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Investigation of the presence of SARS-CoV-2 in the lacrimal sac and sustainability of lacrimal surgeries during the pandemic period

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Abstract

Objective: To investigate the reliability of dacryocystorhinostomy operations in terms of viral spread by examining the presence of severe acute respiratory syndrome (SARS) corona-virus type 2 (SARS-CoV-2) in the lacrimal sac.

Methods: A total of 15 eyes in 14 patients of nasolacrimal duct obstruction that was scheduled for external dacryocystorhinostomy operation were prospectively included in the study. Patients who have coronavirus disease 2019 (COVID-19), had recovered from COVID-19, have a history of close contact with COVID-19 infected persons, and are with vaccination were not included in the study. A nasopharyngeal swab was taken from the surgery planned side of each patient 24 hours before their operation. All cases were real-time, reverse transcription-polymerase chain reaction (RT-PCR) negative. Lacrimal swabs were taken from the lacrimal sac during surgery in these cases. The compatibility of the RT-PCR test results from the lacrimal sac and nasopharyngeal swab was evaluated.

Results: The mean age of the patients was 56.04 ± 14.91 years. The mean duration of nasolacrimal duct occlusion was 3.93 ± 3.40 years. RT-PCR was negative in the swabs taken from the lacrimal sac of all cases (100%). This result showed agreement with the RT-PCR test results of the nasopharyngeal swabs.

Conclusions: Viral RNA of SARS-CoV-2 was not detected in the lacrimal sac in this study. Lacrimal sac surgeries can be performed by taking the necessary precautions.

Keywords: COVID-19; dacryocystorhinostomy; lacrimal sac surgery; pandemics; SARS-Cov-2.

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Pandemi döneminde gözyaşı kesesinde SARS-CoV-2 varlığının ve gözyaşı ameliyatlarının sürdürülebilirliğinin araştırılması

Öz

Amaç: Gözyaşı kesesinde şiddetli akut solunum sendromu (SARS) korona-virüs tip 2 (SARS-CoV-2) varlığını inceleyerek dakriyosistorinostomi operasyonlarının viral yayılım açısından güvenilirliğini araştırmak.

Yöntemler: Nazolakrimal kanal tıkanıklığı nedeniyle eksternal dakriyosistorinostomi operasyonu planlanan 14 hastanın toplam 15 gözü prospektif olarak çalışmaya dahil edildi. Koronavirüs hastalığı 2019 (COVID-19) olan, COVID-19'dan iyileşen, COVID-19 ile enfekte kişilerle yakın temas öyküsü olan ve aşısı olan hastalar çalışmaya dahil edilmedi. Ameliyattan 24 saat önce her hastanın ameliyat planlanan tarafından nazofaringeal sürüntü alındı. Tüm vakalarda gerçek zamanlı, ters transkripsiyon-polimeraz zincir reaksiyonu (RT-PCR) negatifti. Bu olgularda ameliyat sırasında gözyaşı kesesinden sürüntü alındı. Gözyaşı kesesi ve nazofaringeal sürüntüden alınan RT-PCR test sonuçlarının uyumluluğu değerlendirildi.

Bulgular: Hastaların yaş ortalaması 56.04 ± 14.91 yıldı. Nazolakrimal kanal tıkanıklık süresi ortalama 3.93 ± 3.40 yıldı. Tüm olguların lakrimal keseden alınan sürüntülerde RT-PCR negatifti (%100). Bu sonuç, nazofaringeal sürüntülerin RT-PCR test sonuçları ile uyum gösterdi.

Sonuçlar: Bu çalışmada gözyaşı kesesinde SARS-CoV-2 viral RNA'sı saptanmadı. Gerekli önlemler alınarak gözyaşı kesesi ameliyatları yapılabilir.

Anahtar kelimeler: COVID-19; dakriyosistorinostomi; gözyaşı kese cerrahisi; pandemiler; SARS-CoV-2.

INTRODUCTION

Coronavirus disease-2019 (COVID-19), which affects the whole world, can infect the eye by using the angiotensin-converting enzyme (ACE) 2 receptor. ACE 2 receptors have been demonstrated in the epithelial cells of the eye[1,2]. COVID-19 can infect the eye directly, and then it can reach the lacrimal sac and nasal mucosa through the nasolacrimal duct[3,4].

