

The Impact of the First COVID-19 Lockdown Period on the Inpatient and Outpatient Volume of a University Based Tertiary Referral Center with Corneal Subspecialization in Germany

Nadir Maiassi , Kassandra Xanthopoulou, Ursula Löw, Berthold Seitz 

Department of Ophthalmology, Saarland University Medical Center UKS, Homburg/Saar, Saarland, Germany

Correspondence: Berthold Seitz, Department of Ophthalmology, Saarland University Medical Center UKS, Homburg/Saar, Saarland, Germany, Tel +49-6841 1622387, Fax +49-6841 1622380, Email Berthold.Seitz@uks.eu

Background/Aims: To determine the impact of COVID-19 on the number of in- and outpatients surgical and diagnostic procedures performed at a southwestern German university hospital with corneal subspecialization.

Methods: A retrospective examination of the number of inpatients, several outpatients subunits, in- and outpatient surgeries as well as diagnostic procedures at the Department of Ophthalmology, Saarland University Medical Centre during the COVID-19 pandemic “lockdown period” from 18 March until 8 May 2020 in comparison with the corresponding period in 2019 (source: SAP database and electronic patient record FIDUS).

Results: The year 2020 showed a significant decrease in the number of inpatient surgeries with a total number of 285 vs 412 in 2019. However, the number of corneal transplantations increased significantly (60 in 2020 vs 54 in 2019, $p=0.0089$). In the various outpatient units of our department, we observed a significant decrease in the number of consultations (1.711 in 2020 vs 3.194 in 2019), especially for cataract surgery consultations (34 vs 137, $p<0.0001$). The number of outpatient surgeries was significantly reduced in 2020, especially for cataract surgery (64 vs 216, $p=0.007$) and intravitreal injections (577 vs 768, $p<0.0001$).

Conclusion: Despite taking all the necessary precautions to ensure that our medical care can continue to be available reliably and completely safe during the “Corona lockdown period”, the number of in- and outpatient surgeries and the number of outpatient consultations decreased significantly. However, the number of corneal transplantations still increased.

Keywords: COVID-19, coronavirus, corona-lockdown, SARS-CoV-2

Introduction

The new SARS-CoV-2 Virus first appeared in China in December 2019 as a result of the coronavirus disease 2019 (COVID-19) which has turned out to be a highly contagious virus. Ultimately, this virus can lead to a respiratory infection with a potentially fatal outcome and has caused a global pandemic.^{1,2} A Chinese ophthalmologist based in Wuhan – Dr. Li Wenliang – became known for warning the public of this emerging disease, as he was supposedly the first documented patient-to-ophthalmologist fatality contracting the virus from an asymptomatic patient.³

Respiratory aerosols, contact or fomites can transfer the COVID-19 virus and thus the ocular surface is believed to also play a part in passing on the disease. According to a study by the Johns Hopkins University, “there is not only a risk of contamination from aerosols in the air, but also a possible, potential risk from the surface of the patient’s eye”.^{4,5}

However, the majority of the available data regarding SARS-CoV-2 colonization of ocular and periocular tissues have to be considered controversial, it cannot be excluded that SARS-CoV-2 could both infect the eye and the surrounding structures. SARS-CoV-2 may use ocular structure as an additional transmission route, as demonstrated by the COVID-19 patients’ conjunctival secretion and tears positivity to reverse transcriptase-PCR SARS-CoV-2-RNA assay.^{6–9}

The growing number of cases and the rapid geographic spread of the disease has raised great concerns and in consequence has led to the implementation of extraordinary public health measures to reduce the spread of the virus.

Countries tried to stem the spread of the infection by means of social distancing and stay-at-home orders. As a result, routine outpatient visits and elective procedures had been postponed.^{10–13}

All hospitals and clinics in Germany, including ophthalmologists, were recommended to limit visits to emergencies only and to postpone all elective surgeries as well as examinations and treatments, which were not absolutely necessary, starting from the lockdown in Germany in mid-March for a maximum of three months.

In our Department a wide spectrum of hygiene measures had been introduced very soon after the outbreak of the pandemic: The entire staff as well as every patient have been required to wear facemasks during all encounters. Slit lamps have been equipped with a transparent protective filter separating the patient and the doctor. In order to promote social distancing, the chairs were arranged approximately 2 meters away in all waiting rooms. Visits and accompanying persons of patients in the outpatient sector were prohibited except in cases of high necessity or only under special circumstances.

After every use, the equipment is disinfected and additionally hand hygiene is necessary, as usual, prior to entering or exiting the examination room. Furthermore, we have taken all the necessary precautions to ensure that our medical care can continue to be available reliably and completely safe. Protective masks and disinfectant are available for patients.

