

COVID-19 eye infection: Recommendations for ophthalmologist and patients

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ABSTRACT Coronavirus disease (COVID-19) is a public health emergency of international concern as declared by the World Health Organization on 30 January 2020. Currently, COVID-19 is spreading rapidly worldwide, with no proven treatment nor vaccination, thus infection control measures are paramount. The severity of the majority of COVID-19 cases is mild to moderate, with fever as its most common symptoms, followed by dry cough and fatigue. COVID-19 initially reported to be transmitted from bats but then evolved into human-to-human via droplets. Coronavirus has been detected in tears and conjunctival secretions, but there is still a controversy about whether the virus can be transmitted through tears. However, the ocular transmission might be transported through a lacrimal duct to nasopharyngeal mucosa and then cause an infection. Because the nature of close contact in doctor-patient interaction during ophthalmologic practice, strict measures must be taken to minimize the impact both on the patients and health care workers.

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1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection have been reported worldwide, since the first case was identified in December 2019, in Wuhan, China. The novel coronavirus disease 2019 (COVID-19) has now spread over the countries and has become a global pandemic. The situation reports – 14 from WHO was mentioned that, up until 14th June 2020, 7,690,708 cases were reported globally, where most cases (3,711,768) were situated in the Americas.¹ Coronavirus has an incubation period of 2 to 14 days and usually has mild to moderate severity, with fever as its most common symptoms, followed by dry cough, and fatigue.^{2,3} COVID-19 can cause many complications, such as acute respiratory distress, shock, and arrhythmia.³

In January 2020, an ophthalmologist in China was infected with coronavirus that transferred

from an asymptomatic glaucoma patient.³ It shows the possibility of potential transmission through droplets, aerosolized material, and tears. Some reports also have mentioned that the SARS-CoV-2 was detected in tears and conjunctival secretion. However, the transmission of COVID-19 through tears remains controversial.⁴ Ophthalmologists may be infected either through droplets or direct contact with the patients. The other possible transmission was through aerosol contact. Thus health care workers should do proper infection control measures to minimize exposure and cross-contamination.³ The comprehensive facts about SARS-CoV-2 epidemiology and characteristics are necessary for ophthalmologist to understand the outbreak.⁵ By better understanding of the transmission of SARS-CoV-2, hopefully, we could gain better insights on facing this pandemic.

2. Method

A thorough and in-depth exploration through PubMed and Scopus databases for publications on COVID-19 manifestation in ophthalmology from January 2020 to June 2020 was conducted by 2 authors (DR, ITM).

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Due to diversity of clinical and methodological among the articles, our review is presented in a narrative form. The following terms were included in the search of articles: SARS-CoV2, COVID-19, ophthalmology, coronavirus, outbreak, ocular transmission, epidemiology, recommendation. All types of review articles and clinical guidelines were included in this review, while case reports and case series were excluded from this review.

3. Result

3.1 Transmission of coronavirus

The whole genome sequences of SARS-CoV-2 reported to be 75–80% identical to SARS-CoV and shown express the similar host receptor with SARS-CoV, in which angiotensin-converting enzyme 2 (ACE2) receptor.⁵⁻⁸

3.2 Recommendation on environmental control

Cleaning the surrounding by using a disinfectant, such as povidone-iodine, chlorhexidine, alcohol solutions with at least 70% concentration of alcohol, hydrogen peroxide, citric acid, and many more is recommended to minimize the spreading of the virus.^{2,3}

3.3 Recommendation for outpatient setting

Reducing the number of patients in clinics and conduct voice/virtual call for consultation is recommended.^{2,9} Measuring patient's temperature, asking a screening questionnaire about history of traveling, and also history of close contact with a confirmed or suspected case of COVID-19 will help to recognize the patient at risk.^{2,3} Keep the waiting room as empty as possible, with a distance of 2 meters between patients, was also important.¹⁰ Last but not least, reducing contact time and speaking between ophthalmologists and patients would ultimately avoid the risk of SARS-CoV-2 infection.^{3,9,11}

3.4 Recommendation for inpatient setting

Rapid test for COVID-19 screening were mandatory before hospitalizations. Positive COVID-19 patients who need immediate eye care were admitted to an isolation wards.¹² Examination that occupies

ophthalmological instrument that stored in clinic, must be performed after the outpatient clinic finished all needed examination.²

3.5 Recommendation for surgical settings

Elective surgery must be postponed, and only emergency and urgent cases that may proceed.^{2,9} All protocols were mimics to the protocols for inpatient's settings.¹² Confirmed COVID-19 cases, need to be reassessed for the surgery, and postponed until the PCR result is negative.³ Personal Protective Equipment (PPE) is required for all the operating room staff.⁹ Local anesthesia is preferable to prevent aerosolization of the SARS-CoV2 virus.^{2,9} A recommendation regarding the surgery and outpatient clinics was listed by American Academy of Ophthalmology (AAO) in <https://www.aao.org/headline/alert-important-coronavirus-context>.

