



# Open Globe Injury in a COVID-19 Patient: Lessons Learned



Special precautions are required to safely and quickly treat patients with potential infection.

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the viral pathogen that causes the disease COVID-19, originated in Wuhan, China, and has evolved into an unprecedented public health threat.<sup>1</sup> It is crucial to understand the means for transmission and to adopt prevention measures to minimize its transmission.

The virus is known to spread mainly via respiratory droplets (> 5–10  $\mu\text{m}$  in diameter, spread within 1 m)<sup>2</sup> from infected patients or indirectly from fomites. It enters via respiratory mucosa or conjunctival tissue. Debate exists regarding spread via tears and the ocular surface.<sup>3-8</sup> Management of patients with COVID-19 is complex, and there are many implications for ophthalmologists, including retina surgeons. We present a case of an open globe injury in which surgical repair was complicated due to COVID-19 infection.

## CASE PRESENTATION

A 39-year-old woman with a history of chronic dry cough and emphysema presented to the emergency department (ED) with persistent blurry vision 4 days after blunt force injury to the left eye. The patient was evaluated at bedside in the ED. The examining physician wore personal protective equipment (PPE) that included a powered air-purifying respirator (PAPR; Sentinel XL HP, ILC Dover).

The patient's VA was light perception and IOP was 4 mm Hg in her left eye. Anterior segment examination revealed a superotemporal sectoral bullous subconjunctival hemorrhage, a shallow anterior chamber, and total hyphema with no view of the retina. Her right eye was normal.

CT imaging of the patient's orbits revealed an irregular

## AT A GLANCE

- ▶ COVID-19 typically spreads via droplet transmission or fomites. Respiratory mucosa and conjunctiva are vulnerable sites of entry for viruses. Airborne transmission may be possible during intubation and extubation.
- ▶ Using PPE and following proper sanitization practices may help reduce the risk of transmission in the OR.
- ▶ Use of negative pressure ORs may help minimize airborne transmission during intubation.

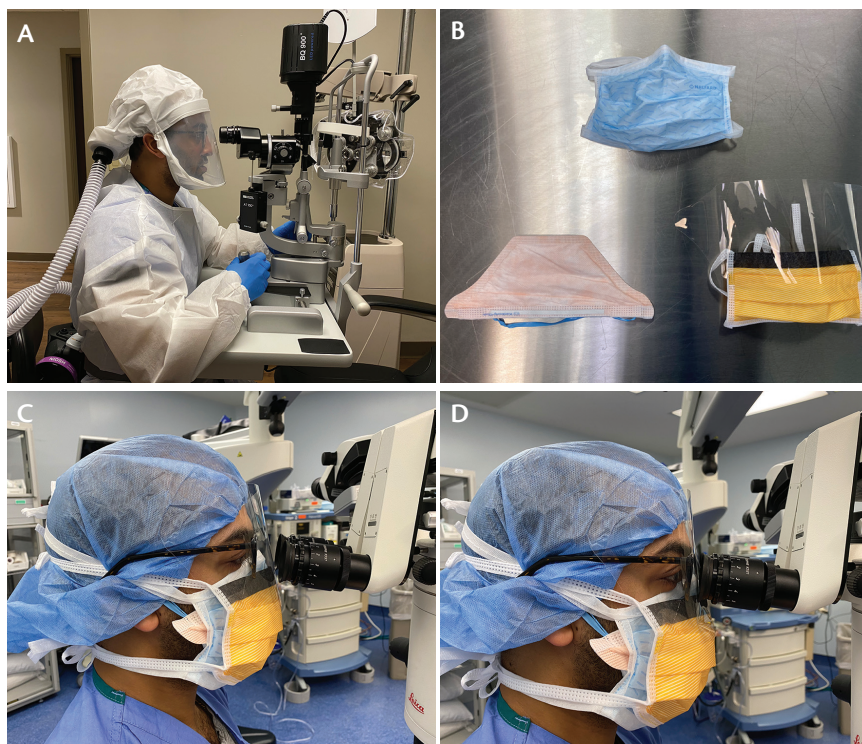


Figure. A variety of PPE was used in the OR during surgery on a patient with potential COVID-19 infection. Dr. Neerukonda is shown using a PAPR at the slit lamp (A). The three masks used during surgery were an N-95 respirator mask, a surgical face mask, and a surgical mask with a face shield (B, left to right). Wearing three pieces of PPE while aligning with microscope oculars proved to be difficult (C), and maximum visualization was achieved with adjustments (D).

contour of the superolimbus sclera, no visible crystalline lens, and no intraocular foreign body. We determined that she likely had a ruptured left globe. Prophylactic intravenous vancomycin (1 g every 12 hours) and ceftazidime (2 g every 8 hours) were administered, and a Fox shield was placed over the eye. We recommended emergent surgical exploration.

