

# Vitreoretinal Surgery amid Coronavirus Disease 2019 Pandemic Restrictions

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## Abstract

**Purpose:** To define the characteristics of vitreoretinal surgeries amid coronavirus disease 2019 (COVID-19) pandemic restrictions in Turkey.

**Methods:** This descriptive, cross-sectional study was conducted for vitreoretinal surgeries during the 10-week period (during this period, all elective surgeries were postponed across the country by the order of the Republic of Turkey Ministry of Health) in a single tertiary referral hospital in Ankara, Turkey. The number of surgeries, surgical indications, risk factors, etiological factors, and associated conditions were investigated and compared with the clinical features of the patients who underwent vitreoretinal surgery in the same period of the recent year.

**Results:** During this period, vitreoretinal surgery was performed more commonly for the male population ( $P < 0.001$ ). The number of vitreoretinal surgeries was statistically significantly correlated with the number of COVID-19 cases ( $P = 0.006$  and  $r = -0.791$  for weekly numbers of new surgeries and cases, and  $P < 0.001$  and  $r = 0.929$  for cumulative numbers of surgeries and cases). Diabetes mellitus in 26 patients (32.9%) was the most common systemic comorbidity. The most common indication for vitreoretinal surgery was rhegmatogenous retinal detachment in 44 patients (55.7%) followed by diabetic retinopathy complications in 21 patients (26.6%). No one was operated on for vitreoretinal interface disorders during this period, and the rate of rhegmatogenous retinal detachment was higher than the same period of the recent year ( $P = 0.003$ ).

**Conclusions:** Amid COVID-19 pandemic restrictions in Turkey, the number of vitreoretinal surgeries was inversely associated with the number of confirmed COVID-19 cases. The male population needed more vitreoretinal surgery, and rhegmatogenous retinal detachment was the most common indication for all patients.

**Keywords:** Coronavirus disease 2019, Pandemic, Restriction, Retina, Vitrectomy, Vitreoretinal surgery

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## INTRODUCTION

The first pneumonia cases of unknown origins were diagnosed in December 2019, in Wuhan city, the capital of Hubei province, China.<sup>1</sup> The pathogen was identified as severe acute respiratory syndrome coronavirus 2, and the disease was defined as coronavirus disease 2019 (COVID-19).<sup>2</sup> On March 11, 2020, the World Health Organization declared the condition associated with the disease as a pandemic.<sup>3</sup> At that time, many countries had limited international traffic, and many of them

had imposed to take some preventions, such as using a face mask, quarantine, or curfew.

The first confirmed case and death in Turkey were reported on March 10 and March 15, 2020.<sup>4</sup> By April 1, 2020, all the cities along the country had reported COVID-19 cases.<sup>4</sup> Some important restrictions imposed by the Turkish government were as follows:

1. All schools were closed from the 6<sup>th</sup> day after the first case

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2. Curfew for  $\geq 65$  years old from the 11<sup>th</sup> day after the first case
3. All international flights were stopped from the 16<sup>th</sup> day after the first case
4. Curfew for  $\leq 20$  years old from the 24<sup>th</sup> day after the first case
5. A general curfew for weekends for 31 cities from the 31<sup>st</sup> day after the first case.<sup>5</sup>

The Republic of Turkey's Ministry of Health issued a circular on the postponement of all elective surgeries across the country for nearly 10 weeks between March 17 (the 7<sup>th</sup> day after the first case) and June 1, 2020.<sup>5</sup>

During the COVID-19 pandemic, some changes in demographic, epidemiological, and clinical characteristics of the patients occurred. For example, corneal cross-linking and therapeutic laser applications were postponed, and the rates of emergency surgeries increased in the cornea departments.<sup>6</sup> The primary aim of this study is to define the characteristics of vitreoretinal surgeries during the 10 weeks amid COVID-19 pandemic restrictions. The secondary aim of this study is to compare the clinical features of the patients who underwent vitreoretinal surgery in the same period of the recent year.

