Preoperative COVID-19 RT-PCR Testing of Asymptomatic Patients for Ophthalmic Surgery: Experience from Two Tertiary Referral Centers

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ABSTRACT

Purpose: The aim of this study was to evaluate how prevalent asymptomatic SARS-CoV-2 virus infection (COVID-19) is among patients undergoing ophthalmic surgery at two tertiary referral hospitals.

Materials and Methods: This retrospective study included patients without COVID-19 symptoms who underwent preoperative screening using reverse transcription-polymerase chain reaction (RT-PCR) before ophthalmic surgery at the Kocaeli University and Gaziantep University departments of ophthalmology [between September 1, 2020, and December 15, 2020 (group 1); between March 1, 2021, and May 30, 2021 (group 2)]. Patients scheduled for surgery and followed up in the retina, glaucoma, pediatric ophthalmology and strabismus, cataract and refractive surgery, and cornea departments were examined.

Results: RT-PCR was positive for SARS-CoV-2 in 12 (1.4%) of 840 patients in group 1 and 7 (1.1%) out of 600 patients in group 2. None of the patients were symptomatic of COVID-19. The majority of the patients were scheduled for retina or cataract and refractive surgery in both groups (group 1; retina: 29.2%, cataract and refractive: 57.0%, group-2; retina: 31.3%, cataract and refractive: 54.5%). SARS-CoV-2 RT-PCR testing was positive for seven patients in group 1 (7/245, 2.9%) and five patients in group 2 (5/188, 2.6%) who were scheduled for retinal surgery.

Conclusions: The necessity, availability, and practicality of COVID-19 RT-PCR testing prior to ophthalmic surgeries varies depending on the protocols of each institution. COVID-19 RT-PCR testing is suggested especially before vitreoretinal surgeries and general anesthesia procedures, because of the difficulty in managing postoperative complications.

Keywords: COVID-19, Preoperative testing, vitrectomy, surgery, PCR

INTRODUCTION

In December 2019, a new coronavirus illness (COVID-19) outbreak caused by the SARS coronavirus 2 (SARS-CoV-2) broke out in Wuhan, China, and quickly spread throughout the world.[1,2,3] Even during the incubation period, COVID-19, which has a quick course, may be highly contagious. Asymptomatic cases with positive reverse transcription-polymerase chain reaction (RT-PCR) tests for SARS-CoV-2 may be infectious throughout the virus's incubation phase, increasing the spread of COVID-19.[4,5]

SARS-CoV-2-infected patients have a higher risk of surgical complications and fatality.[6,7,8] Aerosol-generating procedures can put hospital workers at risk if patients have asymptomatic COVID-19.[9,10,11] However, it's unclear whether asymptomatic patients undergoing surgery during the COVID-19 outbreak should be tested, especially in the days prior to ophthalmological procedures. The use of personal protective equipment by operating room workers is recommended to reduce transmission.[12] According to the American Academy of Ophthalmology, surgical centers may determine their own procedures for pre-surgical testing of asymptomatic persons who have had no known contact with carriers.[13] Preoperative screening utilizing SARS-CoV-2 RT-PCR in all asymptomatic persons having surgery was recommended by the Infectious

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Diseases Society of America for the diagnosis of COVID-19.[14] Due to limited resources, the added expense of screening, and the ever-increasing number of elective operations, it is critical to assess the efficacy of pre-operative COVID-19 screening.

The first coronavirus case in Turkey was discovered on March 11, 2020. Many hospitals initiated standard preoperative screening of surgery patients to discover asymptomatic COVID-19 cases in the weeks that followed. On March 9, 2021, the Ministry of Health published routine guidelines for testing in Turkey.[15] According to this procedure, preoperative testing was suggested for asymptomatic and suspected non-exposure patients in places where the frequency of new cases in the previous 14 days was greater than 2%. Between September and December, according to Ministry of Health data, the number of new patients increased dramatically. In Turkey, the number of daily cases jumped from 1.572 on September 1 to 32.102 on December 15.[16] Similarly, the number of daily cases grew from around 9891 on March 1, 2021, to 61 028 on April 20, 2021.[16]

The aim of this study was to see how frequent asymptomatic COVID-19 infection was among patients scheduled for ophthalmic surgery at two separate tertiary referral hospitals during two different COVID-19 waves and to determine whether preoperative COVID-19 PCR testing is necessary.