### PREPARING FOR SURGERY

Due to her nonproductive cough and emphysema, the ED physicians' suspicion for COVID-19 was low, albeit still present and concerning. Notably, she was afebrile and reported no exposure to infected individuals. A nasopharyngeal swab was sent to the reference laboratory for SARS-CoV-2 polymerase chain reaction (PCR) testing. After discussion among the stakeholders on how to proceed regarding the urgent nature of the case, she was transported to the OR.

Multiple precautions were taken to minimize airborne transmission. The anesthesia team wore PAPRs, and the patient was intubated in a negative pressure OR. She was then transferred to the ophthalmology OR, which is equipped with a wall-mounted operating microscope.

For patient and physician protection, the surgeons wore three masks in sequential order: N-95 respirator (Respirator and Surgical Mask, 46727, Kimberly-Clark), a regular surgical face mask (Fog-Free Surgical Mask, Halyard), and a surgical mask with a plastic face shield (Fluidshield Fog-Free Surgical Mask, WrapAround Visor, Halyard).

### SURGICAL AND POSTSURGICAL PERIODS

The ensuing surgical exploration revealed a superior 8-mm curvilinear scleral laceration with uveal prolapse 3 mm posterior to the limbus, which

was successfully repaired with seven interrupted 9-0 polyglactin sutures. The patient was transported back to the negative pressure OR for extubation and was admitted overnight for observation and a continued course of intravenous antibiotics.

The next day, the COVID-19 PCR test returned positive. The ophthalmology team wore PAPRs for bedside examinations. The patient's VA was hand motion and a formed globe was observed. B-scan ultrasound revealed vitreous hemorrhage and possible retinal detachment. The patient was educated about her COVID-19 diagnosis, discharged from the hospital, and asked to self-isolate for 14 days. Subsequent postoperative follow-up was arranged in the ED due to the availability of ancillary support and PPE.

### LESSONS LEARNED

COVID-19 has presented newfound obstacles to medical care. This case highlights the myriad complexities involved in caring for patients with ophthalmic surgical emergencies and concurrent potential or confirmed COVID-19 infection.

Barriers to routine care during both examination and surgery were manifold. PPE was needed. A surgical delay amid hospital protocol was resolved by a discussion among the surgical team members and hospital leadership. Concerns regarding viral transmission in the perioperative period, including airway management, had to be addressed.

### Perioperative Management, Anesthesia, and Intubation

Airway management, ophthalmic evaluation, and surgery all expose physicians to sources of viral shedding. An ophthalmic exam exposes the physician to risk of transmission via respiratory droplets due to proximity to the patient as well as indirect contact via equipment. Intubation specifically introduces a novel transmission risk via the airborne route.

Aerosols that are generated may contain droplet nuclei, which are smaller than 5 µm, may remain in the air for extended periods of time, and may be transmitted beyond 1 m.<sup>6-13</sup> If possible, intubation should occur in a negative pressure room, which is designed to prevent air and particles from escaping. Typical ORs provide positive pressure, and air is flow-directed to flush particles out of the room.

### PPE

Wearing PPE that fits appropriately is crucial for all personnel in contact with a patient who may be COVID-19–positive. We wore PAPRs for perioperative ophthalmic examination. Although a PAPR may provide the greatest protection, it is less than ideal for slit-lamp examination or indirect ophthalmoscopy.

Each mask worn by the surgeons was deemed necessary for different protective purposes.<sup>14</sup> The N-95 respirator created a facial seal and minimized small droplet exposure, the surgical mask protected against larger droplets or splashes, and the face shield mask protected the surgeons' conjunctiva from exposure. Wearing multiple masks, particularly the face shield mask, created a challenge for aligning with microscope oculars (Figure).