At the entrance to the hospital, a registration desk has been set up with a hospital porter who explains patients the required hygiene measures and fills in a questionnaire to check whether the patient belongs to a risk group and whether he/she is vaccinated/ boosted. Firstly, the patient is asked whether he/she has been infected with the COVID-19 virus in the last 14 days, or has recently been in contact with a person who has been tested positive for Covid-19 in the last 2 weeks. The patient also has to state whether he/she has any of the following symptoms: sore throat, runny nose, diarrhea, fever, pain in the limbs, cough or other acute respiratory symptoms, loss of smell or loss of taste. If there is no suspicion of an infection with the Coronavirus, the patient may go to the appropriate sector in compliance with all hygiene regulations. If an emergency patient has had contact with an infected person and/or shows corresponding symptoms, he/she has to go to a separate waiting room or an isolation area to receive a COVID-19 test via nasopharyngeal swab and is examined with appropriate protective equipment.

Registration for the outpatient consultation takes place with the necessary safety distance. A large protective glass protects the patient and the employee. In addition, each of our diagnostic devices has a sneeze and spit shield, which protects patients and staff. During the medical examination, strict hygiene requirements are also observed. As usual, hand and device disinfection before and after each patient is mandatory. All slit lamps in all examination rooms have a sneeze and spit protection, too.

In addition, we carry out a PCR based test prior to any inpatient procedure.¹⁴ Only after receipt of the negative result, the patient is operated on. Until then, the patient remains isolated in the floating area of the ward or in domestic quarantine.¹⁵

Bearing all these precautions in mind, the purpose of this study was to assess the impact of the COVID-19 pandemic on the in- and outpatients as well as surgical and diagnostic procedures at a southwestern German university hospital with corneal subspecialization comparing the first “COVID-19 lockdown” period from 18 March until 8 May 2020 with the same period in 2019.

Materials and Methods

This retrospective study was carried out at the Department of Ophthalmology, Saarland University Medical Center in Homburg/Saar in order to study the impact of the Covid-19 pandemic on patient volume and turnover in the in- and outpatient unit of a German university hospital with corneal subspecialization between 18 March and 8 May 2020 compared to the same period in 2019.

Patient consent to review their medical records was not required, according to the Ethics Committee at the Saarland Medical Association in Saarbrücken, Saarland, Germany, because we did not refer to any confidential patient data, but only number of surgeries and consultations were counted by using the electronic patient administration systems of our Department. In addition, a patient informed consent statement was not required because of the retrospective nature of the study. Compliance with the Declaration of Helsinki was granted by the authors of this study.

The data of in- and outpatients, surgeries and diagnostic procedures required for the study were extracted from the SAP database used in the hospital and the electronic patient records FIDUS for the above-mentioned periods.^{16–19} All data were accumulated from cases which occurred on regular working days during regular working hours from 7:30 a.m. to 4:30 p.m. for the same periods in 2019 and 2020 (emergencies beyond these hours and on weekends were not recorded). Statistical analysis was done using the SPSS software (Version 27, 2020, IBM, USA).

In order to evaluate the difference between the two groups (2019 and 2020) in each category the following tests were used: Chi-Squared Test of Association and Fisher's Exact Test.

By running the test two-tailed a P-value that describes the result was calculated. A P-value < 0.05 was considered to reject the null hypothesis (as there is no difference between the groups) and indicated a statistically significant difference.

Results

In total, 289 patients were admitted to our hospital in 2020 in contrast to 461 patients in 2019. These admissions included 80 emergencies in 2020 and 115 emergencies in 2019.

Regarding the number of inpatient surgeries in our department, we saw a similar number of patients for the following surgeries: PTK, DMEK, Cyclophotocoagulation and filtering bleb revisions when comparing 2020 and 2019. The number of patients with penetrating keratoplasty was significantly higher in 2020 compared to 2019 (60 vs 54, $p=0.0089$). On the other hand, we observed a significant drop in the number of the following operations: Eyelid, Strabismus, Pterygium, EDTA chelation, Amnion membrane transplantation (AMT), Crosslinking, Corneal suture removal, Pars plana vitrectomy and especially Cataract surgeries (phacoemulsification with IOL implantation 24 vs 51, and extracapsular cataract extraction with IOL implantation 2 vs 7). In fact, there was an overall significant decrease in the number of patients operated on in our Department as part of a hospitalization with a total number of 281 in 2020 vs 409 in 2019 (Table 1).

Table 1 Ophthalmic Surgeries of Patients, Who Attended the Inpatient Unit of the Department of Ophthalmology, Saarland University Medical Center Between 18 March and 8 May (2020 and 2019)

Inpatient Surgeries	2020	2019	Fisher's Test P-value
Eyelid surgery	5	9	$P = 0.7879$
Levator muscle surgery	0	6	$P = 0.0454$
Strabismus surgery	6	21	$P = 0.0462$
Pterygium surgery	3	9	$P = 0.3766$
Phototherapeutic keratectomy (PTK)	29	29	$P = 0.1649$
EDTA chelation	1	6	$P = 0.2493$
Suture replacements	13	6	$P = 0.0178$
DMEK	37	37	$P = 0.1059$
Penetrating keratoplasty	60	54	$P = 0.0089$
Amniotic Membrane Transplantation (AMT)	6	15	$P = 0.2672$
Crosslinking	0	1	$P = 1.0000$
Corneal suture removal	3	5	$P = 1.0000$
TE+MMC	3	2	$P = 0.4075$
Filtering bleb-Revision	1	1	$P = 1.0000$
i-Stent	0	1	$P = 1.0000$

(Continued)

Table 1 (Continued).