## METHODS

This descriptive, cross-sectional study was conducted during the 10 weeks between March 23, 2020 (the 1<sup>st</sup> week after the circular was issued) and June 1, 2020 (the day the circular was repealed) in the retina department of a single tertiary referral hospital in Ankara, Turkey.<sup>5</sup> Ethical approval was granted by the local research ethics committee. All procedures were performed by the ethical standards of the Declaration of Helsinki for human participants, and written informed consent was obtained before the vitreoretinal surgical procedures.

During this period, all elective surgeries which had already been planned were postponed. The following retinal conditions were described as emergent/urgent (nonelective) vitreoretinal surgery indications by the vitreoretinal surgeons in this study (M.C. and M.Y.T.):

1. Rhegmatogenous retinal detachment
2. As diabetic retinopathy complications macula involving tractional retinal detachment or vitreous hemorrhage-related severe visual loss in functional one-eye patients
3. Uncontrolled glaucoma or keratopathy associated with emulsified silicone oil
4. Severe inflammation related to lens particle drop
5. Endophthalmitis having less than or equal to light perception visual acuity (according to the suggestions of the Endophthalmitis Vitrectomy Study).<sup>7</sup>

The patients having had these following conditions were not operated on and were referred to an assigned pandemic hospital:

1. History of contact with COVID-19 diagnosed patient, COVID-19 suspected symptoms (e.g., fever, cough,

or respiratory distress), positive polymerase chain reaction (PCR) test, and/or COVID-19-associated computerized tomography (CT) findings

2. Patients described as high risk for general anesthesia (according to American Society of Anesthesiologist risk classification) by internist or anesthesiologist.

The characteristics of the vitreoretinal surgeries in this period, the COVID-19 period, including the number of surgeries, surgical indications, risk factors, etiological factors, and associated conditions were investigated. Some important clinical features of the patients who were operated on in the COVID-19 period were compared with the clinical features of the patients who were operated on in the same period of the recent year (March 25 and June 3, 2019), pre-COVID-19 period.

All patients were evaluated by measuring their fever and by questioning the contact with someone diagnosed with COVID-19 in the last 14 days, having recently experienced fever, cough, tiredness, or chest pain. All patients were asked to wear masks and waiting rooms were rearranged according to a social distance of 1.5 m. Health-care professionals used personal protective equipment, including a surgical/N95 mask, gloves, protective clothing, face shield, and goggles.

The baseline medical history and systemic comorbidities were questioned, and all patients underwent a complete ophthalmological examination. The best corrected visual acuity was examined with a Snellen chart, and the data were converted to logMAR. Visual acuity of 2.00 logMAR or worse was considered nonfunctional eye no matter what the reason and those patients were considered functional one-eyed. Intraocular pressure was measured with iCare tonometry using a reusable tonometer tip for each patient. Anterior segment was evaluated with a slit-lamp biomicroscopy, which was cleaned between use, and a transparent barrier was placed between patients and ophthalmologists. Corneal graft failure, stromal haze, band keratopathy, or nonhealing epithelial defect associated with silicon oil emulsification were diagnosed with keratopathy. If trauma history was present, findings such as dilation weakness, iridodialysis, hyphema, or corneal/scleral suture were described as trauma-related ocular comorbidities. Posterior segment examination was performed with a 90 diopter magnifying lens. Ocular ultrasonography and orbital CT were used if needed.

All participants underwent a routine laboratory investigation including complete blood count, serum biochemistry panel, serology, and coagulation panel, posteroanterior chest radiography, and electrocardiography. All participants underwent an internal diseases consultation, and further evaluations for COVID-19 (PCR or CT) were performed if needed. Local anesthesia was recommended for the majority of the patients. Sedation or general anesthesia options were conserved for only patients undergoing longer surgery or having high anxiety, and anesthesiology consultation was performed for these patients.

