

Characteristics of Ocular Findings of Patients with Coronavirus Disease

Marco Antônio Orsini Neves¹, Nicolle dos Santos Moraes Nunes², Thais de Rezende Bessa Guerra³, Jacqueline Stephanie Fernandes do Nascimento⁴, Janie Kelly Fernandes do Nascimento⁵, Renata Rodrigues Teixeira Castro⁶, Antonio Marcos da Silva Catharino⁷, Thiago Gonçalves⁸, Adalgiza Mafra Moreno^{9,*}

^{1, 6}MD, PhD, Faculty, Medical School, Iguazu University, Brazil

^{2,3,4,5}Medical Student, Medical School, Iguazu University, Brazil

⁷MD, MSc, Faculty - Medical School, Iguazu University, Brazil

^{8,9}PhD, Faculty - Medical School, Iguazu University, Brazil

*Corresponding author

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Abstract— The outbreak of COVID-19 spread rapidly to several countries, leading the World Health Organization to declare a pandemic situation. The correlation of this pathology with ocular structures has been discussed as a possible gateway to SARS-CoV-2. Given the urgency of information related to the control of COVID-19, this article aims to evaluate and expose the main ophthalmological manifestations resulting from viral infection by COVID-19. **Methodology:** This article proposes a review study regarding the current pandemic scenario. To this end, a search was carried out in the primary databases: LILACS, BIREME, PubMed in Portuguese and English, for articles based on current literature. The choice had taken place at random, obviously, following a line of reasoning of the authors involved. **Discussion:** A sequence of cases demonstrated the presence of SARS-CoV in the tear film by polymerase chain reaction with reverse transcription (RT-PCR). Considering that SARS-CoV and SARS-CoV-2 are part of the same family of coronaviruses, and share genetic similarities, it is plausible that the same is observed in COVID-19. During COVID-19 infection, conjunctiva inflammation is the most frequent ophthalmologic manifestation. The most commonly reported ocular manifestations so far are conjunctival hyperemia and watery discharge. **Conclusion:** Although there is still no well-established evidence, recent studies suggest that tears may be direct sources of ocular transmission of COVID-19. Also, reports of ocular manifestations in patients infected with SARS-COV-2 are very scarce, making further research related to the frequency of these events necessary.

Keywords— COVID-19; Ophthalmology; Conjunctivitis; Ocular manifestations; Retinopathy.

I. INTRODUCTION

An outbreak of highly infectious pneumonia caused by a new coronavirus (SARS-CoV-2) emerged in December 2019 in the city of Wuhan, China. ⁽¹⁾ The spread of the infection to other countries and continents, and the difficulty in controlling it, prompted the World Health Organization (WHO) to declare a pandemic situation

quickly. ⁽²⁾ The clinical conditions presented by patients infected with such pathology vary from asymptomatic individuals to severe conditions that culminate in death.

Coronaviruses are characterized as enveloped, capped, and polyadenylated RNA viruses. ⁽³⁾ The virus is believed to live in animals but can infect humans through the zoonotic transmission. ⁽⁴⁾ The human coronaviruses are

mainly disseminated by aerosols or droplets released when infected individuals cough, speak loudly or sneeze. Direct contact with contaminated fomites is also a route of human transmission of SARS-CoV-2. ^(5,6,7,8,9)

Several systemic manifestations of COVID-19 have been reported, notably: fever, dry cough, dyspnea and bilateral ground-glass opacity in computed tomography scans. ^(10,11,12) In addition to these, gastrointestinal changes and eye disorders have also been reported. The most frequent ocular manifestations evidenced are conjunctival hyperemia and watery secretion. ^(13,14)

The correlation between COVID-19 and ocular structures has been widely discussed as a possible gateway for the virus. ⁽⁵⁾ Even though the respiratory complications resulting from viral infection are well documented, the information regarding the ophthalmological impairment generated by the pathogen is still not very clear. Thus, the present article aims to assess and expose, through a bibliographic review, the main ophthalmological manifestations resulting from the viral infection by COVID-19 (FIGURE 1)

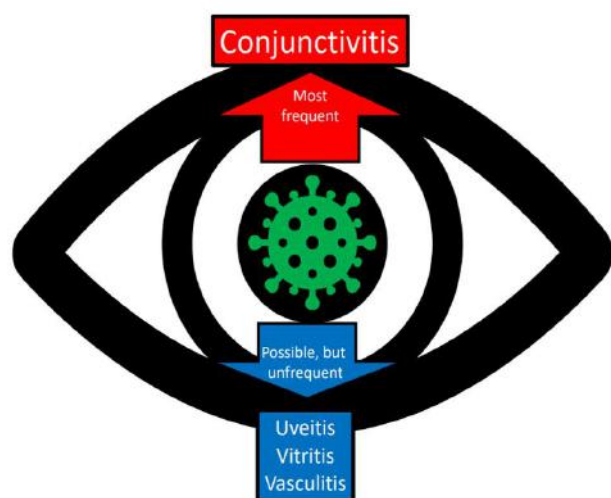


Fig.1: Ophthalmological manifestations resulting from the viral infection by COVID-19

II. METHODOLOGY

This article proposes a review study regarding the current pandemic scenario. To this end, a search was carried out in the primary databases: LILACS, BIREME, PubMed in Portuguese and English, for articles based on current literature. The choice had taken place at random, obviously, following a line of reasoning from the authors involved. The keywords searched were: COVID-19, ophthalmology, conjunctivitis, ocular manifestations.