Inpatient Surgeries	2020	2019	Fisher's Test P-value
CPC	9	9	P = 0.4735
Canaloplasty	7	4	P = 0.2148
Anterior chamber eye flush	9	23	P = 0.1430
Re-Bubbling after DMEK	5	14	P = 0.2388
ECCE+HKL	2	7	P = 0.3200
Phako+HKL	24	51	P = 0.1056
Secondary IOL	5	7	P = 1.0000
Scleral buckling	0	1	P = 1.0000
Exocryocoagulation	1	2	P = 1.0000
IVIs (intravitreal injection)	3	15	P = 0.0491
ppV (pars plana vitrectomy)	47	63	P = 0.7515
Anterior vitrectomy	1	2	P = 1.0000
Globe rupture surgery	1	1	P = 1.0000
Total number	281	401	

Notes: P-values in **Bold** Indicate Statistically Significant Differences.

Abbreviations: EDTA, Ethylenediaminetetraacetic; DMEK, Descemet Membrane Endothelial Keratoplasty; TE+MMC, Trabeculectomy + Mitomycin C; CPC, Cyclophotocoagulation; ECCE+HKL, Extracapsular cataract extraction with IOL implantation; Phako+HKL, Phacoemulsification with IOL implantation.

In the outpatient units of our department, we observed a decrease in the number of consultations with a total number of 1.711 in 2020 vs 3.194 in 2019 (Table 2). This includes a significant drop in patients coming in for cataract consultation (34 vs 137, $p < 0.001$), contact lens consultation (56 vs 220, $p < 0.0001$) and the general university outpatient clinic (1.121 vs 1.883, $p < 0.0001$). In contrast, the decrease in the number of consultations of patients who attended the pediatric ophthalmology and orthoptic unit (458 in 2020 vs 841 in 2019) was not statistically significant ($p = 0.7408$) (Table 2).

From the first to the second analyzed period, we noted a significant decrease of IVIs (intravitreal injection) (577 vs 768, $p < 0.001$) in our IVI center (intravitreal injection center). In addition, there was a significant number of patients who

Table 2 The Number of Consultations of Patients, Who Attended the Various Outpatient Units at the Department of Ophthalmology, Saarland University Medical Center Between 18 March and 8 May (2020 and 2019)

Number of Patients	2020	2019	Chi-Squared P-value
Cataract preoperative examination	34	137	P < 0.0001
Eyelid consultations	37	79	P = 0.4946
Keratoconus consultation	5	34	P = 0.0037
Contact lens consultation	56	220	P < 0.0001
Paediatric ophthalmology and orthoptics clinic	458	841	P = 0.7408
University outpatient clinic	1121	1883	P < 0.0001
Total number	1711	3194	

Notes: P-values in **Bold** Indicate Statistically Significant Differences.

did not show up for their treatment at the IVI center (198 vs 68, $p < 0.0001$) (Table 3), although it was still freely accessible during the lockdown period. In contrast, the number of follow-ups after the IVIs increased in 2020 compared to 2019 (76 vs 49, $p = 0.0036$).

In terms of outpatient operations, there was a significant decrease in patients with corneal suture removal (40 vs 70, $p = 0.0319$), and especially in patients operated on for cataract with 64 vs 216 ($p = 0.0070$) (Table 4).

Regarding the ophthalmologic diagnostic procedures performed in the outpatient unit at the Department of Ophthalmology, Saarland University Medical Centre, we also noted a significant drop (all $p < 0.02$) in the number of most examinations (Visual field, Pentacam, endothelial cell specular microscopy, Anterior Segment-OCT, Corvis-ST (Corneal Visualisation Scheimpflug Technology), ORA (ocular response analyser), Fluorescein angiography (FA)) during the “Corona lockdown period”, with a total number of 7.653 in 2020 in contrast to 12.538 in 2019 (Table 5).

Table 3 The Number of Consultations, Intravitreal Injections and Diagnostic Procedure (M-OCT) of Patients, Who Attended the IVI-Center (Intravitreal Injections Center) of the Department of Ophthalmology, Saarland University Medical Center Between 18 March and 8 May (2020 and 2019)

IVI-Centre (IVI: Intravitreal Injection)	2020	2019	Chi-Squared P-value
Checkup (after the injections)	76	49	P = 0.0036
Macula-OCT	210	254	P = 0.1578
Number of patients that did not show-up	198	68	P < 0.0001
Appointments cancelled by the clinic	6	9	P = 0.5251
The number of IVI	577	768	P < 0.0001
Total number of patients	1067	1148	

Note: P-values in Bold Indicate Statistically Significant Differences.

Table 4 Ophthalmic Surgeries of Patients, Who Attended the Outpatient Operation Center at the Department of Ophthalmology, Saarland University Medical Center Between 18 March and 8 May (2020 and 2019)

Outpatient Surgeries	2020	2019	Fisher's Test P-value
Eyelid surgeries	38	87	P = 0.4959
Conjunctiva surgeries	6	5	P = 0.0813
INTACS	1	1	P = 1.0000
Crosslinking	1	5	P = 0.4810
Corneal suture removal	40	70	P = 0.0319
Phako+HKL	64	216	P = 0.0070
ICL	0	3	P = 0.5635
Total number	150	387	

Note: P-values in Bold Indicate Statistically Significant Differences.