All surgeries were performed in the same week of the patients' presentation. Personal protective equipment was used by the surgical team, and the interval between two surgeries was determined as at least half an hour. Peribulbar injection of 4 ml lidocaine 2% with a 25 G 38 mm needle was a standard application for local anesthesia. Sedation or general anesthesia was performed by an anesthesiologist and an anesthesia technician. Standard three-port 25- or 27 G transconjunctival pars plana vitrectomy (Constellation Vision System, Alcon Laboratories, Inc., Fort Worth, TX, USA), valved microcannula (trocar) system, and a noncontact wide-field visualization system (EIBOS 2; Haag-Streit Surgical GmbH, Hamburg, Germany), with or without chandelier illumination (Alcon Laboratories Inc., Fort Worth, TX, USA), were used. Vitreoretinal surgery was performed using perfluorocarbon, intraocular tamponade (e.g., silicon oil, SF<sub>6</sub>, or C<sub>3</sub>F<sub>8</sub>), and endolaser for rhegmatogenous and tractional retinal detachment patients. Phacofragmentation techniques were used for crystalline lens particle drop cases with retinal covering by perfluorocarbon, and scleral or iris-fixated intraocular lens was implanted. Similarly, dropped intraocular lens was removed under the coverage of perfluorocarbon, and the same intraocular lens was re-implanted as scleral or iris-fixated. For endophthalmitis patients, intraocular anti-biotherapy and silicon oil injection were performed. Vitreoretinal surgery was combined with cataract surgery (phacoemulsification and intraocular lens implantation) for patients with cataracts or ≥60 years old. In patients having emulsified silicon oil-related complications, silicone oil was removed from the vitreous cavity and anterior chamber. The postoperative medical treatment contained topical antibiotic, steroid, and cycloplegic, and a 1-week head-down posture was prescribed if long-acting gas or silicone tamponade was used.

### Statistical analysis

The data obtained during this study were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 22.0 (IBM Corp., New York, USA). Descriptive statistics were presented as mean ± standard deviations and minimum-maximum values. The Chi-square test was used for the categorical variables, and a one-sample Kolmogorov–Smirnov test was used to test the normal distribution of variables. Pearson correlation analysis was performed to evaluate the relationships between the number of vitreoretinal surgeries and the number of confirmed COVID-19 cases (the values were taken from the informative webpage of the Republic of Turkey's Ministry of Health [<https://covid19.saglik.gov.tr/>]).<sup>4</sup> Frequency analysis was performed for all other variables, and frequencies were given also as a percentage. Statistical significance was set at  $P < 0.05$  for all two-tailed tests.

## RESULTS

Seventy-nine patients underwent vitreoretinal surgery during the 10 weeks of COVID-19 pandemic restrictions. The mean

age of the patients was  $54.81 \pm 13.03$  years (19–85), and the male-to-female ratio was 58/21. In this period, vitreoretinal surgery was performed more commonly for the male population ( $P < 0.001$ ).

The weekly number of surgeries gradually decreased for the first 4 weeks of restrictions, and a dramatic increase was observed in the next 2 weeks. A relatively stable number of surgeries was observed for the following weeks. The number of vitreoretinal surgeries amid restrictions was significantly correlated with the number of confirmed COVID-19 cases in Turkey ( $P = 0.006$  and  $r = -0.791$  for weekly numbers of new surgeries and cases, and  $P < 0.001$  and  $r = 0.929$  for cumulative numbers of surgeries and cases, respectively). The relationship between the number of vitreoretinal surgeries and the number of confirmed COVID-19 cases is demonstrated in Figures 1 and 2.

