



# Risk of SARS-CoV-2 transmission to medical staff and patients from an exposure to a COVID-19-positive ophthalmologist

Ori Saban<sup>1</sup> · Jaime Levy<sup>1</sup> · Itay Chowers<sup>1</sup>

Received: 7 May 2020 / Revised: 7 May 2020 / Accepted: 5 June 2020 / Published online: 21 June 2020  
© Springer-Verlag GmbH Germany, part of Springer Nature 2020

## Abstract

**Purpose** To evaluate the risk of transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) after exposure to a COVID-19+ physician in a retina clinic.

**Methods** A retrospective observational study. Records of 142 patients and 11 staff members from a single retina clinic that were exposed to a COVID-19+ ophthalmologist were reviewed. All 153 individuals were placed in quarantine for 14 days. They were contacted after the quarantine period to inquire about symptoms consistent with COVID-19, and the results of diagnostic test for SARS-CoV-2 when performed.

**Results** All patients ( $n = 142$ ) were contacted successfully. The mean age was  $72.8 \pm 13.6$  years; 54.2% ( $n = 77$ ) were females. Twenty-three patients (16.2%) were exposed during an ophthalmic exam, 111 (78.2%) during intraocular injection, 4 (2.8%) underwent exam and injection, 3 (2.1%) underwent surgery, and one patient (0.7%) had laser photocoagulation. Half of the patients (50%;  $n = 71$ ) were in contact with the COVID-19+ physician while he was symptomatic. Forty-four patients (31%) wore a mask on the day of their visit. 11.3% ( $n = 16$ ) of the patients, and all involved staff had been tested for the virus and all were negative. One patient (0.7%) reported transient cough and sore throat, and the remaining 141 (99.3%) patients and 11 (100%) staff did not develop symptoms.

**Conclusions** Low risk for SARS-CoV-2 transmission in the ophthalmic setting was observed when universal safety measures such as social distancing, meticulous hand hygiene, enlarged breath shields, and mask wear during procedures were taken.

**Keywords** SARS-CoV-2 · COVID-19 · Transmission · Retina clinic

## Introduction

The global pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes COVID-19, has rapidly emerged throughout the world with millions of confirmed cases worldwide as of April, 2020, and a mortality rate that falls roughly within 0.5–12% based on reports by the World Health Organization [1].

Health care environments are a potential important source of virus transmission and medical personnel are at significant risk of infection, morbidity, and mortality [2–4]. According to the Center for Disease Control and Prevention (CDC), the incubation period of COVID-19 is within 2 to 14 days [5], although the incubation period could last rarely up to 24 days [6]. SARS-CoV-2 can be transmitted by symptomatic individuals, yet, asymptomatic infected patients appear to have viral loads similar to those detected in symptomatic patients, with similar transmission potential [7, 8].

There are several factors that, theoretically, convey especially high risk of SARS-CoV-2 transmission in the ophthalmic setting [9, 10]. The first is the proximity between ophthalmologists and patients during procedures such as slit lamp exam, intraocular injections, and laser treatments. The second is long waiting hours in ophthalmology clinics as patients have to go through several different investigations and treatments (visual acuity testing, imaging, injections, slit lamp exam, etc.). In addition, COVID-19 can cause conjunctivitis

---

Jaime Levy and Itay Chowers contributed equally to this work.

---

This article is part of the Topical Collection on *Perspectives on COVID-19*

---

✉ Itay Chowers  
chowers@hadassah.org.il

<sup>1</sup> Department of Ophthalmology, Hadassah Medical Center and the Hebrew University - Hadassah School of Medicine, PO Box 12000, 91120 Jerusalem, Israel

which may occasionally be the first sign of the disease, and virus RNA can be shed in patients' tears regardless of ocular involvement [11, 12].

There are anecdotal reports of ophthalmologists that have developed COVID-19. Dr. Li Wenliang was an ophthalmologist in Wuhan Central Hospital. He is now recognized for identifying and warning the authorities about the growing COVID-19 epidemic in Wuhan, an action which resulted in discipline measures against him. Dr. Li had presumably contracted SARS-CoV-2 in the hospital while examining an asymptomatic COVID-19+ glaucoma patient [13, 14]. The death of two additional COVID-19+ ophthalmologists from the same department at Wuhan Central Hospital in the course of approximately 1 month was also reported in the media, but the circumstances and the mode by which they have contracted the disease were not explored so far [15].

