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Research note

More than loss of taste and smell: burning watering eyes in coronavirus disease 2019

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abstract

Objectives: To evaluate ocular symptoms in European non-hospitalized patients with severe acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2) and to investigate associations with the demographic data as well as nasal and general physical symptoms.

Methods: In this prospective, observational study, 108 non-hospitalized patients with PCR-confirmed SARS-CoV-2 infection not requiring intensive care were asked about disease-associated ocular symptoms, demographic data, as well as general physical and nasal symptoms using a standardized questionnaire. Total ocular symptom score (TOSS) was evaluated during and, retrospectively, before development of coronavirus disease 2019 (COVID-19). Associations between TOSS and demographic data as well as general and nasal symptoms were evaluated.

Results: Seventy-five of the 108 COVID-19 patients (69.4%) had at least one ocular symptom during COVID-19. The most common symptoms included burning sensations in 39 (36.1%), epiphora in 37 (34.3%) and redness in 28 (25.9%), compatible with conjunctivitis. These symptoms occurred 1.96 ± 3.17 days after the beginning of COVID-19 and were mild. TOSS was significantly higher during COVID-19 (1.27 ± 1.85) than before the infection (0.33 ± 1.04; p < 0.001). There were no significant associations between TOSS and gender (β coefficient = −0.108; p = 0.302), age (β = −0.024; p = 0.816), rhinorrhea (β = −0.127; p = 0.353), nasal itching (β = 0.028; p = 0.802), sneezing (β = 0.099; p = 0.470), nasal congestion (β = 0.012; p = 0.930), cough (β = −0.079; p = 0.450), headache (β = 0.102; p = 0.325), sore throat (β = 0.208; p = 0.052), or fever (β = 0.094; p = 0.361).

Conclusions: Ocular involvement in European non-hospitalized individuals with COVID-19 seems to be highly underestimated. Overall, these ocular symptoms, including burning sensations, epiphora and redness, seem to be mild and to not need treatment. Alexander C. Rokohl, Clin Microbiol Infect 2020;26:1560.e5–1560.e8 © 2020 European Society of Clinical Microbiology and Infectious Diseases. Published by Elsevier Ltd. All rights reserved.
converting enzyme 2, the entry receptor of SARS-CoV-2, on the human conjunctiva and cornea potentially resulting in conjunctivitis and keratitis [2–5]. SARS-CoV-2 existed in COVID-19 patients’ tears and ocular involvement was present in 1%–32% of hospitalized individuals [3,6]. Ocular involvement included chemosis, epiphora, secretion and conjunctival hyperaemia [6]. There are some studies regarding ocular manifestations in individuals with COVID-19, but most of them evaluated hospitalized patients in China retrospectively [3,5]. Therefore, the objectives of this study included the evaluation of ocular symptoms in European non-hospitalized individuals infected with SARS-CoV-2 and investigation of associations with the demographic data as well as nasal and general physical symptoms.

**Methods**

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration. Institutional Review Board approval was obtained. Inclusion criteria were COVID-19 confirmed by PCR test on a throat swab and age over 18 years. On eight consecutive days, these patients were identified by the records of the University Hospital of Cologne, Germany and all of them were called by phone. Exclusion criteria were hospitalization at any time-point caused by COVID-19. A standardized three-section questionnaire was used. Section **Introduction** requested demographic data, general symptoms including fever, cough, headache and sore throat as well as dates of the positive PCR test and of the first symptom was noted (days), respectively [7]. A score of 0 indicated no symptoms, 1 documented mild symptoms that were easily tolerated, 2 described awareness of symptoms that were bothersome but tolerable, and 3 matched severe symptoms that were hard to tolerate and interfered with daily activities or sleep.

Section **Methods** asked about ocular symptoms during COVID-19 including burning sensations, itching, watering, mucoid and purulent discharge, photophobia, foreign body sensation, conjunctival swelling, eyelid swelling, feeling of pressure, double images, metaporphpsia, redness, reduced visual acuity, and pain for the right and the left eye, respectively. Furthermore, the date of the beginning of each symptom was noted. Total Ocular Symptom Score (TOSS) was evaluated for two different time-points: retrospectively before coronavirus infection and during COVID-19. TOSS included ocular itching, redness, epiphora and eye swelling. Each symptom was graded analogous to nasal symptoms and TOSS was then calculated by adding the four scores to a total score between 0 and 12. Section **Results** requested information about pre-existing eye conditions, topical ocular medication and ophthalmologist’s visits during COVID-19. All statistical analyses were performed with SPSS version 26.0 for Mac. Shapiro–Wilk tests were performed to analyse normal distribution. To compare ocular symptom scores before infection and during COVID-19, Wilcoxon tests were performed. To investigate factors related to TOSS, a general linear model including analysis of variance was used with explanatory variables of gender, age, rhinorrhoea, nasal itching, sneezing, nasal congestion, cough, headache, fever and sore throat. The threshold for statistical significance was set at p < 0.05.