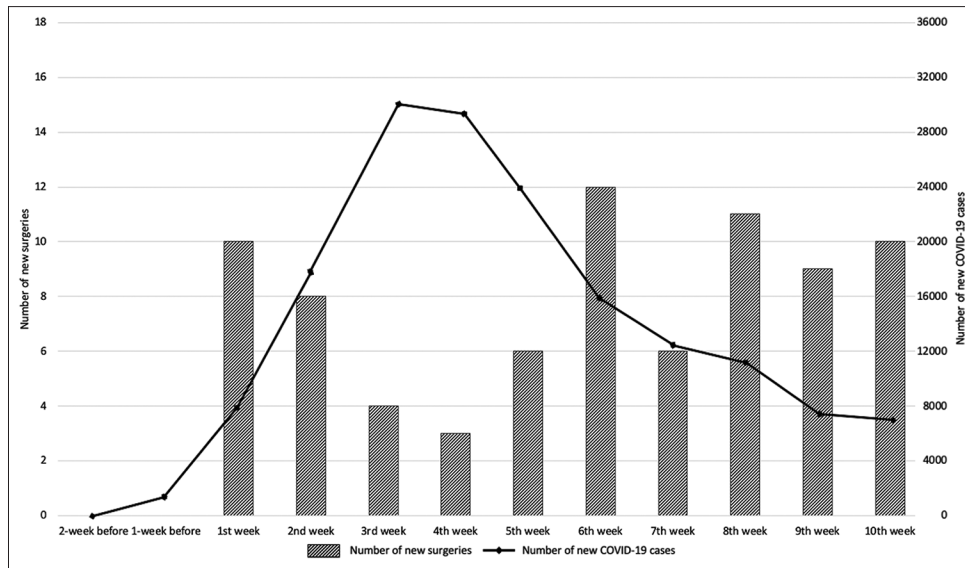
Diabetes mellitus in 26 patients (32.9%) was the most common systemic comorbidity followed by systemic hypertension and coronary artery disease. Previous cataract surgery, previous vitrectomy surgery, and diabetic retinopathy were found as the most common ocular comorbidities.

In the same period of the recent year (pre-COVID-19 period), a total of 219 patients underwent vitreoretinal surgery. The rates of some systemic diseases including systemic hypertension ( $P < 0.001$ ) and coronary artery disease ( $P = 0.046$ ) were significantly lower in the COVID-19 period than the pre-COVID-19 period. Furthermore, the rates of glaucoma ( $P = 0.007$ ) and other trauma-related ocular comorbidities ( $P = 0.042$ ) were higher in the COVID-19 period. The prevalence of systemic and ocular comorbidities in the COVID-19 and pre-COVID-19 periods is given in Table 1.

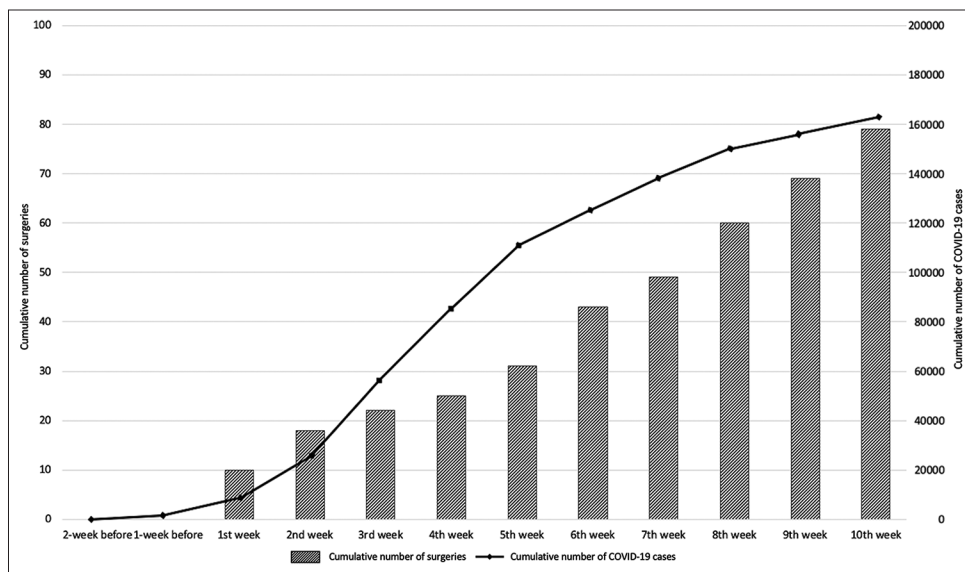
The most common indication for vitreoretinal surgery was rhegmatogenous retinal detachment in 44 patients (55.7%). Diabetic retinopathy complications and silicon oil extraction were other most common vitreoretinal surgery indications. Risk factors and associated conditions for vitreoretinal surgery are given in Table 2. In this period, the number of vitreoretinal surgeries for all indications was lower than the pre-COVID-19 period. The rate of rhegmatogenous retinal detachment was higher in the COVID-19 period than in the pre-COVID-19 period ( $P = 0.003$ ). In addition, no one was operated on for vitreoretinal interface disorders in the COVID-19 period. The prevalence of vitreoretinal surgery indications in the COVID-19 and pre-COVID-19 periods is given in Table 3.

