

## Is novel coronavirus disease (COVID-19) transmitted through conjunctiva?

We read with interest the article of Dr Xia et al<sup>1</sup> on the detection of RNA of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in tears and conjunctival secretions of patients with novel coronavirus disease (COVID-19). Xia et al tested a total of 60 tears and conjunctival secretions samples from 30 patients, with two samples from each patient collected at an interval of 2 to 3 days. While none of the samples from 29 COVID-19 patients without conjunctivitis had detectable SARS-CoV-2 RNA, one patient complicated with conjunctivitis showed SARS-CoV-2 RNA in the two samples of tears and conjunctival secretions. In the discussion, Xia et al<sup>1</sup> mentioned that transmission of SARS-CoV-2 through conjunctiva is not common, but they also stated that the risk of transmission could not be completely eliminated. However, we consider that transmission of SARS-CoV-2 through conjunctiva is less likely based on the findings of Xia et al and other documented literature.

Indeed, ophthalmologists are easily infected with SARS-CoV-2, but this does not mean that SARS-CoV-2 is transmitted through the conjunctiva. Xia et al<sup>1</sup> reasonably explained this issue: close contact with the patients during ophthalmic examinations. Actually, there is almost no distance between ophthalmologists and patients in the examination of the ocular fundus.

The positivity of SARS-CoV-2 RNA in tears and conjunctival secretions of the patient with conjunctivitis does not mean that SARS-CoV-2 can replicate in the conjunctiva. Since COVID-19 patients have viremia during the acute phase,<sup>2</sup> the positivity of SARS-CoV-2 RNA is likely resulted from the virus in the exudation of conjunctivitis. Despite being a small sample size, undetectability of SARS-CoV-2 RNA in 29 patients without conjunctivitis supports this explanation. Nevertheless, sufficient sample size and well-characterized studies are required to obtain more evidence.

If SARS-CoV-2 can be transmitted through the conjunctiva, the initial symptoms should be conjunctivitis. So far, the clinical features of reported COVID-19 patients did not have the initial symptoms as conjunctivitis.<sup>2-5</sup> Based on the "Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19)" summarized from 55 924 laboratory-confirmed cases,<sup>6</sup> the typical signs and symptoms include: fever (87.9%), dry cough (67.7%), fatigue (38.1%), sputum production (33.4%), shortness of breath (18.6%), sore throat (13.9%), headache (13.6%), myalgia or arthralgia (14.8%), chills (11.4%), nausea or vomiting (5.0%), nasal congestion (4.8%), diarrhea (3.7%), hemoptysis (0.9%), and conjunctival congestion (0.8%). Overall, only a very small proportion of the patients had conjunctival

presentations, which is unknown whether the conjunctival congestion was the initial or coexisted symptom. Thus, SARS-CoV-2 is less likely to be transmitted through the conjunctiva.

In theory, the premise for transmission through conjunctiva is that SARS-CoV-2 can replicate in conjunctival epithelia. SARS-CoV-2 is assumed to use angiotensin-converting enzyme 2 (ACE2) as the cellular receptor to enter into cells as SARS-CoV.<sup>7</sup> Currently it is unknown whether conjunctival epithelia can express ACE2. However, oral, nasal, and nasopharyngeal epithelia do not express ACE2,<sup>8</sup> which can explain that most of the COVID-19 patients did not have upper respiratory symptoms.<sup>2-6</sup> Thus, whether conjunctival epithelia express ACE2 merits further study.


It has been proposed that "2019-nCoV transmission through the ocular surface must not be ignored" based on the nosocomial infection of some ophthalmologists and an expert who wore an N95 mask but did not wear anything to protect his eyes was infected with SARS-CoV-2.<sup>9</sup> However, wearing N95 mask does not mean to completely prevent the transmission. Moreover, the infected expert had conjunctivitis just 2 to 3 hours before he developed fever and catarrhal symptoms,<sup>10</sup> rather than several days before the onset of pneumonia.<sup>9</sup> It is unlikely that the onset of pneumonia was developed within 2 to 3 hours following the development of conjunctivitis.

While we consider that SARS-CoV-2 is less likely transmitted through the conjunctiva, it does not mean that protective goggles are not required in managing COVID-19 patients. As eyes and nose are very closely located, the upper edge of a masker is just about one centimeter below the eyes. There is usually a narrow gap underneath the upper edge of a masker because of the uneven surface at nose root, leaving the chance of pathogen exposure. A pair of protective goggles can overcome this problem.

In summary, the absence of SARS-CoV-2 RNA in tears and conjunctival secretions of 29 COVID-19 patients without conjunctivitis,<sup>1</sup> provides evidence that SARS-CoV-2 does not replicate in conjunctival epithelia, which also indicates that SARS-CoV-2 is less likely transmitted through the conjunctiva. The detection of SARS-CoV-2 RNA in tears and conjunctival secretions of the COVID-19 patient complicated with conjunctivitis is a coincident event, rather than a causal event of SARS-CoV-2 infection of the conjunctiva.

### CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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#### REFERENCES

1. 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. *J Med Virol*. 2020. <https://doi.org/10.1002/jmv.25725>
2. 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. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5)
3. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020. <https://doi.org/10.1001/jama.2020.1585>
4. Guan W, Ni Z, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020. <https://doi.org/10.1056/NEJMoa2002032>
5. Sun P, Qie S, Liu Z, Ren J, Li K, Xi J. Clinical characteristics of 50466 hospitalized patients with 2019-nCoV infection. *J Med Virol*. 2020. <https://doi.org/10.1002/jmv.25735>
6. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). February 16-24, 2020. <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>. Accessed 5 March 2020.
7. Zhou P, Yang XL, Wang XG, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*. 2020. <https://doi.org/10.1038/s41586-020-2012-7>
8. Hamming I, Timens W, Bulthuis M, Lely A, Navis G, van Goor H. Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. *J Pathol*. 2004;203(2):631-637. <https://doi.org/10.1002/path.1570>
9. Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet*. 2020;395(10224):e39. [https://doi.org/10.1016/S0140-6736\(20\)30313-5](https://doi.org/10.1016/S0140-6736(20)30313-5)
10. Dai X. Peking University Hospital Wang Guangfa disclosed treatment status on Weibo and suspected infection without wearing goggles. 23 January 2020. <http://www.bjnews.com.cn/news/2020/01/23/678189.html>. Accessed 29 February 2020.