Perspective of Ocular Manifestations in Coronavirus Infection: A Review

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ABSTRACT

Coronavirus (COVID-19), the disease has become pandemic within a short span of time. Transmission of this disease occurs with the secretions from infected individuals to another directly. The secretions can be inhaling of droplets, saliva, or droplets of the infected person. It is a controversial statement if this pandemic can be transmitted through tears. However, this affects various parts of the body, and there exist associated ocular findings. Considering the reported studies on the ocular signs and symptoms of the disease, it has certainly drawn attention to the eye’s anterior segment. These findings include conjunctivitis, epiphora, and chemosis. This narrative review aims to understand the impact of coronavirus on the retina as there are numerous families of viruses that contribute to retinopathy. This review focuses on the imaging techniques that can be implemented to assess the affected patients’ retina. The pandemic has re-enforced health systems to evolve with technology; hence artificial intelligence can be considered to evaluate the ocular signs in patients who report with COVID-19.

Key Words: COVID-19, Coronavirus, Ocular symptoms, Ocular signs, Retina, Fundus imaging

INTRODUCTION

The Coronavirus (COVID-19) is a pandemic, which was generally evolved in Wuhan, China. The initial case was presented as pneumonia which eventually turned into a severe acute respiratory syndrome (SARS-CoV). The diagnosis of COVID 19 at the early stages is necessary to prevent the virus from dispersing from one person to another. It usually has four stages, namely imported cases, local transmission, community transmission, epidemic. Although this pandemic has reached stage four, hence early detection and appropriate treatment become mandatory.

The name Coronavirinae (CoVs) is derived from a Latin word corona means crown. The family Coronaviridae has a sub-family CoVs. These are further divided into four genera, namely alphacoronavirus, betacoronavirus, gamma coronavirus, and delta coronavirus. These zoonotic viruses that are regularly transmitted from animal species to humans.¹ Among this alpha- or the beta- CoV is known to cause the disease among humans. The seven types of CoVs ² known to infect humans are illustrated in Figure 1.

[Figure 1: Types of Coronavirinae (CoVs).]

The crown-shaped COVID-19 has an approximate diameter between 6 and 140 nm and is capped by 9 to 12 nm lengthened typical spikes.² The virus is known to enter the human cell and binds with the angiotensin-converting enzyme (ACE) 2 protein. This protein is usually found to be present in the epithelial cells of the lungs and other tissues. Patients with diabetes mellitus and hypertension are found to have increased expression of ACE-2 protein.³

Transmission of the virus as postulated can be through contaminated dry surfaces or self-inoculation of mucous membranes of the nose, eyes, or mouth.⁴ The survival of viruses in the environment depends upon the temperature, nature of the surface, and relative humidity. It can survive more than
If left untreated, it can lead to serious complications. Whereas shortness of breath, chest pain, loss of taste or smell, persistent cough, sputum production, and myalgia are common respiratory features. The marginal symptoms include gastrointestinal inflammation, diarrhea, fatigue, cough, sputum production, and myalgia. Studies report that 30%-40% of the patients presenting with symptoms of COVID-19 manifest ocular findings which are consistent with conjunctivitis.

There are various preventive measures for opthalmologists that should be taken care of during diagnosing such patients. The precautions include patient isolation, sanitization, wearing a mask, gloves, goggles, shield, gowns, silence, fast track, outdoor clothes, etc. However, the correlation of COVID-19 with any of the ocular manifestations is still in its onset, to uncover the disease’s suspicion. In this paper, the ocular manifestations and corona virus-induced retinal changes are being reviewed.

CLINICAL SIGNS AND SYMPTOMS

The nature of COVID-19 patients can be symptomatic as well as asymptomatic. The various features observed in symptomatic COVID-19 patients can be respiratory or marginal. The common respiratory features include fever, headache, diarrhea, fatigue, cough, sputum production, and myalgia. The marginal symptoms include gastrointestinal inflammation, ocular congestion, skin rashes, headache, and loss of taste or smell, whereas shortness of breath, chest pain, loss of speech or movement are some of the serious symptoms. Although there are various symptoms for the detection of COVID-19, the precise diagnosis of the disease is still elusive.

OCULAR TRANSMISSION AND PATHOGENESIS

The only source of transmission of the disease through the eyes is the tears, therefore it is alarming for opthalmologists to diagnose COVID-19 in the eyes as well. However, the researchers explain its transmission and pathogenesis through ACE 2 protein as well. The presence of ACE-2 is also seen in the anterior segment of the eye, which is similar to receptors of avian influenza species and the human influenza virus. These are extensively present in the corneal and conjunctival epithelium, similar to the nasal and tracheal mucosal lining. Hence it can be proposed that the transmission of this virus can occur through the tears in the ocular surface to the nasal cavity and tracheal tissues. However, the tears get renewed constantly by the lacrimal glands in the eye, and it can be speculated that the virus enters the tears in the form of droplets, which might be then transferred to the nasal and tracheal tissues.

Choudhary et al. in 2017 postulated that the ACE-2 protein is majorly expressed in the posterior segment of the eye and can be commonly seen in the retinal pigment epithelium. A few studies suggest that COVID-19 is proficient in producing a wide spectrum of ocular manifestations including sight-threatening conditions such as retinitis and optic neuritis. The virus may develop in-vivo mutations that can transform the manifestations of the disease. At present, there is limited literature supporting the COVID-19 infection through ACE-2 and its adverse effects in the eye. As this pandemic continues, a better understanding of the virus is required to understand its pathogenesis in the eye.

OCULAR MANIFESTATIONS OF COVID-19

Studies report that 30%-40% of the patients presenting with positive COVID-19 manifest ocular findings which are consistent with conjunctivitis. This may also be accompanied by other ocular symptoms such as epiphora, conjunctivitis, chemosis, and anterior uveitis. The potential sources of transmission are the mucous membrane of the eye. According to a recent update by the American Academy of Ophthalmologists (AAO), conjunctivitis can be one of the symptoms in patients having this disease. If left untreated, it can result in keratoconjunctivitis and ultimately lead to severe blindness. Studies suggested the presence of the virus on the ocular mucosa is 35% of the eye CoVs and 10% of the associated conjunctivitis cases. Tears contact may thus rapidly lead to the spread of the virus which is a contradictory.

Can COVID-19 affect the Retina?

The COVID-19 pandemic has a massive impact on the human biological system, the associated coronaviridae decreases the cell-mediated immunity and makes the person highly susceptible to opportunistic viral ocular infections as well. Retinal findings in COVID 19 patients are still a mystery. It can be hypothesized that the pathogenesis of conjunctival and retinal microvasculopathy is perhaps similar and might involve increased plasma viscosity, circulating immune centers, and
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CONCLUSION

Although existing knowledge about COVID-19 is rapidly growing. Evidence shows its transmission through tears; however, its risk may be truncated. This paper gives an insight into the ocular findings due to coronavirus. Also, it is proposed that retinal images may guide ophthalmologist to understand its effect on the retina. Imaging considering the anterior and posterior segment complications is possible, but the pathophysiology still remains unclear. This can be understood by extensive clinical research among COVID 19 patients. Further, these images along with artificial intelligence can provide a basis to automate the diagnosis of COVID 19. Eye care professionals should pool in resources and work together to understand these ocular manifestations and address the current pandemic in a scientific manner.

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