III. DISCUSSION

In 2003, for the first time, a sequence of cases demonstrated the presence of SARS-CoV in the tear film by polymerase chain reaction with reverse transcription (RT-PCR). A study carried out with 36 patients diagnosed with SARS, found that three patients had samples of tears with positive results for SARS-CoV, through the conjunctival swab route. Considering that SARS-CoV and SARS-CoV-2 are part of the same family of coronaviruses, and share genetic similarities, it is plausible that the same is observed in COVID-19. ^(15,16)

The main receptor for SARS-CoV-2 in the human body is the Angiotensin-Converting Enzyme (ACE2) receptor. ⁽¹⁷⁾ In vitro study showed the expression of these receptors in cells of the conjunctiva and cornea, as well as the effective binding of SARS-COV-2 S240 proteins with the ACE2 receptor on cells. ⁽¹⁸⁾ Given the high vascularization of the conjunctiva and the expression of ACE2 on the surface of endothelial cells, the possibility of the ocular manifestation of COVID-19 being a transient local vasculitis cannot be excluded. ^(19,20,21) Beyond that, ACE2 receptors were observed in aqueous humor, which indicates that this may be the target of contamination by COVID-19. ⁽¹⁷⁾

Conjunctiva's inflammation is the most frequent ophthalmological manifestation of COVID-19 infection ⁽¹⁷⁾. Thus, conjunctival hyperemia and watery secretion are commonly reported ocular manifestations. ⁽⁵⁾ Nevertheless, some studies suggest the possibility of other eye diseases such as uveitis, vitritis, or retinal vasculitis by SARS-CoV-2 due to the presence of receptors of the Renin-Angiotensin-Aldosterone System in the ocular tissues. ^(22,23,24)

A study recently published by The Lancet exposed retinal changes in 12 adult patients, where nine tested positive for COVID-19; these were examined 11 to 33 days after the onset of symptoms. The diagnostic test used was RT-PCR and antibody testing. All patients reported asthenia, fever, and dyspnea, and 11 of these had anosmia. As a result, it can be seen that all patients had hyperreflective lesions to the point of ganglion cells and the internal plexiform layer, with a more robust presence in the papillomacular bundle of both eyes. ⁽²⁴⁾

In a systematic review, 252 patients infected with COVID-19 were analyzed, among which 32% demonstrated ocular conjunctivitis. ⁽²⁾ Three of these patients had conjunctivitis and positive ocular swab RT-PCR, eight had positive ocular swab RT-PCR without conjunctivitis, and fourteen had conjunctivitis during negative ocular swab RT-PCR. ^(25,26) The authors related

the inconsistency in the result of low viral load in conjunctival secretion, contamination of the sample, and damage to genetic material. Still, they suggest that conjunctival swab RT-PCR should not be proposed as a standard diagnostic technique for COVID-19. ⁽²⁶⁾

At the moment, there are still few studies that demonstrate eye changes in SARS-CoV-2; those that are currently published are from China and report just a few cases. A survey carried out in Hubei province, China, with 38 COVID-19 patients, found ocular symptoms in 12 of them. Symptoms included epiphora, conjunctival hyperemia, exacerbated eye discharge, and chemosis. Of these patients, one third had a severe form of COVID-19. Patients who develop eye symptoms are more likely to have leukocytosis and higher neutrophil counts, in addition to higher levels of procalcitonin, lactate dehydrogenase and C-reactive protein (CRP), when compared to patients who do not have ophthalmological disorders. ⁽²⁷⁾

Although there is still no well-established evidence, recent studies also suggest that tears may be a direct source of ocular transmission of COVID-19 and the target of infectious material. Considering that tears have a viral load, it is likely that contact with the eye may favor the inoculation of the virus. Therefore, it is worth noting that ophthalmologists point out that professionals working as a front line should be alert to conjunctivitis, mainly when associated with respiratory symptoms or fever, as they can predict SARV-CoV-2 infection. ⁽²⁷⁾

IV. CONCLUSION

It is clear that ophthalmological changes are associated with SARS-CoV-2 infection. This fact can be explained by the presence of ACE2 receptors in ocular tissues. Furthermore, the scarcity of studies on the pathophysiological mechanisms, as well as evidence of visual dysfunctions for SARS-CoV-2, are not decisive to confirm ocular transmissibility. Thus, further studies are needed in order to clarify the occurrence, or not, of ocular transmission.

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