Abbreviations: INTACS, Intracorneal ring segments; Phako+HKL, phacoemulsification with IOL implantation; ICL, Implantable contact lens.

Table 5 The Number of Diagnostic Procedures Performed at the Outpatient Unit at the Department of Ophthalmology, Saarland University Medical Center Between 18 March and 8 May (2020 and 2019)

Diagnostic Procedures	2020	2019	Chi-Squared p-value
Visual field	251	487	P = 0.0264
Macula-OCT	1166	1931	P = 0.7518
Pentacam	669	1402	P < 0.0001
Endothelial cell specular Microscopy	1115	1623	P = 0.0011
Anterior Segment OCT	1545	2255	P < 0.0001
CORVIS ST (Corneal Visualisation Scheimpflug Technology)	36	319	P < 0.0001
ORA (Ocular Response Analyser)	28	299	P < 0.0001
Fluorescein angiography	2843	4222	P < 0.0001
Total number	7654	12,538	

Note: P-values in Bold Indicate Statistically Significant Differences.

Abbreviation: OCT, optical coherence tomography.

Discussion

COVID-19, which has turned out to be a highly contagious virus, can ultimately lead to a respiratory infection with a potentially fatal outcome and has caused a global pandemic. The current knowledge is that the virus can be transferred via aerosols. However, other ways of transmission are still unknown and it has been controversially discussed that transmission is possible through infected ocular tissue.²⁰ Furthermore, it has been hypothesized that the nasolacrimal system can act as a conduit for viruses to travel from the upper respiratory tract to the eye. Hence, ocular tissue and fluid may represent a potential source of SARS-CoV-2.^{20,21}

In March 2020, the American Academy of Ophthalmology (AAO) recommended limiting practice visits to emergencies and cancelling elective surgeries.²²

A publication by the AAO from 18 March 2020 “New recommendations for urgent and non-urgent patient care”, advised ophthalmologists to stop providing any treatment that is not urgent.

The recommendations included the following:

- Re-schedule appointments for patients with non-urgent ophthalmic problems and only see patients with emergent needs or those requiring frequent management.
- Only patients are allowed inside the practice but in certain circumstances, one person may accompany the patient.
- Minimizing interaction between patients and staff by using online transfers for additional payments.
- Use slit lamp breath shields.
- While the slit lamp examination is in progress, patient and physician should keep conversations to a minimum.
- For patients with documented COVID-19, persons under investigation, or patients who are “potentially infected with COVID-19,” ophthalmologists should wear personal protective equipment (PPE) including an N95 mask, gown, gloves and eye protection.^{23,24}

In Germany, the Federal Association of Ophthalmologists decided to postpone all examinations and treatments, which were not absolutely necessary - starting from the lockdown in Germany in mid-March - for a maximum of three months. This includes: routine checks, glaucoma controls, diabetic screening without known retinopathy, cataract surgery, cosmetic operations on the eyelids as well as surgical correction of ametropia (refractive surgery).

The recommendation of the German Ophthalmology Society (DOG) was that the patients should only consult an ophthalmologist in a clinic or practice if absolutely necessary and applied to checkups that could not be postponed as

well as therapies such as IVIs or emergency interventions. New prescriptions for medication, which were required permanently, should be sent by post, as recommended by the Federal Association of Ophthalmologists. Emergency care had to be maintained. Likewise, care had of course to be maintained for patients whose treatments could not be postponed for several weeks or months without the risk of permanent loss of vision.²⁵

During the initial phase of the pandemic, a contingency plan for non-selective basic eye care was developed at the initiative of the Association of German Chief Ophthalmic Physicians (DOCH) and in consultation with the boards of directors of the Retinological Society (RG), the Association of Ophthalmology Chairholders (VOL) and the German Ophthalmological Society (DOG). The indications and emergencies listed in Table 6 are understood as basic recommendations, which must be weighted in each individual case and according to available resources.²⁶ It should be noted that “keratoplasty” was grouped with “surgical treatment within hours until the following day”.

During the COVID-19 outbreak, the majority of treatments in our department were especially threatening conditions, such as corneal ulcers, retinal detachment, angle-closure glaucoma attack and other ophthalmic emergencies.^{14,27,28}

Table 6 Contingency Plan for Non-Selective Basic Eye Care in Germany During the Corona Lockdown Period Developed at the Initiative of the Association of German Chief Ophthalmic Physicians (DOCH) and in Consultation with the Boards of Directors of the Retinological Society (RG), the Association of Ophthalmology Chairholders (VOL) and the German Ophthalmological Society (DOG)