Reduction of patients load, social distancing, installation of enlarged breath shields, mask wearing, and frequent hand and equipment sanitizing were employed to minimize risk for SARS-CoV-2 transmission in ophthalmic clinics [16]. In the current study, the risk for contracting SARS-CoV-2 from a COVID-19+ ophthalmologist was retrospectively evaluated among exposed patients and staff in order to assess the benefit of using such universal protective measures in the routine ophthalmic setting.

## Methods

This is a retrospective observational study. The study was approved by the local Ethics Committee and adheres to the tenets of the Helsinki Declaration. Details of a case of COVID-19+ ophthalmologist were extracted. Following his diagnosis, a detailed contact tracing was performed at the ophthalmology department and all contacts (staff and patients) were recommended to stay in quarantine for 14 days from the last contact with the COVID-19+ ophthalmologist. Following the quarantine, all staff performed a SARS-CoV-2 real-time polymerase chain reaction (RT-PCR) test prior to resuming their clinical activities. All patients were contacted at a minimum of 14 days following the exposure to inquire whether they got sick or had a COVID-19 RT-PCR test. In addition, patients were asked if they wore a mask of any kind during their visit in the ophthalmology clinic. Demographics of the exposed patients were extracted and the type of procedure they had—slit lamp exam, intravitreal injection, slit lamp exam and intravitreal injection, laser treatment, or surgery—was recorded. These procedures have different characteristics in terms of duration and nature of physician-patient interaction. Patients were also classified according to the date of their visit in order to determine whether it was while the COVID-19+ physician was symptomatic or asymptomatic at the time of

their exposure. Data collection and descriptive statistics were done using Microsoft Excel 2019.

## Results

### Case description

A 32-year-old generally healthy ophthalmologist male has developed headache for 2 days. He had no fever or additional symptoms at that time, and he continued to work. At the third day, he developed dry cough and low-grade shortness of breath. He worked during the morning and left home early. An RT-PCR test for SARS-CoV-2 that was performed the next morning was positive with a cycle threshold of 21.56, which is considered to be highly positive (35–38 cycles—borderline, > 38 cycles negative). He was admitted to the hospital and had a mild course of COVID-19. He stayed positive for the virus for 4 tests and became negative in 2 consecutive tests 3 weeks following the first positive test. The epidemiology investigation results indicated that the physician had probably contracted the virus 7 days prior to the diagnosis.

### Staff exposure

Altogether, eight physicians, two nurses, and a technician were in contact with the COVID-19+ physician for more than 15 min in a proximity of less than 2 m and were therefore placed in quarantine. The physicians interacted together with the COVID-19+ colleague in the clinic, seeing patients together. The nurses assisted the COVID-19+ colleague in performing intravitreal injections, and the technician had worked for 4 h in a close proximity with the COVID-19+ colleague (analyzing images together) at a day when he already suffered from headaches. All have stayed in quarantine for 14 days from the last contact with the COVID-19+ colleague and all had a negative RT-PCR test for SARS-CoV-2 at the end of the quarantine period. None had developed symptoms of COVID-19.

### Patient exposure

All patients who were in contact with the COVID-19+ physician ( $n = 142$ ) were identified, noticed of his diagnosis, and instructed to be in isolation for 14 days from the last contact. Approximately half ( $n = 77$ ; 54.2%) were females. The mean age  $\pm$  SD was  $72.8 \pm 13.6$  years (median = 74, range 21–98). Seventy-one patients (50%) were in contact with the COVID-19-positive physician while he was symptomatic (during the 3 days prior to the RT-PCR diagnosis). Most of the patients had intravitreal injection only ( $n = 111$ ; 78.2%), 23 (16.2%) had only slit lamp exam, 4 (2.8%) had slit lamp exam and intravitreal injection on the same day, 3 (2.1%) had surgery

and slit lamp exam the day after, and one patient (0.7%) had panretinal photocoagulation (PRP) laser treatment.