## DISCUSSION

Studies in the literature report that gender distribution in vitreoretinal surgery is equal or slightly higher in the male population.<sup>8,9</sup> In this series which investigated vitreoretinal surgeries amid COVID-19 pandemic restrictions in Turkey, males needed vitreoretinal surgery more commonly than females. To investigate the potential reasons for these dissimilar results in gender distribution is beyond the scope of



**Figure 1:** The relationship between the weekly number of vitreoretinal surgeries and the weekly number of confirmed new coronavirus disease 2019 cases



**Figure 2:** The relationship between the cumulative number of vitreoretinal surgeries and the cumulative number of confirmed coronavirus disease 2019 cases

this study, and the results are not enough to determine the exact reasons. Nevertheless, a similar result in vitreoretinal surgery was reported during the COVID-19 lockdown in India.<sup>10</sup>

The graphic demonstrated the weekly number of vitreoretinal surgeries was curved, and the bottom and top points were in the middle portion. Decreasing and increasing trends in the number of vitreoretinal surgeries were inversely associated with the number of confirmed COVID-19 cases.<sup>4</sup> The most interesting result of this study is probably the presence of a significant correlation between the number of vitreoretinal surgeries and COVID-19 cases. A decreasing trend in the weekly number of vitreoretinal surgeries for

the first 4 weeks can be associated with the tightened restrictions, which may have limited patients’ access to the hospital because of the limited capacity of public transportation and polyclinic services. Despite that fact that there were no restrictions in ambulance and emergency health services, these factors cannot be fully excluded for patients, especially those living in the rural areas. Similarly, patients’ growing concerns for COVID-19 may have pushed them to delay their visit to the hospital. “Stay at home” inculcations given through television and social media and increased daily published numbers of COVID-19 cases can also be the important factors for some patients to make this decision. A peak point in the number of vitreoretinal

**Table 1: Prevalence of systemic and ocular comorbidities in Coronavirus disease 2019 (COVID-19) and COVID-19 periods**

General clinical conditions	COVID-19, n (%)	Pre-COVID-19, n (%)	P
Systemic comorbidities			
Diabetes mellitus	26 (32.9)	82 (37.4)	0.473
Hypertension	9 (11.4)	77 (35.2)	<0.001
Coronary artery disease	5 (6.3)	33 (15.1)	0.046
Chronic liver disease	4 (5.1)	14 (6.3)	0.670
Chronic kidney disease	2 (2.5)	13 (5.9)	0.236
Chronic respiratory disease	1 (1.3)	7 (3.2)	0.364
Neurovascular disease	1 (1.3)	7 (3.2)	0.364
Ocular comorbidities			
Pseudophakic	38 (48.1)	124 (56.6)	0.192
Vitrectomized	25 (31.6)	72 (32.9)	0.842
Diabetic retinopathy	22 (27.8)	59 (26.9)	0.877
Cataract	17 (21.5)	44 (20.1)	0.787
Functional one eyed	15 (19.0)	27 (12.3)	0.145
Glaucoma	12 (15.2)	12 (5.5)	0.007
Trauma-related other ocular comorbidities	7 (8.9)	7 (3.2)	0.042
Degenerative myopia	6 (7.6)	17 (7.8)	0.962
Aphakia	3 (3.8)	3 (1.4)	0.187
Keratopathy	3 (3.8)	11 (5.0)	0.660
Age-related macular dystrophy	2 (2.5)	4 (1.8)	0.703
Pseudoexfoliation syndrome	1 (1.3)	2 (0.9)	0.979

