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## Ocular manifestations in patients with corona virus disease (COVID-19)

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### Abstract

**Introduction:** Coronavirus disease (COVID-19) has affected many subspecialties including ophthalmology. We aimed to determine the ocular manifestations of COVID-19 patients treated in a dedicated tertiary care hospital, in Nepal.

**Method:** This was a descriptive cross-sectional study in hospitalized COVID-19 patients in Patan Hospital, Patan Academy of Health Sciences, Kathmandu, Nepal. Data were collected for 6 months from November 2020 to May 2021 to achieve a specified sample size of 90. Ophthalmological manifestations were recorded in the consenting participants. Ethical approval was obtained.

**Result:** One or more ocular manifestations were seen in 3.4% of admitted COVID-19 patients. Bilateral diffuse red eyes were the most common manifestation.

**Conclusion:** Bilateral diffuse red eye was the common ocular manifestation in admitted COVID-19 patients.

**Keywords:** COVID-19, Nepal, ocular manifestations, ophthalmology

## Introduction

Ocular manifestations of COVID-19 (coronavirus disease due to SARS-CoV-2 infection) are seen in various studies across the world.<sup>1,2</sup> The SARS-CoV-2 is detected in several bodily fluids, including the tears of patients with conjunctivitis.<sup>3,4</sup> The WHO has recommended the use of personal eye and face protective equipment and to refrain from touching mucous membranes without taking full precaution.<sup>5</sup> Nepal Ophthalmic Society has published COVID-19 Ophthalmology Practice Guidelines which assume that the disease can spread through tears.<sup>6</sup> This descriptive cross-sectional study was performed to determine the ocular manifestations of a COVID-19 patient admitted to Patan Hospital, Patan Academy of Health Sciences, Kathmandu, Nepal. Results of this study can help to understand the ocular manifestations of COVID-9 in the local population and the need for precautions while treating patients.

## Method

A descriptive cross-sectional study was conducted in the COVID ward and COVID Intensive Care Unit (ICU) patients with confirmed Polymerase Chain Reaction (PCR) for COVID-19 admitted to Patan Hospital, Patan Academy of Health Sciences, Lalitpur, Nepal. We used convenience sampling to enroll consecutive patients with suspected ocular abnormalities by treating physicians in the COVID ward or ICU and requested an eye examination. We excluded those who did not give consent, and where ocular examination could not be performed. The criteria for clinical diagnosis, admission, and treatment of confirmed COVID-19 patients followed the hospital guidelines. The sample size was estimated to be 90 based on a pooled prevalence of 5.5% of ophthalmological manifestations.<sup>1</sup>

Informed consent was taken from the patients before enrolling them in the study. In the case

of ICU admitted patients, the caretaker of the patient was approached for permission. A full set of personal protective equipment (PPE) was used for examining the patient as per the hospital guidelines. A full ocular examination was performed to the extent possible in the COVID unit (COVID ward AND ICU), avoiding unnecessary physical contact with the patients. Ophthalmological manifestations were documented. Gross assessment of vision was performed, as well as an external ocular examination of the eyelids and eyelashes for matting, conjunctival congestion, and corneal clarity using a torchlight. For corneal staining, a fluorescent strip was used and examined with a cobalt blue filter of direct ophthalmoscope which was kept in the COVID ward till the end of the study and disinfected after completion of the study.

All study data were collected in paper form and transferred to a password-protected electronic database in Microsoft Excel, limiting access to the investigators only. No personally identifiable information was recorded, and patients were identified by hospital numbers only. Data analysis was done with Statistical Package for the Social Sciences (SPSS), version 16.

## Result

During the study period, there was a total of 822 patients admitted with COVID-19. The patients were from 22 different districts of Nepal. Out of 822 patients, 90 (10.9%) were suspected of ocular manifestation, and 28 (3.4% of 822) were confirmed to have an ocular manifestation. The mean age was  $37.04 \pm 17.26$  years, males 54 (60%), Table 1.

Among the 28 patients with ocular manifestation, males were 16 (57.1%), the bilateral diffuse red-eye was present in 18 (64.3%) followed by other manifestations of conjunctival inflammation, Table 2.