MATERIALS AND METHODS

This is a retrospective study of all patients scheduled for surgery at the ophthalmology departments of the Kocaeli University and Gaziantep University Schools of Medicine during two separate COVID-19 waves in Turkey [(group 1; between September 1, 2020, and December 15, 2020), (group 2; between March 1, 2021, and May 30, 2021)]. This research was conducted with the approval of the institutional review board at Gaziantep University and in accordance with the Declaration of Helsinki. Informed consent was obtained from all patients prior to surgery and RT-PCR testing for the SARS-CoV-2 virus.

During the COVID-19 pandemic, preoperative oropharyngeal and nasopharyngeal swabs for RT-PCR were collected from all patients at the two tertiary centers and transferred to a laboratory as part of the standard procedure one day before surgery, and patients were questioned about the presence of COVID-19 symptoms (fever, cough, myalgia, headache, and throat pain). Patients who had positive test results for SARS-CoV-2 RT-PCR were referred to a COVID-19 management facility and contacted again three weeks later to schedule the surgery.

Patients scheduled for surgery who were followed up within the retina, cornea, glaucoma, strabismus and pediatric ophthalmology, oculoplastic, and cataract and refractive surgery departments were evaluated. Information regarding patient demographics, diagnosis, procedure type, and RT-PCR testing was collected.

In both periods, SARS-CoV-2 RT-PCR positivity of emergency cases was also evaluated. Although the SARS-CoV-2 RT-PCR testing was applied for emergency surgeries, the patients were operated on without waiting for the test results, as such the surgery team took special precautions by considering all the patients as positive for SARS COVID.

RESULTS

A total of 840 patients were scheduled for surgery at the two tertiary centers between September 1, 2020, and December 15, 2020 [Table 1]. The average age of the patients was 52.8 ± 7.6 years (range: 1–80 years); 478 were males (56.9%), and 362 were females (43.1%). 600 patients were planned for surgery between March 1, 2021, and May 30, 2021. The average age of the patients was 56.78 ± 19.81 years (range: 1–98 years); 323 were males (53.8%), and 277 were females (46.2%) [Table 1].

None of the patients had symptoms of COVID-19 in both groups. However, during the 3.5-month period, 12 (1.4%) patients' RT-PCR tests for SARS-CoV-2 were positive in group 1. A total of 148 general anesthesia procedures (17.6%)

Table 1: *Patients distribution of departments during the study periods*

	Group 1		Group 2	
Departments	Number	Percent	Number	Percent
Retina	245	29.2	188	31.3
Glaucoma	47	5.6	29	4.8
Strabismus and Pediatric Ophthalmology	24	2.9	19	3.2
Cataract and Refractive Surgery	479	57.0	327	54.5
Oculoplastic	30	3.6	23	3.8
Cornea	15	1.8	14	2.3

and 692 regional anesthesia procedures (82.4%) were planned in the centers during this period. Two of the 12 patients who tested positive for SARS-CoV-2 RT-PCR were scheduled for general anesthesia. When these 12 patients were called back for their surgery appointments, three of the patients who had tested positive were being monitored in an intensive care unit. 7 (1.1%) patients' RT-PCR tests for SARS-CoV-2 were positive in group 2. A total of 133 general anesthesia procedures (22.2%) and 467 regional anesthesia procedures (77.8%) were planned in the centers. Only one of the seven patients in group 2 with positive SARS-CoV-2 RT-PCR results had a general anesthetic scheduled. One patient's death from COVID-19 illness was discovered after 7 patients were called back for a surgery appointment.

The clinico-demographic profiles of the COVID-19 RT-PCR-positive patients are summarized in Table 2. Remarkably, the majority of COVID-19 RT-PCR-positive patients had a systemic disease (group 1; 5/12 had diabetes, 1/12 had hypertension, 3/12 had hypertension and diabetes, 1/12 had chronic obstructive pulmonary disease [COPD], and 1/12 had a malignancy, group 2; 2/7 had diabetes, 1/7 had hypertension, 3/12 had hypertension and diabetes).

In group 1, of the patients who were scheduled for surgery in the retina department, 18.0% (44/245) had diabetes, 17.6% (43/245) hypertension, 24.1% (59/245) diabetes and hypertension, 2.4% (6/245) COPD, 8.2 % (29/245) had other diseases. In group 2, of the patients who were scheduled for surgery in the retina department, 17.6% (33/188) had diabetes, 19.1% (36/188) hypertension, 24.1% (45/188) diabetes and hypertension, 3.2% (6/188) COPD, 5.3 % (10/188) had other diseases. Patients with retinal disease had a higher frequency of hypertension and diabetes than those who were followed in other departments for both groups. Table 3 considers other departments in terms of systemic diseases in both groups.