The Indications and Emergencies Listed Below are Understood as Basic Recommendations that Must be Weighed in Each Individual Case and According to Available Resources	
Surgical treatment within hours until the following day	<ul style="list-style-type: none"> -Acute retinal detachment. -Retinal holes/tears (depending on localization and vitreous status). -Endophthalmitis. -Conservatively unmanageable glaucoma/acute intraocular pressure elevation. -Globe perforation/perforating corneal ulcer. -Trauma/foreign body/eyelid wounds (eyelid edge involvement, tear duct tears). -Acute orbital hematoma/Optic compression/Pediatric orbital floor fracture. -Keratoplasty.
Operative care within days to two weeks (“Intermediary emergency”)	<ul style="list-style-type: none"> -Care of surgical complications. -Subretinal bleeding with involvement/threat to the macula. -Vitreous hemorrhage in suspected retinal detachment or retinal defect, Oculus melior (better eye). -Older retinal detachment/re-retinal detachment (macula detached). - Intraocular lens (IOL) dislocation in the better eye. -Macular foramen/vitreomacular traction with visual deterioration in the better eye. -Corneal ulcer. -Progressive glaucoma (better eye, severe glaucoma damage). -Malignant tumors (eg retinoblastoma), growth, ulceration, difficult localization. -Deterioration during conservative therapy (corneal hydrops, optic nerve compression, dacryocystitis). -Diplopia/Asthenopia in pathophoria/Strabismus/muscle paresis. -Intravitreal injections: Treatment according to the recommendations of the BVA (Professional Association of Ophthalmologists in Germany).
Operative care within two weeks to three months	<ul style="list-style-type: none"> -Severe progressive proliferative diabetic retinopathy. -Macular hole and progressive vitreomacular traction. -Hyperature/mature cataract in the better eye. -Intraocular lens (IOL) or crystalline lens dislocation. -Operations to prevent amblyopia. -Pronounced bullous keratopathy (keratoplasty). -Foreign body revisions, suture removals.

(Continued)

Table 6 (Continued).

Acute conservative treatment	<ul style="list-style-type: none"> -Acute loss of visual acuity/visual field restrictions. -Acute uveitis (viral retinitis, toxoplasmosis, etc.). -Acute corneal pathologies (ulcers, keratitis, keratoconus etc.). -Arterial and venous retinal occlusions. -Acute optic lesions (ischemia, neuritis, etc.). -Eyelid and orbital phlegmons, orbital inflammation, dacryocystitis. -Burns/flashes. -Panretinal laser coagulation in neovascularization to prevent bleeding. -Urgent postoperative controls, Controls for retinopathy of prematurity. -Prismatic treatment of latent and manifest strabismus (risk of falling).
-------------------------------------	--

Notes: Please Note That “Keratoplasty” Was Grouped Within the “Surgical Treatment Within Hours Until the Following Day”.

Due to the pronounced increasing number of Covid-19 cases in Germany starting with only one single case on 27 January 2020 to 262 confirmed cases on 04 March 2020 and following the instructions of the German Government and the German Ophthalmology Society, the Department of Ophthalmology at Saarland University Medical Center decided to cancel and postpone the majority of cataracts, eyelid, glaucoma and elective operations starting from 6 March 2020. Additionally, all appointments with the exception of emergencies were postponed for seven weeks to reduce the influx of patients to our clinic. As a result, we observed a significant decrease in the number of admissions to our hospital with a total number of 289 patients in 2020 compared to 461 patients in 2019, including 80 emergencies in 2020 and 115 emergencies in 2019. There was a significant decline in the number of the following outpatient and inpatient surgeries: Eyelid, Strabismus, Pterygium, EDTA, Crosslinking, Corneal Suture Removal, Pars plana vitrectomy (ppV) and especially Cataract surgeries. This has been reported for glaucoma surgeries in the literature.²⁹ In comparison, we saw a similar number of patients for the following surgeries: PTK, DMEK, Cyclophotocoagulation and filtering bleb revisions when comparing 2020 and 2019.

A report from 39 academic ophthalmology centers in Italy, another country severely impacted by the pandemic, compared surgical interventions of the 2-month lockdown period (March 10 to May 9, 2020) to pre-lockdown months (January 10 to March 9, 2020) and the corresponding 2 months in 2019 (March 10 to May 9 2019). Overall, the number of surgeries decreased by 68.8% and 69.9%, respectively, with a reduction of 96.2% and 96.4% in the number of elective surgeries and 50.7% and 53.9% in the number of urgent surgeries.³⁰

In the outpatient units of our department, we observed a significant decrease in the number of consultations with a total number of 1.711 in 2020 compared to 3.194 in 2019 (Table 3) which includes patients coming for cataract consultation (34 vs 137, $p<0.001$), contact lens consultation (56 vs 220, $p<0.0001$) and the general ophthalmic outpatient clinic (1.121 vs 1.883, $p<0.0001$).

In our center for intravitreal drug injections (IVI), established at our department in 2016 and separate from the other sections, we especially treat patients with macular diseases.³¹ During the “Corona lockdown period” we had given considerable attention to the importance of the therapy with IVIs for the treatment of choroidal neovascularization mainly secondary to age-related macular degeneration, diabetic macular edema, and also macular edema linked to retinal venous thrombosis. None of the treatments mentioned above were postponed within our IVI Center from our side due to the pandemic.

