharif and her collogue documented that coronaviruses had lower eye-tissue-tropism and that conjunctival

congestion was uncommon in cases with COVID-19. Additionally, Al-Sharif et al. reported that in different stages of COVID-19 infection the SARS-CoV-2 viruses can be excreted in the ocular fluid before the results of throat swab was positive, hence, the eye must be considered as a potential source for the dissemination of infection despite the low prevalent viral loads in the ocular tissue [12]. In our study, all the clinical manifestations did not significantly vary across the age groups on the other hand, all the examined variables did not exhibit significant differences across both genders. Previous literatures showed that the ocular manifestations could be attributed to the direct effects of the virus, immune-mediated tissue damage, activation of the coagulation cascade, and the prothrombotic state generated by the viral infection, in addition to the presence of concomitant comorbidities and pharmacological interventions employed in the treatment [13–17]

Despite the isolation of the viral RNA from the ocular tissue, the role of eye as an infection route remains under debate in the scientific community of the ophthalmologists. On the other hand, ophthalmic symptoms may either be the initial symptom of COVID-19 infection or may occur many weeks post-recovery. Therefore, Ophthalmologists must recognize the potential correlations between ocular diseases and SARS-CoV-2 to inquire pertinent medical history, identify relevant signs, and recommend proper investigations tests, and consequently reduce the infection transmission while diagnosing and commencing early treatment for complications that threaten life and vision [17–25].

It has been widely postulated that ophthalmological manifestations show a wide diversity in their presentations in term of severity and timing. Previous studies documented that patients with severe systemic diseases characterized by aberrant hematological and inflammatory markers, were more likely to have ophthalmic manifestations compared to those with no or mild systemic diseases [27]. Furthermore, it had been proposed that unprotected eye exposure can lead harboring the SARS-Cov-2 infection [15]. However, there are different theories about the route of spread of virus to the eyes, among these theories is the direct inoculation of the conjunctiva, the transmission of infection from the upper respiratory tract via the Naso-lacrimal canal or via hematological transmission due to involvement of the lacrimal gland [6]. It is worth mentioned that some pharmaceuticals employed in the treatment of COVID-19 may affect the eye and ocular tissue and may result in retinal toxicity,

retinopathy, retinal vein occlusion, serous retinal detachment and other complications [28,29]. It has been documented that ophthalmic manifestations may appeared within a time from 5-12 days from the time of development of COVID-19 based on the affected ophthalmic site [30]. In general, the incidence of ocular symptoms in patients with COVID-19 varies from 2%-32% [31]. Till the present time, the causality relationship between eye manifestation and involvement in the pathological process of COVID-19 has not been definitively proven for any of these illnesses. Ophthalmologists are urged to document cases linked to COVID-19 to enhance the global knowledge base [32].

5. CONCLUSIONS

The main manifestations of eye infection reported among COVID-19 patients were ocular pain which is the more frequent followed by tearing and congestion. Other findings including red eye, lid swelling and discharge were less frequent. The most prevalent type of eye infection among COVID-19 patients was conjunctivitis, which was 17.6%. Rate of vaccinated patients was low. The main treatment administered for eye infection was topical antibiotics while small proportion of the patients required combined systemic and topical antibiotics.

Ethical Approval:

All ethical issues were approved by the author. Data collection and patients enrollment were in accordance with Declaration of Helsinki of World Medical Association , 2013 for the ethical principles of researches involving human. Signed informed consent was obtained from each participant and data were kept confidentially.

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