### Hospital Protocols

Given the uncertainty of the patient's COVID-19 infection at the time of presentation, emergent discussions between the ophthalmology team and hospital leadership were required to ultimately facilitate a safe surgery. Our hospital's policy regarding known COVID-19 patients states that urgent surgery should be delayed if possible until the infection is cleared and that only emergency surgery should be performed with special precautions taken. Of note, all elective surgeries in the hospital have been postponed during the COVID-19 pandemic.

This case emphasized the importance of a fast-paced, comprehensive algorithm to address emergent surgery in possible or confirmed COVID-19 patients. It is imperative that ophthalmologists be involved in the development of these protocols. We should all have worst-case scenario plans on hand.

### Keep Your Guard Up

Despite a low pretest probability, the patient was tested for COVID-19, and everything proceeded as if she were positive. It is crucial to have a low threshold to rule out COVID-19. At the time this patient presented, rapid COVID-19 testing was not yet available. Patients should be treated as COVID-19–positive until proven otherwise, and rapid COVID-19 testing should be employed whenever feasible.

### CONCLUSION

This case highlights novel barriers to ophthalmic patient care. It raised numerous questions regarding safe and efficient management of surgical emergencies in the COVID-19

era. To safely and efficiently care for vulnerable COVID-19 patients with ocular emergencies, our profession must be prepared and proactive. ■

1. Coronavirus disease 2019 (COVID-19) situation report. World Health Organization. March 25, 2020. [www.who.int/docs/default-source/coronaviruse/situation-reports/20200325-sitrep-65-covid-19.pdf?sfvrsn=2b74edd8\\_2](http://www.who.int/docs/default-source/coronaviruse/situation-reports/20200325-sitrep-65-covid-19.pdf?sfvrsn=2b74edd8_2). Accessed May 14, 2020.
2. Infection prevention and control of epidemic-and pandemic prone acute respiratory infections in health care. World Health Organization. June 21, 2015. [www.who.int/csr/bioriskreduction/infection\\_control/publication/en/](http://www.who.int/csr/bioriskreduction/infection_control/publication/en/). Accessed May 14, 2020.
3. Jun ISY, Anderson DE, Kang AEZ, et al. Assessing viral shedding and infectivity of tears in coronavirus disease 2019 (COVID-19) patients [published online ahead of print March 24, 2020]. *Ophthalmology*.
4. Xia J, Tong J, Liu M, Shen Y, Guo D. Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS CoV 2 infection [published online ahead of print February 26, 2020]. *J Med Virol*.
5. Li JPO, Lam DSC, Chen Y, Ting DSW. Novel coronavirus disease 2019 (COVID-19): the importance of recognising possible early ocular manifestation and using protective eyewear. *Br J Ophthalmol*. 2020;104(3):297-298.
6. Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet*. 2020;395(10224):e39.
7. Phan LT, Nguyen TV, Luong QC, et al. Importation and human-to-human transmission of a novel coronavirus in Vietnam. *N Engl J Med*. 2020;382(9):872-874.
8. Seah I, Agrawal R. Can the coronavirus disease 2019 (COVID-19) affect the eyes? a review of coronaviruses and ocular implications in humans and animals. *Ocul Immunol Inflamm*. 2020;28(3):391-395.
9. Liu J, Liao X, Qian S, et al. Community transmission of severe acute respiratory syndrome coronavirus 2, Shenzhen, China, 2020 [published online ahead of print June 17, 2020]. *Emerg Infect Dis*.
10. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *N Engl J Med*. 2020;382(13):1199-1207.
11. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497-506.
12. Burke RM, Midgley CM, Dratch A, et al. Active monitoring of persons exposed to patients with confirmed COVID-19 - United States, January-February 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(9):245-246.
13. Canelli R, Connor CW, Gonzalez M, Nozari A, Ortega R. Barrier enclosure during endotracheal intubation [published online ahead of print April 3, 2020]. *N Engl J Med*.
14. Understanding the Difference. World Health Organization. [www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf](http://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf). Accessed May 14, 2020.

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- Financial disclosure: Advisory board (Allergan, Genentech), Speaker (Novartis)

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- Financial disclosure: None