The dacryocystorhinostomy (DCR) operation aims to create a new pathway between the lacrimal sac and the nasal mucosa in nasolacrimal duct obstruction[5]. Although nasolacrimal surgeries are mostly considered elective surgery in ophthalmology. Since the nasolacrimal duct is a continuation of the nasal mucosa, it can be assumed that the virus may invade the lacrimal tissue from the nasal mucosa. Because of this anatomical proximity and high aerosol generation, elective ocular surgeries and especially nasolacrimal surgeries are not recommended during the pandemic period[6-8]. In addition, it is also possible for nasal, real-time, reverse transcription-polymerase chain reaction (RT-PCR) tests taken before surgery to show false negativity[9]. However, it is recommended that all precautions be taken in patients requiring emergency surgery, even if the PCR tests are negative[10,11]. These measures include personal protective equipment, operating room conditions, and avoidance of high aerosol formation during surgery[10-12].

Postponing lacrimal surgeries is not sustainable due to the prolongation of the pandemic period. This study investigated the presence of COVID-19 virus in the lacrimal sac and evaluated the compatibility of these results with RT-PCR results in nasopharyngeal swabs (NFSs). Thus, it was aimed to investigate the reliability of nasolacrimal duct surgeries in terms of infection during the COVID-19 pandemic period.

METHODS

This cross-sectional prospective study was carried out in accordance with the standards of the Helsinki declaration and approved by the

Research Protocol and Ethics Committee of Haydarpasa Numune Training and Research Hospital (HNEAH-KAEK 2021/119). Informed written consent for data collection was obtained from all patients after an explanation of the nature of the study.

Fifteen eyes in 14 cases of primary nasolacrimal occlusion were included in the study. A detailed history was taken from all patients, and a complete ophthalmological examination was performed. Nasolacrimal duct obstruction was confirmed by probing and irrigation. Ear, nose and throat (ENT) consultation was performed in all cases. Cases of other ocular disorders that may affect the lacrimal drainage system were not included in the study.

A history of COVID-19 infection and/or close contact was obtained from all cases at the first examination. This task was repeated 24 hours before surgery. Patients who have COVID-19, had recovered from COVID-19, have a history of close contact with a COVID -19 infected persons, and are with vaccination were not included in the study. NFSs were taken from the surgery planned side of each patient within 24 hours of the operation. When the lacrimal sac was reached during DCR, a swab sample was taken from the lacrimal sac. All patients included in the study underwent surgery on different days.

Precautions taken during external DCR operation due to COVID-19 infection

Patients schedule their first examination using the appointment system. The appointment system is connected to the central ' Life Fits Into Home' 'LFIH' system. This system does not schedule appointments to cases of COVID-19 infection and/or with close contact with a COVID-19-infected person. A real-time RT-PCR test is applied to all cases 24 hours before surgery. Positive cases are not taken into surgery. The hospital management has been flexible about the number of cases and whether surgeons take cases.

All DCR surgeries were performed under general anesthesia. All employees used N95 masks. The time between other surgeries was increased. Cleaning rules were fully implemented. Operating room ventilation was achieved with a high-efficiency particulate absorbing (HEPA) filter.

Statistical Analysis

Statistical analysis was performed using SPSS Version 22 (IBM SPSS, Turkey). Descriptive statistics were expressed as mean ± standard deviation or median (minimum-maximum) for continuous variables and as number of observations and percentage for categorical variables. Statistical agreement of virus positivity between a swab of the lacrimal sac and a nasal swab was tested by the kappa coefficient (κ). The $p < 0.05$ value was considered statistically significant.

RESULTS

The mean age of a total of 14 cases (8 females and 6 males) was 56.04 ± 14.91 years. The mean duration of nasolacrimal duct occlusion was 3.93 ± 3.40 years. The body mass index (BMI) of all 14 cases was determined to be 23.92 ± 1.46 kg/m^2. Nasolacrimal duct obstruction was in the right eye in 9 cases, in the left eye in 4 cases, and bilateral in one case. Table I shows the characteristics of the patients.

Table I. Characteristics of subjects

Age(year)	**56.04±14.91**
Sex(F/M)	11/3
Eye(R/L)	10/5
BMI (kg/m^2)	23.92±1.46
Duration of nasolacrimal duct occlusion (year)	**3.93±3.40**

BMI, Body mass index.

PCR tests were negative in all NFSs (100%). PCR tests taken from the lacrimal sac were negative all 15 cases (100%). There was statistical

agreement between the swab of the lacrimal sac and NFS in terms of negative PCR results.

DISCUSSION

In this study, the presence of severe acute respiratory syndrome (SARS) corona-virus type 2 (SARS-CoV-2) in the lacrimal sac was examined with a swab taken from the lacrimal sac in cases of persons who underwent external DCR operation during the COVID-19 pandemic. In addition, the PCR results of NLSs and lacrimal sac swabs were evaluated for compatibility. Thus, the reliability of performing DCR surgeries during the pandemic period in terms of infection was investigated. No virus was detected in the lacrimal sac in any case; this result was found to be compatible with the NFS.