However, we could observe a significant decrease in the number of anti VEGF injections between 2020 and 2019 (577 vs 768). In addition, we were confronted with a significant increase in patients who just did not turn up for their appointment (198 vs 68). It should be noted that most of the patients who come in for treatment with anti VEGF injections are elderly, and some patients present with more advanced or severe systemic disease. This in turn suggests that patients were reluctant to present for treatment in our department to avoid the risk of eventual exposure to COVID-19, which could be potentially dangerous for them. Furthermore, we noted that the means of transport during the pandemic were restricted and diminished which was another disadvantage for patients to reach the clinic.

The literature indicates that patients were afraid of contracting the virus leading to a lower request for healthcare services/hospitalizations – particularly during the period of hard lockdown (March – May 2020). This factor certainly contributed to a lower afflux of patients to hospital and to contentious relationship between patients and health care workers (HCWs). On the other hand, the hard lockdown led to a worsening of the conditions of non-autonomous

patients.^{32–34} In a study performed in Italy only 70% of patients for whom an operation/intravitreal injection was recommended, finally underwent surgery. The remaining patients did not turn up because they were afraid of being infected at the hospital (23%), taking public transportation (6.5%), or unavailable swabs (0.5%).³⁴

It is also worth noting that during lockdown, some models of working from home or home schooling were proposed to improve productivity, including online work and home schooling, based on the use of electronic equipment. There is no doubt that these smart work models with electronic equipment have given rise to new lifestyles, digital work and digital school, forcing people, both young and adult, into prolonged near visual work. Unfortunately, this can predispose to ocular surface disorders, such as dry eye disease (so-called “quarantine dry eye”).³⁵

Despite the main streaming, in the present study we observed a significant increase on the number of corneal transplantations between 2020 and 2019 (60 vs 54). This may be due to the fact that we are one of the university departments performing most penetrating keratoplasties in Germany and there is a constant need for donor tissue. In addition, “keratoplasty” was classified under “emergencies” in Germany (Table 6). Thus, we decided not to interrupt our eye bank activities, since tissue was available and must not be discarded.³⁶ We recommended continuing the collection of all available corneas, as long as the appropriate precautions were taken. Only tissue from donors with confirmed SARS-CoV-2 infection or with a high clinical suspicion of COVID-19 should not be selected for transplantation purposes.³⁷

In other European countries, in Italy for example, corneal transplants were considered as an elective surgeries and during lockdown a dramatic reduction in the number of keratoplasties was observed there. The number of cancelled transplantations during the COVID-19 lockdown period in 2020 was 103. On the other hand, in the same timeframe of 2019, only 27 cancelled procedures were registered.³⁸

The risk of transferring viral loads - through respiratory droplets or contact with surfaces - from the patient to the physician increases where a close proximity to the patient is required during the application of ophthalmic diagnostic equipment and procedures, for example slit lamp, ophthalmoscope or ocular manipulation. Furthermore, there are certain ophthalmic instruments, which are used frequently during single-patient visits and can become potential sources of transmission if they are not disinfected accordingly.³⁹ In our Department, single-use instruments, for example a single-use tonometer, were used during the Corona lockdown period. Additionally, we decided to limit the use of certain diagnostics procedures that posed a high risk of transmitting infection through the air pulse such as Ocular Response-Analyzer (ORA) and Corvis-ST (evaluation of corneal biomechanical response, tonometry and pachymetry) as much as possible which resulted in a significant decrease in ophthalmologic diagnostic procedures performed in the outpatient unit during the lockdown with a total number of 7.653 in 2020 in contrast to 12.538 in 2019 (Table 5).

A paradigm shift for ocular surgery and preparatory examinations during the still ongoing COVID-19 era seems to be mandatory. While telemedicine may be able to solve some problems in clinical ophthalmology, the lack of adequate health and legal protections for surgeons and patients may result in an excessive reduction in the volume of surgical interventions, thus determining inability to ensure required health care to all patients.⁴⁰

Conclusion

Despite taking all the necessary precautions to ensure that our medical care can continue to be available reliably and completely safe during the “Corona lockdown period”, the number of in- and outpatient surgeries and the number of outpatient consultations decreased significantly. However, the number of corneal transplantations still increased, as this procedure relies on donor tissue in demand and was thus classified as an emergency in Germany.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Williams AM, Kalra G, Commiskey PW, et al. Ophthalmology Practice During the Coronavirus Disease 2019 Pandemic: the University of Pittsburgh Experience in Promoting Clinic Safety and Embracing Video Visits. *Ophthalmol Ther.* 2020;9:1–9.
2. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. *Lancet.* 2020;395(10223):470–473. doi:10.1016/S0140-6736(20)30185-9