Overall, minority of 46 patients (32.4%) wore a mask (surgical, N95, or alike) on the day of their visit while 96 (67.6%) did not use a mask. As for the group of patients that were in contact with the COVID-19+ physician after he became symptomatic, approximately half ( $n = 33$ ; 46.5%) wore a mask. In total, 27 patients (19.0%) had slit lamp exam or PRP laser treatment during the 7 days prior to the diagnosis, and 19 of them (70.3%) were examined while the COVID-19+ physician was symptomatic. Surgical mask was intermittently worn by the COVID-19+ physician only in the last day of work prior to the diagnosis because he felt ill.

All of the 142 patients (100%) that were exposed to the COVID-19+ physician were contacted successfully by telephone following at least 14 days from the exposure. Only one patient reported being sick, experiencing symptoms of cough, sore throat, and fever. He had an intravitreal injection on the day of his visit and he did not wear a mask. The patient completely recovered after few days. Sixteen patients (11.3%) had a COVID-19 RT-PCR test, including the patient that reported having suspicious symptoms, and all of them came back negative (Table 1).

## Discussion

In this study, we retrospectively reviewed 142 patients and 11 medical staff members who were exposed to a COVID-19+ ophthalmologist. No case of validated disease transmission was identified among patients or medical staff. One patient reported suggestive symptoms, but his RT-PCR results came back negative and he had fully recovered from the symptoms within few days.

**Table 1** Proportion of patients having symptoms and SARS-CoV-2 RT-PCR test

	No. of patients (%)
All	142 (100%)
Symptoms consistent with COVID-19	
Yes	1* (0.7%)
No	141 (99.3%)
Missing	0
SARS-CoV-2 QPCR test	
Yes	16 (11.3%)
No	126 (88.7%)
Confirmed COVID-19 cases	
Yes	0
No	142 (100%)

\*Had a negative RT-PCR test for COVID-19

As the COVID-19 pandemic evolved and was starting to emerge in Israel, we have changed our day to day conduct in the ophthalmology clinic. Physicians were instructed to refrain from staying together in the same room or less than 2-m distance from each other as much as possible, the importance of hand hygiene was further emphasized, social encounters (in staff rooms, etc.) were reduced to a minimum, and telemedicine was encouraged. Furthermore, clinic visits and slit lamp exam (with enlarged breath shields) were significantly reduced. Staff was allocated to three separate groups, and interactions among these groups were prevented. In the retina clinic, optical coherence tomography was often the sole criteria when deciding if an intravitreal injection is necessary for recurrent patients.

The majority of patients that were in contact with the COVID-19+ physician in the current study underwent intravitreal injection. The use of a surgical mask during the injection preparation and procedure is advised in order to minimize the spread of droplets containing oral contaminants from the staff [17]. As part of the standard practice of intravitreal injection in our clinic, the injections are performed in dedicated rooms equipped with a fan-filtering unit (FFU) with high-efficiency particulate air (HEPA) filter, where the injecting ophthalmologist and other members of the medical staff in the room are wearing surgical masks and a non-talk policy is taken. Stricter protective measures are taken for surgical procedures. These standard safety measures conceivably prevented SARS-CoV-2 transmission to patients and co-workers alike. This is further supported by a case report by Kangqi et al., where out of 41 healthcare workers that were exposed to a confirmed COVID-19+ patient, none was infected; 85% of the workers were protected by a surgical mask only, and the rest by N95 masks [18].

Importantly, surgical mask or gloves were not routinely worn at the time of the incident for standard slit lamp exam or PRP laser treatment (these protection measures were later employed), and minority of the patients wore masks. Altogether, 19 patients were cared for by a COVID-19+ physician while he was symptomatic and while both parties did not wear masks. In theory, these patients had a greater chance of being infected, yet, none had developed COVID-19.

Caveats of the study include its retrospective design. Not all of the patients that have been in contact with the COVID-19-positive physician had performed RT-PCR tests for COVID-19 infection. As was suggested by other reports, there might be some patients that have been infected but remained asymptomatic [7, 19]. In addition, virus transmission may vary among patients and “super-spreaders” may exist. Accordingly, if the COVID-19+ staff member would have been a “super-spreader,” the outcome of the scenario might have been different.