Interestingly, in both groups, the majority of SARS-CoV-2 RT-PCR-positive patients (group 1; 7/12 and group 2; 5/7) were scheduled for retinal surgery. In group 1, seven patients (7/245, 2.9%) who were scheduled for retinal surgery had a positive SARS CoV-2 RT-PCR test; in group 2, this number

Table 2: *Clinico-demographic profile of patients who tested positive for COVID-19 RT-PCR*

Patient Number	Department	Diagnosis	Systemic disease	Age	Gender
Group-1					
1	Retina	Rhegmatogenous Retinal Detachment	Diabetes	50	M
2	Retina	Operated Retinal Detachment for Silicone Oil Removal	COPD	75	M
3	Retina	Epiretinal Membrane	Diabetes and Hypertension	80	F
4	Cataract and Refractive	Cataract	Diabetes and Hypertension	69	M
5	Retina	Intraocular Hemorrhage	Diabetes	40	F
6	Retina	Intraocular Hemorrhage	Diabetes and Hypertension	50	F
7	Retina	Intraocular Hemorrhage	Diabetes	66	F
8	Oculoplastic	Nasolacrimal Duct Obstruction for Probing	n/a	1	F
9	Cataract and Refractive	Cataract	Diabetes	65	M
10	Retina	Tractional Retinal Detachment	Diabetes	61	F
11	Cornea	Bullous Keratopathy for Keratoplasty	Malignancy	60	M
12	Cataract and Refractive	Cataract	Hypertension	75	M
Group-2					
1	Retina	Dislocated Intraocular Lens	Diabetes and Hypertension	65	M
2	Retina	Intraocular Hemorrhage	Diabetes	52	M
3	Retina	Tractional Retinal Detachment	Diabetes	57	M
4	Cataract and Refractive	Cataract	Diabetes and Hypertension	72	M
5	Cataract and Refractive	Cataract	Hypertension	68	F
6	Retina	Rhegmatogenous Retinal Detachment	n/a	43	F
7	Retina	Intraocular Hemorrhage	Diabetes and Hypertension	66	F

Table 3: *Patients distribution of departments during the study periods*				
	Group 1		**Group 2**	
Departments **Diagnosis**	Number	Percent	Number	Percent
Glaucoma				
Diabetes	5/47	10.6	4/29	13.8
Hypertension	5/47	10.6	4/29	13.8
Diabetes and hypertension	3/47	6.4	2/29	6.9
COPD	1/47	2.1	1/29	3.4
Other diseases	8/47	17.0	5/29	4.8
Strabismus and Pediatric Ophthalmology				
Hereditary Disorders	6/24	25.0	4/19	21.1
Cataract and Refractive Surgery				
Diabetes				
Hypertension	60/479	12.5	37/327	11.3
Diabetes and hypertension	63/479	13.2	46/327	14.1
COPD	59/479	12.3	50/327	15.3
Other diseases	18/479	3.8	15/327	4.6
	113/479	13.6	60/327	18.3
Oculoplastic				
Diabetes	-	-	1/23	4.3
Hypertension	2/30	6.7	-	-
Diabetes and hypertension	-	-	2/23	8.7
COPD	2/30	6.7	-	-
Other diseases	6/30	20.0	5/23	2.2
Cornea				
Diabetes	1/15	6.7	1/14	7.1
Hypertension	2/15	13.3	2/14	14.3
Diabetes and hypertension	2/15	13.3	1/14	7.1
Other diseases	2/15	13.3	3/14	21.5