COVID-19: Coronavirus disease 2019

**Table 2: Risk factors and associated conditions for vitreoretinal surgery**

Indications	Risk factors and associated conditions	n (%)
Rhegmatogenous retinal detachment	Previous cataract surgery	24 (54.5)
	Previous vitrectomy surgery	12 (27.3)
	Trauma	4 (9.1)
	Degenerative myopia	4 (9.1)
Diabetic retinopathy	Macula-involving tractional retinal detachment	13 (61.9)
	Vitreous hemorrhage in functional one-eye	8 (38.1)
Silicone oil extraction	Uncontrolled glaucoma	6 (66.7)
	Corneal complications	3 (33.3)
Crystalline lens or intraocular lens drop	Trauma	2 (66.7)
	Pseudoexfoliation syndrome	1 (33.3)
Endophthalmitis	Trauma	1 (50)
	Glaucoma filtering surgery	1 (50)

**Table 3: Prevalence of vitreoretinal surgery indications in Coronavirus disease 2019 (COVID-19) and COVID-19 periods**

	COVID-19, n (%)	Pre-COVID-19, n (%)	P
Rhegmatogenous retinal detachment	44 (55.7)	81 (36.9)	0.003
Diabetic retinopathy complications	21 (26.6)	49 (22.3)	0.449
Silicone oil extraction	9 (11.4)	37 (16.9)	0.245
Crystalline lens or intraocular lens drop	3 (3.8)	6 (2.7)	0.637
Endophthalmitis	2 (2.5)	5 (2.3)	0.900
Vitreomacular interface disorders	0 (0.0)	41 (18.7)	<0.001

COVID-19: Coronavirus disease 2019

surgeries was observed in the 6<sup>th</sup> week, and it is likely postponed ophthalmological examinations were performed in the 5<sup>th</sup> and 6<sup>th</sup> weeks. Relatively balanced vitreoretinal surgery numbers were observed for weeks 7–10. The

patients and health-care system seem to be better adapted to these unusual conditions.

Loukovaara *et al.*<sup>8</sup> reported that systemic hypertension was the most common systemic comorbidity in the Finnish

population and was followed by diabetes mellitus with only a little difference in their large series of vitreoretinal surgeries. Systemic comorbidities such as diabetes mellitus are highly related to racial features, and the prevalence of the disease may be different in different countries. It would be better to compare the results of a Turkish or Caucasian population-based study that included all indications for vitreoretinal surgery; however, to the best of our knowledge, there is no such study in the literature. According to the results of this study, diabetes mellitus was the most common systemic comorbidity by far. Therefore, it can be concluded that required vitreoretinal surgery which cannot be postponed is more frequent in diabetic individuals. By this conclusion, one of the most common ocular comorbidities was found as diabetic retinopathy in this series.

Breazzano *et al.*<sup>11</sup> reported that retinal detachment repair was a more common vitreoretinal surgery indication amid the COVID-19 pandemic in the USA when compared with the other vitreoretinal surgery indications. They also reported that important decrease in the numbers of vitreoretinal surgeries although the American Academia of Ophthalmology endorsed the continued performance of emergent/urgent vitreoretinal surgical procedures.<sup>11</sup> In this study, rhegmatogenous retinal detachment was the most common indication for vitreoretinal surgeries with a rate of 55.7% amid COVID-19 pandemic restrictions in Turkey and followed by diabetic retinal complications. Silicon oil-related complications, crystalline lens/intraocular lens drop, and endophthalmitis were the other indications for vitreoretinal surgery. In addition, the number of vitreoretinal surgeries for all indications were decreased when compared pre-COVID-19 period. Gupta *et al.*<sup>9</sup> reported a very close rate for rhegmatogenous retinal detachment (54.8%) in their large retrospective series conducted in the pre-COVID-19 period, and diabetic retinopathy complications were also the second most common indication. They did not include silicon oil extraction as an independent entity and vitreoretinal interface disorders, which included macular hole and epiretinal membrane, were reported as the third most common indication followed by the lens- and trauma-related complications.<sup>9</sup> On the other hand, the rankings of vitreoretinal surgery indications in their series are substantially similar to the rankings in the pre-COVID-19 period. In this regard, it can be concluded that vitreoretinal interface disorders are the most important indication for vitreoretinal surgery which can be postponed amid restrictions.