4. Discussion

4.1 Transmission of coronavirus

SARS-CoV-2 belongs to a novel *Betacoronavirus* of *Sarbecovirus* subgenus in the Coronaviridae family. It is an enveloped single-stranded RNA virus in which its genome resembles the SARS and MERS.^{7,13} A study reported that the whole genome sequences, SARS-CoV-2 was 75–80% identical to SARS-CoV.⁸ Moreover, several studies showed that the SARS-CoV-2 express the similar host receptor with SARS-CoV, in which angiotensin-converting enzyme 2 (ACE2) receptor.⁵⁻⁷ The infection coronaviruses can be done by two processes, in which binding to the host cell by spike (S) protein and S protein priming by cellular serine protease TMPRSS2.¹⁴ This is suggesting that both viruses exhibit similar route of transmission.

The transmission of SARS-CoV-2 from human-to-human occurred in the family settings, community, and hospital or clinics. Most of the transmission occurred via respiratory droplet, aerosolized, and contact transmission.^{6, 15} Thus, transmission the SARS-CoV-2 is likely happen through ocular surface. Several eye specimens were studied, among them, the expression of ACE2 and TMPRSS2 were positive in human conjunctiva, limbus, cornea, and pterygium tissues.^{16, 17} This is suggesting that SARS-CoV-2 transmission might be happen via ocular

surface. First, the coronavirus host receptor ACE2 was identified on several eye specimens.^{18,19} Second, the eyes possess an open microenvironment that vulnerable for droplets and aerosolized transmission. Third, the interconnection of the ocular mucosal immune system to the nasolacrimal lymphoid tissue.⁵

4.2 Eye care recommendations for ophthalmologists

4.2.1 Environmental control

Coronavirus may contaminate the environment (frequently touched objects and surfaces) and ophthalmic equipment, thus proper decontamination through routine cleaning using a disinfectant that is recommended by CDC, such as povidone-iodine, chlorhexidine, alcohol solutions with at least 70% concentration of alcohol, hydrogen peroxide, citric acid, and many more.^{2,3} Due to this, it is also recommended that health care workers wash their hands using an alcohol-based solution or the combination of alcohol and chlorhexidine.³ As coronavirus droplets also may contaminate the air, the air ventilation in the waiting area should be improved. The use of High-efficiency particulate air filter (HEPA) is useful to augment the rate of air change in the waiting room.²

4.2.2 Outpatient setting

Reducing the number of patients appointments is recommended for every clinics include ophthalmology clinics.² Consultations through a video call or voice call should also be prioritized if possible. The doctor can determine the condition of the patients, and if the patients require further consultation and test.⁹ The patient's temperature needs to be examined before entering the outpatient ward. Re-scheduling the appointment is necessary, if the patients exhibit a fever and the eye condition was non-urgent. The screening questionnaire regarding the history of traveling to affected areas during the incubation period, close contact with a confirmed or suspected case of COVID-19, and history of acute respiratory symptoms were performed for every patients.²
³ If they are negative to all the questions, they are allowed to enter the clinic. The suspected patients needing same-day consultation will be escorted to

the isolation room.² The patients that diagnosed with acute conjunctivitis need to postpone their appointments for at least 14 days in some clinics.³

The respiratory droplets sized >5 µm that produced by breathing, talking, sneezing, coughing can travel approximately at least 1 meter and can be inhaled into the lungs.²⁰ The waiting room should be kept as empty as possible, with a distance of 2 meters between patients.¹⁰

When examines ophthalmic outpatients, the ophthalmologist needs to wear primary personal protection with disposable cap, surgical mask, and gown. Direct ophthalmoscopy, intraocular pressure measurement with non-contact tonometry, lacrimal irrigation, and probing, as well as ophthalmic laser therapy were included as a high-risk procedure. The gloves, N95 respirator, and goggles or face shield were highly recommended when performing those procedures.^{4,21} In order to avoid cross-infection, the ophthalmic examinations for patients with confirmed or suspect of SARS, MERS, or CoVID-19, should be completed within the quarantine ward with full protection^{22,23}.

Contact time and speaking between ophthalmologists and patients should be minimized. Proper distance should be maintained whenever possible. Patients should also be told not to touch any equipment in the clinic, unless unavoidable. Any procedure involving corneal and lacrimal apparatus examination should be avoided if possible. The ophthalmologist should also use a protective barrier for slit lamp and avoid the use of non-contact tonometry (NCT) because NCT is said to be a possible source of micro aerosol, thus the use of I-Care tonometry or Goldmann applanation tonometry with disposable tips are preferable.^{3,9,11}

4.2.3 Inpatient setting

It is recommended to admit only urgent cases, while follow the infection prevention protocol. Hospitalisations were preceded by rapid test for COVID-19 screening. The nasopharyngeal swab was performed in the patient with history of traveling to affected areas, close contact with a confirmed or suspected case of COVID-19, and history of acute respiratory symptoms. The positive COVID-19 cases

were admitted to an isolation ward, along with confirmed COVID-19 cases.¹² In the inpatient settings, the examination should be done at the bedside as much as possible. However, if the examination must be done in the outpatient clinic, the inpatients should wait in a separate waiting room with no or minimal interaction with other patients. To prevent inpatients from different wards waiting together, the implementation of allotting separate time slots can be done.²