Table 4: *Demographic profile of patients who planned for retinal surgeries*		
	Group 1	Group 2
Age, years, mean±SD (min-max)	55.71 ± 16.35 (1-85)	56.79 ± 15.34 (1-81)
Gender,		
Female (%)	99 (40.40)	79 (42.0)
Male (%)	146 (59.60)	109 (58.0)
Diagnosis, n (%)		
RRD	68 (27.8)	54 (28.7)
IOH	36 (17.4)	25 (13.3)
TRD	35 (14.3)	25 (13.3)
Endophthalmitis	2 (0.8)	1 (0.5)
Subretinal Hemorrhage	5 (2.0)	2 (1.1)
Intraocular silicone oil removal	35 (14.3)	26 (13.8)
ERM peeling or Macular Hole surgery	43 (17.6)	41 (21.8)
Foreign body in vitreous or retina	7 (2.9)	6 (3.2)
Intraocular lens dislocation	11 (4.5)	6 (3.2)
RRD: Rhegmatogenous Retinal Detachment, IOH: Intraocular Hemorrhage, TRD: Tractional Retinal Detachment		

was five (5/188, 2.6%). Subgroup analysis was carried out on patients who were followed up on in the retina department based on their clinico-demographic profile [Table 4].

No PCR-positivity was found in emergency surgeries in both groups. All emergency operations were performed under general anesthesia. The data of the patients who underwent emergency surgery are in Table 5.

DISCUSSION

The study was conducted to evaluate the frequency of asymptomatic COVID-19 infection among patients undergoing ophthalmic surgery in two different waves of COVID-19. The asymptomatic positive rate was 1.4 percent in the last months of 2020 and 1.1 % in the spring of 2021 at two different referral centers.

During the COVID-19 pandemic, it is generally recommended to postpone elective surgeries and continue with emergency cases only. Any surgical procedure has the potential to exacerbate the disease and accelerate its progression under the stress of surgery in patients with asymptomatic COVID-19 infection.[17,18] Therefore, avoiding elective surgeries is advisable. Elective surgery was suspended in numerous hospitals in October and December 2020 and in the spring of 2021 due to an increase in COVID-19 patients in Turkey.[16] Meanwhile, elective surgeries continued in tertiary referral centers, though in small numbers.

Asymptomatic COVID-19 is a serious problem due to the high contagiousness of the disease. Several reports on COVID-19 screening of healthcare personnel have highlighted the importance of asymptomatic COVID-19 transmission.[19,20,21] When a surgical operation is performed on an asymptomatic patient, the operating room, postoperative care unit or rehabilitation room may become contaminated, potentially infecting hospital workers and other patients. Ophthalmologists are more likely to contact the virus because they work with patients who may be asymptomatic.[22,23] UHM et al. compared the course of disease in asymptomatic and symptomatic COVID-19 individuals and showed that approximately 17.2% of patients may be COVID-positive but have no symptoms.[4] Furthermore, Wu et al. reported that 9.6% of the population in Wuhan had asymptomatic positive COVID-19 serology tests.[5] However, it has been stated that the use of surgical drapes and personal protective equipment may reduce disease transmission.[12]

It is suggested that elective oculoplastic surgeries be postponed as much as possible during the COVID-19 pandemic.[24] Nasal samples, pharyngeal samples, phlegm, bronchial swabs, tears, intestinal tissue, plasma, and feces have all been shown to contain SARS-CoV-2 particles. As a result, operations like dacryocystorhinostomy would be categorized as 'high-risk.'[25] Because the virus load in the nasal cavity is larger than in the throat, oculoplastic surgeons who operate on the nasolacrimal region are at a higher risk than ophthalmologists and other clinicians.[22,26] COVID-PCR testing should be performed prior to surgeries that generate high levels of aerosol exposure, such as dacryocystorhinostomy.[24] In our study, a small number of oculoplastic operations (30, 3.6%) were planned in both centers, and preoperative COVID-19 RT-PCR positive test was identified in one patient scheduled for probing, despite all of these risks.

In the incubation or asymptomatic COVID-19 positive patients, studies show that surgery may worsen the disease.[17,7] A surgical procedure leads to impairment in cell-mediated

Table 5: *Demographic profile of patients who underwent emergency surgery*

	Group 1 N=23	**Group 2** N=17
Age, years, mean±SD (min-max)	35.60 ± 20.76 (1-67)	37 ± 19.97 (1-65)
Gender,		
Female (%)	8 (34.78)	7 (41.17)
Male (%)	15 (65.21)	10 (58.82)
Diagnosis, n (%)		
Penetrating injury in Zone-1	10 (43.47)	8 (47.05)
Penetrating injury in Zone-2	1 (4.34)	1 (5.88)
Penetrating injury in Zone-3	2 (8.69)	0 (0.0)
Penetrating injury in Zone-1 and Zone-2	4 (17.39)	2 (11.76)
Canalicular injuries	6 (26.08)	5 (29.41)
Foreign body in cornea	0 (0.0)	1 (5.88)

immunity, which is the primary defense against viral infection.[27,28] In a study of 34 patients who underwent elective surgery in China during the COVID-19 incubation period, it was shown that 15 (44.1%) of them needed to be admitted to the intensive care unit (ICU) postoperatively, and 7 (20.5%) of the patients died after being transferred to the ICU.[7]