For rhegmatogenous retinal detachment, previous cataract surgery was the most common risk factor in this series. Previous vitrectomy surgery was reported as another important risk factor because re-detachment cases were included in the statistical analysis. Takkar *et al.*<sup>12</sup> have also reported similar results for their series, which included primary and re-detachment cases. In this series, history of trauma and degenerative myopia were other risk factors as per the literature.<sup>12</sup>

The main indications for diabetic vitreoretinal surgeries are nonclearing vitreous hemorrhage and tractional retinal

detachment.<sup>9</sup> It can be easily thought that many vitreous hemorrhage cases were treated more conservatively. Follow-up and laser photocoagulation options were taken into consideration before surgery decision following the literature's suggestions, and early vitreoretinal surgery was suggested only in functional one-eye. For these reasons, it can be thought that amid COVID-19 pandemic restrictions, the prevalence of indications in diabetic retinal complications was changed in favor of macula-involving tractional retinal detachment.

Uncontrolled glaucoma and corneal complications are some of the most common complications associated with emulsified silicone oil.<sup>13</sup> Because of the high risk for glaucomatous optic disc damage and permanent corneal opacity, vitreoretinal surgery and silicone oil removal cannot be postponed for a long time.<sup>14,15</sup> Following the literature, vitreoretinal surgery was performed to prevent the complications associated with emulsified silicone oil. In this series, uncontrolled glaucoma was a more common indication than corneal complications for vitreoretinal surgery and silicone oil removal amid restrictions.

Inflammation-related crystalline lens/intraocular lens drop and endophthalmitis were other vitreoretinal surgery indications amid COVID-19 pandemic restrictions. It can be expected that the rates of these indications increase under unusual circumstances such as the postponement of all elective surgeries. When compared the rates of indications for vitreoretinal surgery in the COVID-19 and pre-COVID-19 periods, it was seen that the rates of these indications were almost the same, and the cumulative number of surgeries for these indications in the COVID-19 period were less. Crystalline lens/intraocular lens drop and endophthalmitis can be associated with ocular trauma, and work-related accident is an important factor for ocular trauma. Many industries have been directly affected by COVID-19 pandemic restrictions, and construction and manufacturing, especially almost came to a standstill. This unusual condition can explain the decreased number of vitreoretinal surgeries for these indications and their rankings at the bottom of the list given in this study. On the other hand, it is known that the most common etiological factor for infectious endophthalmitis is cataract surgery, and this study reports a different result from the literature because all cataract surgeries were postponed by the COVID-19 pandemic restrictions.<sup>16</sup> In this series, trauma and glaucoma filtering surgery were the two etiological factors for vitreoretinal surgery performed for endophthalmitis indication.

Despite the presence of important limitations for this study such as being a single-center study and having a limited case number, investigating nonelective vitreoretinal surgeries amid COVID-19 pandemic restrictions in Turkey was a unique experience. The number of vitreoretinal surgeries was inversely associated with the number of confirmed COVID-19 cases for 10 weeks of restrictions. The male population needed a greater number of vitreoretinal surgery than the female population. For patients who underwent vitreoretinal surgery, diabetes mellitus was the most common systemic comorbidity.

Rhegmatogenous retinal detachment was the most common indication for vitreoretinal surgery followed by diabetic retinopathy complications.

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### **Conflicts of interest**

There are no conflicts of interest.

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