**Table 1. Sociodemographic characteristics of COVID-19 patients (n = 90)**

Variables	Categories	Number	Percent
Age: mean $\pm$ standard deviation (years)	37.04 $\pm$ 17.26		
Gender	Male	54	60.0%
	Female	36	40.0%

**Table 2. Patterns of ocular manifestations among patients with COVID-19. (n = 28)**

Variables	Number	Percent
Gender		
Male	16	57.1%
Female	12	42.85%
Ocular manifestations		
Red eye (bilateral, diffuse)	18	64.3%
Discharge	10	35.6%
Conjunctival redness (partial/unilateral)	09	32.1%
Visual impairment	07	25.0%
Eye Pain	05	17.7%
Lid edema	02	07.1%
Corneal opacity	02	07.1%

## Discussion

In our study, 10.9% (90 out of 822) of admitted COVID-19 patients were suspected to have an ocular abnormality, and we found that overall 3.4% (28 of 822) had at least one ocular manifestation. This was lower compared to a study done in Hubei, China, in which they studied 38 COVID-19 patients during the early phase of pandemic and found that 12 patients (31.6%) had ocular symptoms. However, if we consider confirmed ocular abnormality among COVID-19 patients who were suspected (90 out of 822) by treating physician and subsequently had ophthalmic consultation 31.1% (28 out of 90) had one or more eye abnormalities. A meta-analysis that included 16 studies, reported the pooled estimate of ocular manifestations to be 11.64% among 2347 confirmed COVID-19 cases; 2.26% of patients had ocular manifestations as the presenting symptom.<sup>2</sup> Systematic review and meta-analysis including 38 studies with a total of 8,219 COVID-19 patients reported a pooled prevalence of all ocular symptoms to be 11.03% among COVID-19 patients.<sup>8</sup>

The lower rate of ocular manifestation in the current study could be we did not enroll all the COVID 19 patients and only 90 (10.9% of 822) who were suspected for ocular abnormalities by treating physician and consulted for

detailed examination by an ophthalmologist, and so the true prevalence of ocular manifestations may be higher. However, the identified rate of ocular involvement is expected to be close to the true prevalence of ocular involvement in the Nepali population because patients were of diverse backgrounds from 22 districts, and all COVID-19 patients with eye symptoms or suspected of any ocular abnormalities by treating physician were included.

Among 28 patients with ocular manifestation, the most common was diffuse and bilateral red eye (64.3%) followed by discharge (35.6%), unilateral partial conjunctival redness (32.1%), visual impairment (25%), pain (17.7%), and lid edema and corneal opacity (7.1% each). In one of the meta-analyses done, the most common ocular manifestation was ocular pain, followed by discharge, redness, and follicular conjunctivitis.<sup>2</sup> Red eye and discharge are commonly associated with conjunctivitis that has been directly attributed to coronavirus and SARS-CoV-2.<sup>9,10</sup> In a study of 142 COVID-19 patients most prevalent ocular finding was conjunctival hyperemia (44 persons; 31%). Red-eye without discharge in the current series could be directly related to conjunctival hyperemia associated with SARS CoV2.<sup>11</sup> In the present study, we did not perform PCR on tears or conjunctival secretions. However,

prior studies have shown possibilities of viral shedding in tears or conjunctival discharge<sup>12,13</sup>, thus transmission of SARS-CoV-2 by tear is not unlikely<sup>14</sup> and the eye can be pathway<sup>15</sup> for infectious droplets to enter the body. Anatomically, the conjunctiva of the eye is easily exposed to infectious droplets and fomites during close contact with infected individuals and contaminated hands. Some respiratory viruses such as human adenovirus and avian influenza virus (H7) frequently cause highly infectious conjunctivitis or keratoconjunctivitis.<sup>16</sup> Hence, the conjunctiva is postulated to be an important portal of entry for respiratory viruses, while tear and conjunctival secretions may contain the virus and spread viral infection. Additionally, anatomically the mucosa of the ocular surface (i.e., conjunctival and corneal epithelial) and the upper respiratory tract are connected by the nasolacrimal duct. When dropped into the eye, the liquid is partially absorbed by the cornea and conjunctiva but mostly drained into the nasal cavity through the nasolacrimal duct and then transported toward the lower part of the respiratory tract, including the nasopharynx and trachea, or swallowed into the gastrointestinal tract. This allows pathogens to which the eye is exposed to be transported to respiratory and gastrointestinal tract mucosa. Angiotensin-converting enzyme 2 (ACE2), the entry receptor of SARS-Corona virus-2, is highly expressed on human lung alveolar epithelial cells, enterocytes of the small intestine, and the proximal tubular cells of the kidney, and also in the human conjunctiva but at a lower level of expression.<sup>17</sup>