During the COVID-19 pandemic, numerous facilities postponed cataract procedures. Some clinics, however, continued to perform cataract surgeries since they were a relatively short procedure that could be done under topical anesthesia and a lot of patients were waiting. Shih et al.[29] stated that they continued to perform cataract procedures with measures such as phone pre-screening, the use of a N95 mask, and a limited number of attendants. McGhee et al.[30] assessed the risk of microdroplet contamination during cataract surgery and concluded that the usage of personal protective equipment was adequate. Koo et al.[31] found SARS-CoV-2 RNA in aqueous humor samples from asymptomatic patients undergoing anterior segment surgery. According to their study, out of 31 samples that were successfully analyzed, 6 (19.4%) demonstrated detectable SARS-CoV-2 RNA. In the study of Tannous et al., a small percentage of physicians, 9.8% (n=14), conducted laboratory tests for COVID-19 in the preoperative period.[32] The necessity of SARS-Cov-2 RT-PCR tests prior to cataract surgery is controversial, and their availability and practicality are considered within each institution's protocols.

Kannan et al.[33] stated that the prevalence of asymptomatic SARS-CoV-2 virus infection among patients undergoing elective vitreoretinal surgeries was 2.2%. In this study, patients who were scheduled for surgery in the retina department were also analyzed. Patients with retinal disease in two different periods had a COVID-PCR positive rate of 2.9% and 2.6%. Three of the patients who were followed up on in the ICU were given an appointment from the retina department. This is especially crucial in vitreoretinal surgery, which takes a long time to perform and may require a particular postoperative posture. Patients who have undergone surgery for intraocular hemorrhage may require reoperation for re-hemorrhage in the early postoperative period.[34,35] Additionally, following vitrectomy and silicone oil injection, open- and closed-angle mechanisms can cause early postoperative ocular hypertension (OH), with an incidence ranging from 3% to 40% of patients.[36,37,38] Patients who acquire COVID-19 symptoms during the postoperative phase may not continue to receive appropriate postoperative therapy. Even in emergency situations, intervention with raised intraocular pressure induced by intraocular tamponade may not be conducted in patients with severe COVID-19 symptoms. Endophthalmitis, one of the most significant surgical complications, may be impossible to manage in patients with severe COVID-19 symptoms.

It was observed that after the spread of COVID-19 vaccines, there was a decrease in disease-related mortality and hospitalizations.[39] Despite the fact that an increasing number of individuals are receiving the vaccination, many people still refuse or are unable to do so due to the vaccine's potential side effects.[40,41] Furthermore, given the fast transmission of the Omicron variant, there may be an increase in the number of asymptomatic patients prior to surgery. Due to the possibility of a more severe course of asymptomatic disease in the postoperative period and the difficulties of managing potential complications, preoperative PCR testing, especially in those who are not vaccinated against COVID-19, may be recommended.

Our study has some limitations, including short follow-up duration and retrospective design. Furthermore, we assessed patients only on the basis of clinical symptoms and PCR tests. Asymptomatic COVID-19 patients may have a lower viral load than symptomatic COVID-19 patients due to sample error in RT-PCR.[42-44] Furthermore, the patients' CT scans were not examined before surgery. However, this can be ignored because chest CT is not suggested for screening in asymptomatic patients.[45]

In conclusion, in this study, we describe the outcomes of a monitoring and testing program for patients having ophthalmic operations during the COVID-19 outbreak at two separate tertiary referral hospitals. We found that almost 1 in 100 patients coming for ophthalmologic surgery may be asymptomatic carriers of COVID-19 infection. The PCR test should be carried out prior to operations performed under general anesthesia or operations that cause significant aerosol production. Due to extreme difficulties in managing postoperative complications, RT-PCR testing for COVID-19 may be beneficial prior to vitreoretinal operations.

DECLARATION

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of interest The authors declare that they have no conflict of interest.