4.2.4 Surgical settings

All elective and routine surgery should be postponed, and only urgent and non-deferred procedure that may be done.^{2, 9} Because most of patient who underwent the surgery will be treated as inpatients, all the preparation protocols were matched to the inpatient's settings.¹² In addition, before the surgery, patients should be screened for the possibility of contracting COVID-19 infections.¹⁰ If the patient is confirmed having COVID-19 disease, then the patient should be reassessed whether the surgery can be postponed until the PCR result is negative.³ However, if the situation does not allow to postpone the surgery, patients' vital signs should be closely monitored, ultimately elderly patients above 65 years old, or those with comorbid diseases such as respiratory disease, cardiovascular disease, or immunocompromised patients. For COVID-19 negative patients, it is recommended that the procedure is ambulatory to prevent hospital stays. However, if not possible the hospital should have a non-COVID ward to prevent nosocomial infection.⁹

All the operating room staff should use proper PPE. It is recommended that every operating room staff use an N95 mask and if it's not possible for the staff to exit the operating room. The operator should use a disposable plastic visor mask rather than goggles, as the latter tend to impair vision due to condensation. Other protective equipments that should be used are disposable apron, disposable head and shoe covers, and double gloves. The amounts of personnel in the operating room should be minimized, and the staffs' circulation should be diminished as much as possible.⁹

Whenever possible, general anesthesia should be avoided to prevent aerosolization of the SARS-CoV2

virus due to intubation.^{2, 9} Any surgical procedure that may cause aerosolization of the virus such as ocular surface irrigation with serum, drills, electrical cutting, and coagulation, should be avoided if possible.¹¹ Sight-threatening conditions that needed surgery should be carried out right away. American Academy of Ophthalmology (AAO) has been released a recommendation regarding the surgery and outpatient clinics that listed in <https://www.aao.org/headline/alert-important-coronavirus-context>.

4.2.5 Primary health care setting

World Health Organization propose the principles role of primary health care in COVID-19 response as follows: (1) immediately recognize and manage possible cases; (2) prevent the transmission of virus to health-care workers and their relatives; (3) support the delivery of necessary health care services; (4) enhance surveillance for COVID-19; and (5) educate and involve the community in the COVID-19 detection and prevention.²⁴ As mentioned above, reducing the number of patients appointments is recommended for every clinics including primary health care.^{2, 25} A telehealth approach could be done through a video call or voice call. The condition of the patients could be determined by the doctor, and if further consultation and test are required, the patient could visit the primary health care.^{9, 25} It is important to identify the value of coordinated response from primary health for facing the pandemic COVID-19.²⁶ The conjunctivitis is reported as a common eye condition that might occurred in COVID-19 patients.²⁷ Therefore, eye protection is a mandatory safety measurement that needs to be wear while examining the patients.

4.3 Eye care recommendations for patients

Hospital visitation during COVID-19 pandemic need certain strict protocols. All patients in the outpatient setting should go through body temperature examination and triage questions before entering the clinics.²⁰ The clinical characteristic of COVID-19 were varying, from asymptomatic to anosmia or fatigue, fever, dyspnea, cough, and myalgia.^{28, 29} Thus, patients with those symptoms need to be suspected as COVID-19 patients. For patients with urgent ophthalmology appointment with no respiratory

illness symptoms, no fever and no COVID-19 risk factors should do standard precautions.

Standard precautions such as hand hygiene, cough etiquette, and use of PPE. Patient will also be asked to speak minimally, and not to speak during slit lamp biomicroscopic examination.³⁰ For patient with urgent ophthalmology appointment with respiratory illness symptoms, but no fever and no COVID-19 risk factors should be given. And placed in a surgical mask. For patients with urgent ophthalmic problem with high risk for COVID-19, the patient should be sent to the ER or other hospital facility that is equipped to evaluate and manage COVID-19.³⁰

Urgent ophthalmology cases that are stated above are cases where there is a high risk of visual loss without treatment. Such as exudative age-related macular degeneration; severe diabetic retinopathy; acute retinal detachment; advanced or rapidly progressive glaucoma; severe, active uveitis; serious ocular oncology conditions; retinopathy of prematurity; globe rupture or other severe trauma; or serious ocular infections.³¹

5. Conclusion

COVID-19 infection is a global public health threat. It is mainly transmitted through droplets and direct contact. However, the possible transmission through tears or conjunctival secretions cannot be deterred. In ophthalmologic practices, where there is close contact between patients and doctors, infection control is strictly needed. It aims to ensure that healthcare workers and patients are safe. Providing patients with face masks, promoting cough etiquette and hand hygiene is important. Proper use and removal of personal protective equipment, hand hygiene, and self-awareness by health care workers are important to avoid hospital-related transmission during practice. The primary health care also essential for managing the COVID-19 through several roles, such as: identify and isolate probable cases, minimize triage burden at hospital, enhance effective communication in community, and deliver the education to the community.

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