A recent study investigating viral pathogens in the lacrimal sac and nasal mucosa in nasolacrimal duct obstruction showed the presence of coronaviruses 229E, HKU1, OC43 in 7 cases in the nasal mucosa[13]. However, although the nasal swab was negative in one case, human coronavirus HKU1 RNA was detected in the nasolacrimal sac biopsy sample[13]. The nasolacrimal duct contains ectopic nasal epithelial cells[14]. In addition, the respiratory mucosa and lacrimal duct have the same sialic acid sequence, which acts as a receptor for infectious agents[15]. Because of these similar immunological and histological features of the nasolacrimal duct epithelium and nasal mucosa, it is possible for viruses in the nasal mucosa to pass into the nasolacrimal duct and spread the virus. In addition, it is also possible for a viral conjunctivitis agent to reach the lacrimal sac in the direction of tear drainage and spread from there to the nasal mucosa. In a study, a high viral load was shown in the nasopharyngeal swab after conjunctival inoculation of SARS-CoV-2.3

The sensitivity of NFSs in the real-time RT-PCR test is considered the gold standard for the detection of RNA of SARS-CoV-2. However, an NFS may give false negative results for reasons such as anatomical difficulties, inexperience of person taking the swab, difference in test sensitivity, or time of taking the test[16]. In our study, confirmation of the absence of anatomical differences in the cases as a result of ENT consultation, the experience of person taking NFSs, and the application of the same test to each patient prevented the risk of false negativity in the NFSs. In addition, a recent study reported that the sensitivity of a nasal swab is equivalent to the sensitivity of a NFS[17]. In our study, the RT-PCR was not positive in any of the swab samples taken from the lacrimal sac. This result was consistent with the RT-PCR test results of NFS.

To reduce viral spread during ophthalmological examination and surgical procedures, measures to be taken individually, apart from central and general measures, are reported. Many measures, such as triage, reducing the number of patients, social distancing, mask use, frequent cleaning of the environment, disinfection of devices, hand hygiene, disposable gloves, personal protective equipment, HEPA filters, and avoidance of aerosol-generating processes, have been reported[18-20]. During the pandemic period, nasolacrimal and nasal surgical procedures were not recommended due to proximity to the nasal mucosa in the ophthalmology and otolaryngology guidelines.[5] However, some otolaryngology clinics reported that emergency surgeries can be performed by taking all precautions[10]. In addition, semi-elective cases were also taken by taking the necessary precautions.

One of the factors affecting our result may be the use of a central appointment system in outpatient clinic examinations. This system was integrated with the 'LFIH' system, which includes the warning of COVID-19 infection and/or close contact with a person infected with COVID-19. It has also been reported that performing NFSs by experienced people can

reduce the rate of negativity[21].For this reason, the RT-PCR test performed on patients within 24 hours before their surgery by an experienced doctor may have ensured in safe surgeries in our clinic. During surgery, an incision was made with a scalpel, and debris and fluid were removed from the wound site with an aspirator. The aerosol-forming effect of the aspirator may increase the spread of the virus. However, the N95 mask allows safe surgeries due to its high level of protection[22].

In a recent study, two patients who were found to be PCR negative in NFSs and underwent cataract surgery had positive aqueous humor PCR tests[23]. In addition, there are several studies documenting COVID-19 genetic material in conjunctival swabs and tears[24]. For this reason, it is recommended to use a shield and or protective glasses during close contact with the patients[25]. However, in studies conducted in cases with PCR positive COVID-19, only 3-16% virus was detected in conjunctival swabs.[2] This low rate may be due to the effect of lactoferrin, the natural protector of the eye[26].

This study includes a limited number of cases. However, this study, emphasizes that lacrimal surgeries are a sustainable surgery during the pandemic period due to the long duration of the pandemic and the possibility of future pandemics. Lacrimal surgery is generally an elective surgery. Postponing elective surgeries may lead to obstruction of the health systems in the future[27]. Therefore, we suggest that lacrimal sac surgeries are feasible if measures are taken by the central government, such as the use of high protective masks and general hygiene measures.

In conclusion, SARS-CoV-19 was not found in the swab taken from the lacrimal sac during the DCR operation in this study. This result was compatible with NFS. Lacrimal surgeries can be performed safely by taking the necessary precautions.

Ethics Committee Approval: This cross-sectional prospective study was carried out in accordance with the standards of the Helsinki declaration and approved by the Research Protocol and Ethics Committee of Haydarpasa Numune Training and Research Hospital (HNEAH-KAEK 2021/119).

Conflict of Interest: The author declares no conflict of interest.

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