3. Parrish RK. 2nd, Stewart MW, Duncan Powers SL. Ophthalmologists Are More Than Eye Doctors - In Memoriam Li Wenliang. *Am J Ophthalmol.* 2020;213:A1–A2. doi:10.1016/j.ajo.2020.02.014
4. Zhou L, Xu Z, Castiglione GM, Soiberman US, Eberhart CG, Duh EJ; Zhou L, Xu Z, Castiglione GM, Soiberman US, Eberhart CG, Duh EJ. ACE2 and TMPRSS2 are expressed on the human ocular surface, suggesting susceptibility to SARS-CoV-2 infection. *Ocul Surf.* 2020;18(4):537–544. doi:10.1016/j.jtos.2020.06.007
5. Kermani O. [Assessment of the Covid-19 risk with various standard diagnostic methods]. *Z Prakt Augenheilkd.* 2020;41:353–356. German.
6. Aiello F, Gallo Afflitto G, Mancino R, et al. Coronavirus disease 2019 (SARS-CoV-2) and colonization of ocular tissues and secretions: a systematic review. *Eye.* 2020;34:1206–1211. doi:10.1038/s41433-020-0926-9
7. 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;92:589–594. doi:10.1002/jmv.25725
8. Wu P, Duan F, Luo C, et al. Characteristics of ocular findings of patients with coronavirus disease 2019 (COVID-19) in Hubei Province, China. *JAMA Ophthalmol.* 2020;2019:4–7.
9. Fang Z, Zhang Y, Hang C, Zhang W, Ai J, Li S. Comparisons of nucleic acid conversion time of SARS-CoV-2 of different samples in ICU and non-ICU patients. *J Infect.* 2020;81:147–178. doi:10.1016/j.jinf.2020.03.013
10. WHO Statement on the meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). Geneva, World Health Organization; 2020. Available from: [https://www.who.int/news-room/detail/23-01-2020-statement-on-The-meeting-of-The-international-health-regulations-\(2005\)-emergency-committee-regarding-The-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/23-01-2020-statement-on-The-meeting-of-The-international-health-regulations-(2005)-emergency-committee-regarding-The-outbreak-of-novel-coronavirus-(2019-ncov)). Accessed June 2, 2022.
11. [SARS-CoV-2: Case numbers in Germany, China and worldwide. Robert Koch Institute]. Retrieved 2 March 2020.
12. [“Supplement to the National Pandemic Plan - COVID-19 - novel coronavirus disease” (PDF)]. rki.de. Robert Koch Institute. Retrieved 4 March 2020.
13. [“Robert Koch-Institut: COVID-19-Dashboard”] (in German). Robert Koch Institute Retrieved 26 June 2020.
14. Tóth G, Xanthopoulou K, Stachon T, Németh et al. Impact of COVID-19 Pandemic on Emergency Inpatient Volume at a Tertiary Eye Care Center in Germany with Corneal Main Specialization. *Klin Monbl Augenheilkd.* 2021;238:715–720. doi:10.1055/a-1327-3393
15. Arbeiten in Zeiten von Corona in der Universitäts-Augenklinik des Saarlandes. 2020. Available from: <https://augenklinik-saarland.de/blog/corona>. Accessed June 2, 2022.
16. Spira-Eppig C, Eppig T, Bischof M, et al. [Per aspera ad astra: implementation of electronic patient records in a university eye hospital: experience with FIDUS in the Clinic for Ophthalmology at the Saarland University Medical Center UKS]. *Ophthalmologe.* 2018;115:868–877. German. doi:10.1007/s00347-017-0588-6
17. Spira-Eppig C, Eppig T, Bischof M, et al. [Work in progress: adaptation of electronic medical records to the requirements of a university eye clinic: individual extensions of the software “FIDUS” at the Department of Ophthalmology of the Saarland University Medical Center UKS]. *Ophthalmologe.* 2019;116:1046–1057. German. doi:10.1007/s00347-019-0881-7
18. Czapski P, Schiebl G, Treder M, et al. [FIDUSweb version 2.0: an electronic platform to establish a cooperative university eye network]. *Ophthalmologe.* 2020;117:677–686. German. doi:10.1007/s00347-019-00993-7
19. Maamri A, Fries FN, Spira-Eppig C, et al. [Employee survey after introduction of the FIDUS electronic patient file at the Saarland University Eye Hospital]. *Ophthalmologe.* 2015;1:854. German.
20. Seah I, Agrawal R. Can the Coronavirus Disease 2019 (COVID-19) Affect the Eyes? A Review of Coronaviruses and Ocular Implications in Humans and Animals. *Ocul Immunol Inflamm.* 2020;28:391–395. doi:10.1080/09273948.2020.1738501
21. Seah IYJ, Anderson DE, Kang AEZ, et al. Assessing Viral Shedding and Infectivity of Tears in Coronavirus Disease 2019 (COVID-19) Patients. *Ophthalmology.* 2020;127:977–979. doi:10.1016/j.ophtha.2020.03.026
22. American Academy of Ophthalmology. New recommendations for urgent and nonurgent patient care. 2020. Available from: <https://www.aao.org/headline/newrecommendations-urgent-nonurgent-patient-care>. Accessed 8 Apr 2020.
23. American Academy of Ophthalmology Coronavirus impact: practice operations and safety considerations. Available at: www.aao.org/practicemanagement/article/coronavirus-practice-operations-safety-advice. Accessed April 3, 2020.
24. American Academy of Ophthalmology. New recommendations for urgent and nonurgent patient care. 2020. Available at: www.aao.org/headline/new-recommendations-urgent-nonurgent-patientcare. Accessed March 31, 2020.
25. [Recommendations of the German Ophthalmological Society, the professional association of ophthalmologists in Germany, the Federal Association of German Ophthalmic Surgeons for ophthalmologists on the subject of Covid 19 (2020)]. Available from: <https://www.dog.org/?cat=288>. Accessed June 2, 2022.
26. Hattenbach L, Reinhard T, Walter P, et al. [Crisis management strategies of hospitals during the pandemic]. *Ophthalmologe.* 2020;117:652–658. German. doi:10.1007/s00347-020-01162-x
27. McCannel CA. Meta-analysis of endophthalmitis after intravitreal injection of anti-vascular endothelial growth factor agents: causative organisms and possible prevention strategies. *Retina.* 2011;31:654–661. doi:10.1097/IAE.0b013e31820a67e4
28. Liebmann JM, Barton K, Weinreb RN, et al. Evolving Guidelines for Intracameral Injection. *J Glaucoma.* 2020;29(Suppl 1):S1–S7. doi:10.1097/IJG.0000000000001451
29. Ayub G, Vasconcelos JPC, Costa VP. The Impact of Covid-19 in the Follow-Up of Glaucoma Patients in a Tertiary Center: a Comparison Between Pre-Pandemic and Pandemic Periods. *Clin Ophthalmol.* 2021;15:4381–4387. doi:10.2147/OPTH.S334147
30. Nioi M, Napoli P, Finco G, et al. Fear of the COVID-19 and medical liability. Insights from a series of 130 consecutives medico-legal claims evaluated in a single institution during SARS-CoV-2-related pandemic. *Signa Vitae.* 2021;17:79–85.
31. Abdin AD, Suffo S, Bischoff-Jung M, et al. [Advantages of a designated IVI center for a German university eye hospital]. *Ophthalmologe.* 2020;117:50–57. German. doi:10.1007/s00347-019-0911-5
32. d’Aloja E, Finco G, Demontis R, et al. COVID-19 and medical liability: Italy denies the shield to its heroes. *EClinicalMedicine.* 2020;25:100470. doi:10.1016/j.eclim.2020.100470
33. Nioi M, Napoli PE, Lobina J, Fossarello M, d’Aloja E. COVID-19 and Italian healthcare workers from the initial sacrifice to the mRNA vaccine: pandemic chrono-history, epidemiological data, ethical dilemmas, and future challenges. *Front Public Health.* 2020;8:591900. doi:10.3389/fpubh.2020.591900
34. dell’Omo R, Filippelli M, Virgili G, et al. Effect of COVID-19-related lockdown on ophthalmic practice in Italy: a report from 39 institutional centers. *Eur J Ophthalmol.* 2022;32:695–703. doi:10.1177/11206721211002442

