Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Ophthalmia neonatorum as the presenting sign of SARS-CoV-2

Elzbieta Mechel, MD,a Minh Trinh, MD,a Sylvia Kodsi, MD,a,b,c Maggie Hymowitz, MD,a,c Mundeep K. Kainth, DO, MPH,b,c,d and Alice M. Lee, MD, FAAPb,c

The most common ocular manifestation of SARS-CoV-2 in adults and children is acute conjunctivitis. We report the case of a 4-day-old infant who presented with acute-onset mucopurulent discharge of the left eye as well as subconjunctival hemorrhage and palpebral injection, without corneal findings. A diagnosis of ophthalmia neonatorum was established, for which ocular cultures and Gram staining were performed. No bacterial growth was noted, and polymerase chain reaction (PCR) testing for Chlamydia trachomatis, Neisseria gonorrhoea, and herpes simplex were negative. Nasopharyngeal and conjunctival SARS-CoV-2 PCR were positive. Given the identification of SARS-CoV-2 illness, lack of other underlying bacterial or viral etiology on testing, and the well-documented ability for SARS-CoV-2 to cause conjunctivitis, the clinical picture was supportive of ophthalmia neonatorum secondary to SARS-CoV-2. The infant was treated with ceftriaxone and azithromycin prior to culture results. During admission, no systemic findings of Covid-19 illness were observed.

T
he most common ocular manifestation of coronavirus disease 2019 (COVID-19), caused by the novel coronavirus variant severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), is acute conjunctivitis; cases of keratoconjunctivitis, panuveitis and optic neuritis, episcleritis, and cranial nerve palsies have also been reported.1-3 In the pediatric population, ocular symptoms, including conjunctival discharge and injection as well as eye rubbing, are mild and self-limiting though often associated with more severe systemic illness.4,5 We report a case of ophthalmia neonatorum as the presenting sign of COVID-19.

Case Report

A 4-day-old girl presented at Northwell Health Department of Ophthalmology for evaluation of mucopurulent discharge. She was born via spontaneous vaginal delivery at 38.6 weeks’ gestational age. Pregnancy and delivery were uncomplicated, with Apgar scores of 9 and 9 at birth. Routine neonatal care included preventative erythromycin ophthalmic ointment. At birth, the eyes were without any notable findings. The mother had no past medical history, no history of sexually transmitted infections, and she received routine prenatal care. On admission to labor and delivery, both the mother and father underwent testing for COVID-19, which was negative.

On day 3 of life, the parents noticed a mucopurulent discharge of the left eye. The discharge progressively worsened, prompting the parents to seek medical treatment. On examination, the infant blinked to light with both eyes. There was crusted mucopurulent discharge evident surrounding the left eye. Mild ecchymosis of the upper eyelid was noted. Subconjunctival hemorrhage was present inferiorly, with mild chemosis (Figure 1). In addition, injection of the surrounding palpebral conjunctiva was evident, and the bulbar conjunctiva was erythematous as well, with few follicles (Figure 1). The cornea was clear, without any staining on fluorescein examination. Pressure on the lacrimal sac failed to elicit reflux. Dilated fundus examination was normal.

The patient was directed to the emergency department. Cultures of the palpebral conjunctiva showed no bacterial growth, and Gram stain demonstrated no organisms. Polymerase chain reaction (PCR) testing for Chlamydia trachomatis, Neisseria gonorrhoea, and herpes simplex were negative. Immediately after culture samples were taken, the infant was started on intravenous ceftriaxone and oral azithromycin as well as erythromycin ointment. Nasopharyngeal and conjunctival SARS-CoV-2 PCR testing were positive. During admission, the vital signs remained stable, and no evidence of systemic disease was noted. The conjunctivitis resolved within 8 days. At that time, the mother tested positive for SARS-CoV-2, suggesting the possibility that the mother and infant may have been infected, either within the incubation period, prior to, or at the time of delivery.

The acute conjunctivitis was deemed secondary to COVID-19, given positive nasal PCR for the virus, concomitant positive testing from the conjunctival specimens, lack of any other identifiable pathogen on extensive testing, and the well-documented propensity for SARS-CoV-2 to affect the conjunctiva.

Discussion

The most common ocular manifestation of COVID-19 described is acute conjunctivitis, with a prevalence ranging from 0.8% to 31.6%.1 Most adult cases present with bilateral conjunctival hyperemia, chemosis, a follicular reaction, and
Several studies have examined the possibility of vertical maternal-fetal transmission of the SARS-CoV-2. Three studies demonstrated no findings suggestive of COVID-19 in infants born to affected mothers, with amniotic fluid, cord blood, and breast milk all negative for the virus. In a study by Zeng and colleagues, 3 infants in a cohort of 33 born to mothers with COVID-19 illness tested positive on nasopharyngeal testing and exhibited symptoms, including fever, lethargy, vomiting, and pneumonia.

This case highlights the importance of considering COVID-19 infection as a cause of ophthalmia neonatorum during the current epidemiologic circumstances, particularly in the setting of no other established infectious etiology. We hypothesize that in our patient transmission of SARS-CoV-2 potentially occurred via the birth canal of the mother or by respiratory transmission after delivery. We highlight the finding of a hemorrhagic-type conjunctivitis in this patient, similar to that seen by Pérez-Chimal and colleagues, which may be related to the local thrombotic and vascular disruption caused by the virus. Further clinical evidence is necessary to establish a more thorough understanding of this entity.

**References**

1. Bertoli F, Veritti D, Danese C, et al. Ocular findings in COVID-19 patients: a review of direct manifestations and indirect effects on the eye. J Ophthalmol 2020;4827304.
2. Cheema M, Aghazadeh H, Nazarali, et al. Keratoconjunctivitis as the initial medical presentation of the novel coronavirus disease 2019. Can J Ophthalmol 2020;55:125-9.
3. Falcone MM, Rong AJ, Salazar H, et al. Acute abducens nerve palsy in a patient with the novel coronavirus disease (COVID-19). J AAPOS 2020;24:216-17.
4. Ma N, Li P, Wang X, et al. Ocular manifestations and clinical characteristics of children with laboratory-confirmed COVID-19 in Wuhan, China. JAMA Ophthalmol 2020;138:1079-86.
5. Valente P, Iarossi G, Federici M. Ocular manifestations and viral shedding in tears of pediatric patients with coronavirus disease 2019: a preliminary report. J AAPOS 2020;24:212-15.
6. Scalinci SZ, Trovato Battagliola E. Conjunctivitis can be the only presenting sign and symptom of COVID-19. IDCases 2020;20:e00774.
7. Pérez-Chimal LG, Cuevas GG, Di-Luciano A, Chamartín P, Anadeo G, Martínez-Castellanos MA. Ophthalmic manifestations associated with SARS-CoV-2 in newborn infants: a preliminary report. Epub ahead of print 15 February; 2020. J AAPOS 2020;24:212-15.
8. Mallika PS, Asok T, Faisal HA, et al. Neonatal conjunctivitis—a review. Malays Fam Physician 2008;3:77-81.
9. Esmaeelpour M, Watts PO, Boulton ME, et al. Tear film volume and protein analysis in full-term newborn infants. Cornea 2011;30:400-404.
10. Zeng L, Xia S, Yuan W, et al. Neonatal early-onset infection with SARS-CoV-2 in 33 neonates born to mothers with COVID-19 in Wuhan, China. JAMA Pediatrics 2020;174:722-5.

**FIG 1.** Clinical photograph at presentation showing erythematous palpebral conjunctiva and a subconjunctival hemorrhage of the left eye.