To the best of our knowledge, this is the first study to report the outcome of exposure of patients and staff to COVID-19+

staff member in the setting of an ophthalmologic clinic. The transmission rate in this report was very low while standard safety measures such as social distancing, hand hygiene, and mask wear during intravitreal injections were taken. More studies of this nature are needed in order to shed more light into the risk of transmission of COVID-19 in the setting of ophthalmic care.

### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** This article does not contain any studies with human participants performed by any of the authors.

### References

1. WHO. WHO COVID-19 dashboard. World Health Organization. Published 2020. Accessed 9 Apr 2020. <https://who.sprinklr.com/>
2. Remuzzi A, Remuzzi G (2020) COVID-19 and Italy: what next? *Lancet*. 2:10–13. [https://doi.org/10.1016/S0140-6736\(20\)30627-9](https://doi.org/10.1016/S0140-6736(20)30627-9)
3. Wu Z, McGoogan JM (2020) Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China. *JAMA*. 323(13):1239–1242. <https://doi.org/10.1001/jama.2020.2648>
4. Zhan M, Qin Y, Xue X, Zhu S Death from Covid-19 of 23 health care workers in China. *N Engl J Med*. Published online 2020. <https://doi.org/10.1056/NEJMc2005696>
5. CDC. Symptoms of coronavirus. Published 2020. Accessed April 10, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/about/symptoms.html>
6. Guan W, Ni Z, Hu Y et al Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. Published online 2020 <https://doi.org/10.1056/nejmoa2002032>
7. Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020. *Euro Surveill* 2020;25(10):1–5. doi:<https://doi.org/10.2807/1560-7917.ES.2020.25.10.2000180>
8. Zou L, Ruan F, Huang M et al (2020) SARS-CoV-2 viral load in upper respiratory specimens of infected patients. *N Engl J Med* 382(12):1177–1179. <https://doi.org/10.1056/NEJMc2001737>
9. van Doremalen N, Bushmaker T, Morris DH et al (2020) Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 382(16):1564–1567. <https://doi.org/10.1056/nejmc2004973>
10. Li Q, Guan X, Wu P et al (2020) Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 382(13):1199–1207. <https://doi.org/10.1056/NEJMoA2001316>
11. Xia J, Tong J, Liu M, Shen Y, Guo D (2020) Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection. *J Med Virol* 92:589–594. <https://doi.org/10.1002/jmv.25725>
12. Wu P, Duan F, Luo C et al Characteristics of ocular findings of patients with coronavirus disease 2019 (COVID-19) in Hubei Province, China. *JAMA Ophthalmol*. Published online 2020. <https://doi.org/10.1001/jamaophthalmol.2020.1291>
13. Lee KJ. Coronavirus kills Chinese whistleblower ophthalmologist. American Academy Of Ophthalmology. Published 2020. Accessed 10 Apr 2020. <https://www.aao.org/headline/coronavirus-kills-chinese-whistleblower-ophthalmol>
14. Parrish RK, Stewart MW, Duncan Powers SL. Ophthalmologists are more than eye doctors—In Memoriam Li Wenliang Am J Ophthalmol Published online 2020. <https://doi.org/10.1016/j.ajo.2020.02.014>
15. You T. Four doctors at Wuhan hospital where coronavirus whistleblower worked have died of the disease in just over a month. *The Daily Mail*. Published 2020. Accessed 11 Apr 2020. <https://www.dailymail.co.uk/news/article-8091705/Fourth-colleague-Chinas-coronavirus-whistle-blower-doctor-dies-disease.html>
16. Important coronavirus updates for ophthalmologists. American Academy Of Ophthalmology. Published 2020. Accessed 10 Apr 2020. <https://www.aao.org/headline/alert-important-coronavirus-context>
17. Avery RL, Bakri SJ, Blumenkranz MS et al (2014) Intravitreal injection technique and monitoring: updated guidelines of an expert panel. *Retina*. 34:S1–S18. <https://doi.org/10.1097/IAE.0000000000000399>
18. Ng K, Poon BH, Kiat Puar TH et al COVID-19 and the risk to health care workers: a case report. *Ann Intern Med*. Published online 2020. <https://doi.org/10.7326/120-0175>
19. Bai Y, Yao L, Wei T et al (2020) Presumed asymptomatic carrier transmission of COVID-19. *JAMA*. 323(14):1406–1407. <https://doi.org/10.1001/jama.2020.2565>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.