**Table 1**

Ocular symptoms of 108 European non-hospitalized patients (216 eyes) with COVID-19

| Ocular symptoms                        | Right and left eyes with symptoms, no (%) | Patients with bilateral symptoms, n (%) | Duration of occurrence since first symptom was noted (days), mean ± SD (range) |
|----------------------------------------|------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|
| Burning sensations                     | 76 (35.2%)                               | 37 (34.3%)                             | 1.89 ± 3.26 (range 0–13)                                                      |
| Itching                                | 38 (17.6%)                               | 18 (16.7%)                             | 2.53 ± 3.72 (range 0–13)                                                      |
| Epiphora (waterting eyes)              | 71 (32.9%)                               | 34 (31.5%)                             | 1.91 ± 3.59 (range 0–13)                                                      |
| Mucoid discharge                       | 18 (8.3%)                                | 9 (8.3%)                               | 0.78 ± 1.09 (range 0–13)                                                      |
| Purulent discharge                     | 0 (0.0%)                                 | 0 (0.0%)                               | —                                                                               |
| Photophobia                            | 44 (20.4%)                               | 22 (20.4%)                             | 1.77 ± 3.41 (range 0–13)                                                      |
| Foreign body sensation                 | 15 (6.9%)                                | 7 (6.5%)                               | 2.25 ± 2.12 (range 0–6)                                                       |
| Conjunctival swelling                  | 16 (7.4%)                                | 8 (7.4%)                               | 1.14 ± 1.46 (range 0–3)                                                       |
| Eyelid swelling                        | 30 (13.9%)                               | 15 (13.9%)                             | 2.00 ± 2.88 (range 0–10)                                                      |
| Feeling of pressure                    | 45 (20.8%)                               | 22 (20.4%)                             | 2.04 ± 2.40 (range 0–7)                                                       |
| Double images                          | 4 (1.9%)                                 | 2 (1.9%)                               | 3.50 ± 2.12 (range 2–5)                                                       |
| Metaporphpsia                          | 0 (0.0%)                                 | 0 (0.0%)                               | 2.07 ± 2.67 (range 0–10)                                                      |
| Redness                                | 54 (25.0%)                               | 26 (24.1%)                             | 3.10 ± 2.60 (range 0–7)                                                       |
| Reduced visual acuity                  | 19 (8.8%)                                | 9 (8.3%)                               | 2.09 ± 2.12 (range 0–7)                                                       |
| Pain                                   | 22 (10.2%)                               | 11 (10.2%)                             | —                                                                               |
Discussion

This prospective study showed for the first time the high prevalence of burning sensation, redness and watering in non-hospitalized European individuals with COVID-19. The consecutively enrolled individuals were much younger than in previous studies including mostly inpatients in China [3,6]. Younger patients without any pre-existing conditions normally have a mild course of disease and therefore need not be hospitalized. Approximately one-third of the outpatients in this study had epiphora or burning sensations, respectively, and one-quarter reported ocular redness. Therefore, the incidence of conjunctivitis, especially in outpatients, seems to be highly underestimated. Ocular symptoms occurred mostly in the first 3 days of COVID-19, but were usually mild. However, in some rare cases moderate or severe courses including subconjunctival bleeding, keratitis, or even vitreous haemorrhages may occur [8,9].

The reasons why patients had no ophthalmologist’s visit, despite a high incidence of symptoms, remain unclear. The mild disease, fear of infection and/or the home quarantine order by the health authorities might be reasons.

Ocular symptoms were not associated with nasal symptoms, cough, headache, fever or sore throat as associated with TOSS during COVID-19 (analyses of variance p 0.559; p ≥ 0.05, respectively).

Transparency declaration

The authors declare that they have no conflicts of interest. All authors have full control of all primary data and they agree to allow review of their data upon request.

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Authors’ contributions

ACR and LMH conceptualized the study. NL, PAWM and SZ collected the data. ACR conducted the data analyses. ACR and NL had the overall responsibility.

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Table 2

Graded ocular symptoms and total ocular symptom score of 108 European COVID-19 non-hospitalized patients before versus during COVID-19 infection

| Graded ocular symptoms | Before COVID-19 | During COVID-19 | p value |
|------------------------|-----------------|-----------------|---------|
| Ocular itching, mean ± SD (range) | 0.05 ± 0.25 (range, 0–2) | 0.30 ± 0.67 (range, 0–3) | 0.001 |
| None, n (%) | 104 (96.3%) | 88 (81.5%) | — |
| Mild, n (%) | 3 (2.8%) | 9 (8.3%) | — |
| Moderate, n (%) | 1 (0.9%) | 10 (9.3%) | — |
| Severe, n (%) | 0 (0.0%) | 1 (0.9%) | — |
| Ocular redness, mean ± SD (range) | 0.06 ± 0.27 (range, 0–2) | 0.33 ± 0.64 (range, 0–3) | <0.001 |
| None, n (%) | 103 (95.4%) | 80 (74.1%) | — |
| Mild, n (%) | 4 (1.9%) | 22 (20.4%) | — |
| Moderate, n (%) | 1 (0.9%) | 4 (3.7%) | — |
| Severe, n (%) | 0 (0.0%) | 2 (1.9%) | — |
| Epiphora, mean ± SD (range) | 0.17 ± 0.42 (range, 0–2) | 0.45 ± 0.72 (range, 0–3) | <0.001 |
| None, n (%) | 92 (85.2%) | 71 (65.7%) | — |
| Mild, n (%) | 14 (13.0%) | 27 (25.0%) | — |
| Moderate, n (%) | 2 (1.9%) | 8 (7.4%) | — |
| Severe, n (%) | 0 (0.0%) | 2 (1.9%) | — |
| Eye swelling, mean ± SD (range) | 0.06 ± 0.31 (range, 0–2) | 0.19 ± 0.51 (range, 0–3) | 0.022 |
| None, n (%) | 103 (95.4%) | 93 (86.1%) | — |
| Mild, n (%) | 3 (2.8%) | 11 (10.2%) | — |
| Moderate, n (%) | 2 (1.9%) | 3 (2.8%) | — |
| Severe, n (%) | 0 (0.0%) | 1 (0.9%) | — |
| Total Ocular Symptom Score, mean ± SD (range) | 0.33 ± 1.04 (range, 0–8) | 1.27 ± 1.85 (range, 0–12) | <0.001 |
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