All health workers including ophthalmologists need to be aware that ocular symptoms may develop a few hours or days before the onset of COVID-19 systemic signs such as fever and cough.<sup>18</sup> From an ophthalmology point of view, ophthalmologists are at higher risk due to the proximity of physicians to patients (20-30 cm) for routine ophthalmic examinations such as slit-lamp examination and direct ophthalmoscopy which increases the exposure to tears or ocular secretions or the instruments contaminated by patients. Also, there is the possibility of spread as the virus can be present

in the tear fluid with deceiving eye symptoms (conjunctivitis) even before the fever and respiratory symptoms in COVID-19 patients.<sup>19,20</sup>

The SARS-CoV-2 infection has evolved as a global health emergency and is a major public health concern in the present era.<sup>21</sup> Strict hand hygiene and proper personal protection equipment, including masks, gowns, gloves, and goggles, are highly recommended to avoid hospital-related viral transmission during all examination procedures including ophthalmic practice. When high-risk procedures are performed on these patients, for example, direct ophthalmoscopy, lacrimal irrigation and probing, intraocular pressure measurement with contact tonometry, ophthalmic laser therapy, and ophthalmic surgeries, N95 respirator, gloves, and goggles or face shield, are highly recommended. Ophthalmic personnel is also recommended not to touch their goggles, face shield, surgical/N95 mask, eye, head, and neck region before the handwashing procedure is completed.<sup>22</sup> For patients with confirmed or suspected COVID-19, ophthalmic consultation should be completed within the quarantine ward to avoid cross-infection. Hand washing, preferably with the use of a chlorhexidine alcoholic hand rub, and gloves changed after each high-risk procedure are mandatory to prevent cross-infection.

## Conclusion

Ocular manifestations were suspected in 10.9% and were confirmed in 3.4% of COVID-19 patients admitted to Patan Hospital. Bilateral red eye was the most common manifestation followed by eye discharge; hence ophthalmologists should be cautious and consider the possibility of COVID-19 infection in any patient presenting with red eyes.

## Conflict of Interest

None

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**Author Contribution**

Concept, design, planning: RS, BPS; Literature review: RS, SS; Data collection/analysis: SA, AJ, KS; Draft manuscript: DA; Revision of draft: RS, DA; Final manuscript: RS; Accountability of the work: All.