REFERENCES

1. Zhu N, Zhang D, Wang W, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019 N Engl J Med. 2020;382:727-33.
2. 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;323:1061-9.
3. Holshue ML, DeBolt C, Lindquist S, et al. First Case of 2019 Novel Coronavirus in the United States N Engl J Med. 2020;382:929-36.
4. Uhm JS, Ahn JY, Hyun J, et al. Patterns of viral clearance in the natural course of asymptomatic COVID-19: Comparison with symptomatic non-severe COVID-19 Int J Infect Dis. 2020;99:279-85.
5. Wu X, Fu B, Chen L, et el. Serological tests facilitate identification of asymptomatic SARS-CoV-2 infection in Wuhan, China J Med Virol. 2020;92:1795-6.
6. Besnier E, Tuech JJ, Schwarz L. We Asked the Experts: Covid-19 Outbreak: Is There Still a Place for Scheduled Surgery? "Reflection from Pathophysiological Data" World J Surg. 2020;44:1695-8.
7. Lei S, Jiang F, Su W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection EClinicalMedicine. 2020;21:100331.
8. Aminian A, Safari S, Razeghian-Jahromi A, Ghorbani M, Delaney CP. COVID-19 Outbreak and Surgical Practice: Unexpected Fatality in Perioperative Period Ann Surg. 2020;272:e27-e29.
9. Kluytmans-van den Bergh MFQ, Buiting AGM, Pas SD, Bentvelsen RG, et al. Prevalence and Clinical Presentation of Health Care Workers With Symptoms of Coronavirus Disease 2019 in 2 Dutch Hospitals During an Early Phase of the Pandemic JAMA Netw Open. 2020;1;3:e209673.
10. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster Lancet. 2020;395:514-23.
11. Hu Z, Song C, Xu C, et al. Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China Sci China Life Sci. 2020;63:706-11.
12. Chandra A, Haynes R, Burdon M, et al. Personal protective equipment (PPE) for vitreoretinal surgery during COVID-19. Eye (Lond). 2020;34:1196-9.
13. American Academy of Ophthalmology. Special considerations for ophthalmic surgery during the COVID-19 pandemic. Available at: https://www.aao.org/headline/special-considerations-ophthalmic-surgery-during-c Accessed 2020.
14. Bhimraj A, Morgan RL, Shumaker AH, et al. Infectious Diseases Society of America Guidelines on the Treatment and Management of Patients with COVID-19 Clin Infect Dis. 2020;ciaa478.
15. Republic of Turkey Ministry of Health. Working Guide and Infection Control Measures in Healthcare Institutions in the COVID-19 Pandemic. Available at: https://covid19.saglik.gov.tr/Eklenti/40282/0/covid19-saglikkurumlarindacalismarehberiveenfeksiyonkontrolonlemleripdf.pdf Accessed 2020.
16. Republic of Turkey Ministry of Health COVID-19 Information Page. Available at: https://covid19.saglik.gov.tr/ Accessed 2020.
17. Kaye K, Paprottka F, Escudero R, et al. Elective, Non-urgent Procedures and Aesthetic Surgery in the Wake of SARS-COVID-19: Considerations Regarding Safety, Feasibility and Impact on Clinical Management Aesthetic Plast Surg. 2020;44:1014-42.
18. Diaz A, Sarac BA, Schoenbrunner AR, et al. Elective surgery in the time of COVID-19. Am J Surg. 2020;219:900-2.
19. Korth J, Wilde B, Dolff S, et al. SARS-CoV-2-specific antibody detection in healthcare workers in Germany with direct contact to COVID-19 patients J Clin Virol. 2020;128:104437.
20. Bendavid E, Mulaney B, Sood N, et al. COVID-19 antibody seroprevalence in Santa Clara County, California Int J Epidemiol. 2021;50:410-9.
21. Steensels D, Oris E, Coninx L, et al. Hospital-Wide SARS-CoV-2 Antibody Screening in 3056 Staff in a Tertiary Center in Belgium JAMA. 2020;324:195-7.
22. Vukkadala N, Qian ZJ, Holsinger FC, et al. COVID-19 and the Otolaryngologist: Preliminary Evidence-Based Review. Laryngoscope. 2020;130:2537-43.
23. Sengupta S, Honavar SG, Sachdev MS, et al. All India Ophthalmological Society - Indian Journal of Ophthalmology consensus statement on preferred practices during the COVID-19 pandemic Indian J Ophthalmol. 2020;68:711-24.
24. Ali MJ, Hegde R, Nair AG, et al. All India Ophthalmological Society - Oculoplastics Association of India consensus statement on preferred practices in oculoplasty and lacrimal surgery during the COVID-19 pandemic Indian J Ophthalmol. 2020;68:974-80.
25. Ong SWX, Tan YK, Chia PY, et al. Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient. Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient JAMA. 2020;323:1610-2.
26. World Health Organization. Modes of transmission of virus causing COVID-19: Implications for IPC precaution recommendations. Available at: https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations. 2020. Accessed 2020.
27. Amodeo G, Bugada D, Franchi S, et al. Immune function after major surgical interventions: the effect of postoperative pain treatment J Pain Res. 2018;11:1297-305.
28. Hermesh T, Moltedo B, López CB, et al. Buying time-the immune system determinants of the incubation period to respiratory viruses. Viruses. 2010;2:2541-58.
29. Shih KC, Wong JKW, Lai JSM, et al. The case for continuing elective cataract surgery during the COVID-19 pandemic. J Cataract Refract Surg. 2020;46:921.
30. McGhee CNJ, Dean S, Freundlich SEN, et al. Microdroplet and spatter contamination during phacoemulsification cataract