35. Napoli PE, Nioi M, The FM. "Quarantine Dry Eye": the Lockdown for Coronavirus Disease 2019 and Its Implications for Ocular Surface Health. *Risk Manag Healthc Policy*. 2021;14:1629–1636. doi:10.2147/RMHP.S277067
36. Wykrota AA, Weinstein I, Hamon L, et al. Approval rates for corneal donation and the origin of donor tissue for transplantation at a university-based tertiary referral center with corneal subspecialization hosting a LIONS Eye Bank. *BMC Ophthalmol*. 2022;22:17. doi:10.1186/s12886-022-02248-7
37. Hamon L, Bayyoud T, Seitz B. Ocular Findings in Patients with COVID-19: impact on Eye Banking [Letter]. *Clin Ophthalmol*. 2021;15:2051–2052. doi:10.2147/OPTH.S317378
38. Aiello F, Genzano Besso F, Pocobelli G, et al. Corneal transplant during COVID-19 pandemic: the Italian Eye Bank national report. *Cell Tissue Bank*. 2021;22:697–702. doi:10.1007/s10561-021-09934-8
39. Shabto JM, De Moraes CG, Cioffi GA, Liebmann JM. Review of Hygiene and Disinfection Recommendations for Outpatient Glaucoma Care: a COVID Era Update. *J Glaucoma*. 2020;29:409–416. doi:10.1097/IJG.0000000000001540
40. Napoli PE, Nioi M, d'Aloja E, Fossarello M. Safety Recommendations and Medical Liability in Ocular Surgery during the COVID-19 Pandemic: an Unsolved Dilemma. *J Clin Med*. 2020;9:1403. doi:10.3390/jcm9051403

Clinical Ophthalmology

Dovepress

Publish your work in this journal

Clinical Ophthalmology is an international, peer-reviewed journal covering all subspecialties within ophthalmology. Key topics include: Optometry; Visual science; Pharmacology and drug therapy in eye diseases; Basic Sciences; Primary and Secondary eye care; Patient Safety and Quality of Care Improvements. This journal is indexed on PubMed Central and CAS, and is the official journal of The Society of Clinical Ophthalmology (SCO). The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/clinical-ophthalmology-journal>