**Reference**

1. Ulhaq ZS, Soraya GV. The prevalence of ophthalmic manifestations in COVID-19 and the diagnostic value of ocular tissue/fluid. *Graefe's Archive for Clinical and Experimental Ophthalmology*. 2020;258(6):1351-2. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
2. Aggarwal K, Agarwal A, Jaiswal N, Dahiya N, Ahuja A, Mahajan S, et al. Ocular surface manifestations of coronavirus disease 2019 (COVID-19): A systematic review and meta-analysis. *PLoS One*. 2020;15(11):e0241661. | [DOI](#) | [PubMed](#) | [Full Text](#) |
3. Wu P, Duan F, Luo C, Liu Q, Qu X, Liang L, et al. Characteristics of ocular findings of patients with coronavirus disease 2019 (COVID-19) in Hubei Province, China. *JAMA Ophthalmol*. 2020 May 1;138(5):575-8. | [DOI](#) | [PubMed](#) | [Full Text](#) |
4. Chen L, Liu M, Zhang Z, Qiao K, Huang T, Chen M, et al. Ocular manifestations of a hospitalised patient with confirmed 2019 novel coronavirus disease. *Br J Ophthalmol*. 2020;104(6):748-51. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
5. World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected [Internet]. World Health Organization. [cited 2021 Feb 27]. | [Google Scholar](#) | [Full Text](#) |
6. Nepal Ophthalmic Society. Nepal Ophthalmic Society COVID 19 ophthalmology practice guidelines. Kathmandu: Nepal Ophthalmic Society; 2020. | [Full Text](#) |
7. Khalili M, Karamouzian M, Nasiri N, Javadi S, Mirzazadeh A, Sharifi H. Epidemiological characteristics of COVID-19: a systematic review and meta-analysis. *Epidemiol Infect*. 2020;148:e130. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
8. Nasiri N, Sharifi H, Bazrafshan A, Noori A, Karamouzian M, Sharifi A. Ocular manifestations of COVID-19: a systematic review and meta-analysis. *J Ophthalmic Vis Res*. 2021;16(1):103-12. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
9. Amesty MA, Alió del Barrio JL, Alió JL. COVID-19 disease and ophthalmology: an update. *Ophthalmol Ther*. 2020;9:1-12. | [DOI](#) | [Google Scholar](#) | [Full Text](#) |
10. Guo D, Xia J, Shen Y, Tong J. SARS-CoV-2 may be related to conjunctivitis but not necessarily spread through the conjunctiva SARS-CoV-2 and conjunctiva. *J Med Virol*. 2020;92(10):1757-8. [DOI](#) | [PubMed](#) | [Google scholar](#) | [Full Text](#) |
11. Abrishami M, Tohidinezhad F, Daneshvar R, Omidtabrizi A, Amini M, Sedaghat A, et al. Ocular manifestations of hospitalized patients with COVID-19 in Northeast of Iran. *Ocul Immunol Inflamm*. 2020;28:739-44. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
12. Seitzman GD, Doan T. No time for tears. *Ophthalmology*. 2020;127(7):980-1. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
13. Loon SC, Teoh SC, Oon LL, Se-Thoe SY, Ling AE, Leo YS, et al. The severe acute respiratory syndrome coronavirus in tears. *Br J Ophthalmol*. 2004;88(7):861-3 | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
14. Abobaker A, Raba AA, Alzwi A. Extrapulmonary and atypical clinical presentations of COVID-19. *J Med Virol*. 2020;92(11):2458-64. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
15. Dockery DM, Rowe SG, Murphy MA, Krzystolik MG. The ocular manifestations and transmission of COVID-19: recommendations for prevention. *J Emerg Med*. 2020;59:137-40. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
16. Sun CB, Wang YY, Liu GH, Liu Z. Role of the eye in transmitting human coronavirus: what we know and what we do not know. *Front Public Health*. 2020;8:155. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
17. Lange C, Wolf J, Auw-Haedrich C, Schlecht A, Boneva S, Lapp T, et al. Expression of the COVID-19 receptor ACE2 in the human conjunctiva. *J Med Virol*. 2020;92(10):2081-6. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
18. Huang L, Zhang X, Zhang X, Wei Z, Zhang L, Xu J, et al. Rapid asymptomatic transmission of COVID-19 during the incubation period demonstrating strong infectivity in a cluster of youngsters aged 16-23 years outside Wuhan and characteristics of young patients with COVID-19: a prospective contact-tracing

- study. *J Infect.* 2020;80:e1-13. | [DOI](#) | [PubMed](#) | [Full Text](#) |
19. Gupta PC, Kumar MP, Ram J. COVID-19 pandemic from an ophthalmology point of view. *Indian J Med Res.* 2020;151(5):411-8. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
20. Chen X, Yu H, Mei T, Chen B, Chen L, Li S, et al. SARS-CoV-2 on the ocular surface: is it truly a novel transmission route? *Br J Ophthalmol.* 2021;105(9):1190-5. [Epub 2020 Aug 11] | [DOI](#) | [PubMed](#) | [Full Text](#) |
21. Poudel K, Subedi P. Impact of COVID-19 pandemic on socioeconomic and mental health aspects in Nepal. *Int J Soc Psychiatry.* 2020;66(8):748-55. | [DOI](#) | [PubMed](#) | [Google Scholar](#) | [Full Text](#) |
22. Zhang MC, Xie HT, Xu KK, Cao Y. Suggestions for disinfection of ophthalmic examination equipment and protection of ophthalmologist against 2019 novel coronavirus infection [Article in Chinese]. *Zhonghua Yan Ke Za Zhi.* 2020;56(0):E001. | [DOI](#) | [PubMed](#) | [Google Scholar](#) |