surgery in the era of COVID-19 Clin Exp Ophthalmol. 2020;48:1168-74.

31. Koo EH, Eghrari AO, Dzhaber D, et al. Presence of SARS-CoV-2 Viral RNA in Aqueous Humor of Asymptomatic Individuals Am J Ophthalmol. 2021;S0002-9394(21)00286-5.
32. Tannous M, Mendes RLF, Freitas AVC, Magalhães AM, Ferrari R, Miolo BL, Alves MR, Avakian A, Carricondo PC. Impacts of the COVID-19 pandemic on elective cataract surgeries. Einstein (Sao Paulo). 2022;20:eAO6687.
33. Kannan NB, Sen S, Reddy H, et al. Preoperative COVID-19 testing for elective vitreoretinal surgeries: Experience from a major tertiary care institute in South India. Indian J Ophthalmol. 2020;68:2373-7.
34. Khuthaila MK, Hsu J, Chiang A, et al. Postoperative vitreous hemorrhage after diabetic 23-gauge pars plana vitrectomy. Am J Ophthalmol. 2013;155:757-63.e7632.
35. Lee BJ, Yu HG. Vitreous hemorrhage after the 25-gauge transconjunctival sutureless vitrectomy for proliferative diabetic retinopathy. Retina. 2010;30:1671-7.
36. Weinberg RS, Peyman GA, Huamonte FU. Elevation of intraocular pressure after pars plana vitrectomy. Albrecht Von Graefes Arch Klin Exp Ophthalmol. 1976;200:157-61.
37. Han DP, Lewis H, Lambrou FH Jr, et al. Mechanisms of intraocular pressure elevation after pars plana vitrectomy. Ophthalmology. 1989;96:1357-62.
38. Wu L, Berrocal MH, Rodriguez FJ, et al. Intraocular pressure elevation after uncomplicated pars plana vitrectomy: results of the Pan American Collaborative Retina Study Group Retina. 2014;34:1985-9.
39. Glatman-Freedman A, Bromberg M, Dichtiar R, et al. The BNT162b2 vaccine effectiveness against new COVID-19 cases and complications of breakthrough cases: A nation-wide retrospective longitudinal multiple cohort analysis using individualised data. EBioMedicine. 2021;72:103574.
40. Crnej A, Khoueir Z, Cherfan G, et al. Acute corneal endothelial graft rejection following COVID-19 vaccination. J Fr Ophtalmol. 2021;44:e445-e447.
41. Delbarre M, Maréchal M, Froussart-Maille F. Central serous chorioretinopathy following Pfizer-BioNTech COVID-19 vaccine: A case report. J Fr Ophtalmol. 2022;45:e1-e2.
42. Wölfel R, Corman VM, Guggemos W, et al. Virological assessment of hospitalized patients with COVID-2019 Nature. 2020;581:465-9.
43. Ai T, Yang Z, Hou H, et al. Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases Radiology. 2020;296:E32-E40.
44. Fang Y, Zhang H, Xie J, et al. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR Radiology. 2020;296:E115-E117.
45. Rubin GD, Ryerson CJ, Haramati LB, et al. The Role of Chest Imaging in Patient Management during the COVID-19 Pandemic: A Multinational Consensus Statement from the Fleischner Society Radiology. 2020;296:172-80.