

The impact of COVID-19 related national lockdown on ophthalmic emergency in Italy: A multicenter study

European Journal of Ophthalmology
2022, Vol. 32(3) 1782–1794
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DOI: 10.1177/11206721211028046
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Abstract

Purpose: To assess ocular pathologies admitted to Italian Emergency Eye Departments (EEDs) during the COVID-19 pandemic national lockdown in 2020 in comparison with the same period in 2019.

Methods: Electronic records of all patients presenting at EEDs of two tertiary-care Eye Centers during the COVID-19 national lockdown in Italy (March 10–May 3, 2020) were compared with the equivalent period in 2019. Main outcomes were patient age, gender, and diagnoses. Statistical analysis included unpaired Student *t*-tests, Poisson regression, and chi-square test.

Results: Overall EED visits significantly decreased by 54.1% during the 2020 lockdown compared to 2019 (851 vs 1854, $p < 0.001$). During lockdown, patients showed comparable mean age (52.8 years in 2020 vs 53.3 years in 2019, $p = 0.52$) and significant male gender bias (61.1% in 2020 vs 55.8% in 2019, $p < 0.0001$). The most frequent pathologies were eye inflammations, trauma-related incidents, and spontaneous acute vitreous detachment. Patients with inflammation, headache/hemicrania, and spontaneous subconjunctival hemorrhages were significantly less, whereas those with trauma-related diagnoses were significantly higher during the lockdown as compared with 2019 ($p < 0.05$). The proportion of non-urgent visits decreased from 17% in 2019 to 8% in 2020 ($p < 0.001$).

Conclusions: During the 2020 lockdown, there was a significant reduction of accesses to EED, especially for non-urgent pathologies. Potentially visual function threatening conditions, such as trauma-related pathologies, retinal detachment or ruptures, and wet AMD, showed lower number of cases but higher or stable proportion relative to the total caseload, suggesting a correct and efficient access to ophthalmic health care during the pandemic period.

Keywords

COVID-19, SARS-CoV-2, pandemic, lockdown, eye emergency

Date received: 21 January 2021; accepted: 7 June 2021

Introduction

The coronavirus disease COVID-19 is caused by highly contagious virus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection.^{1,2} The first cluster of cases, characterized by severe pneumonia, was seen in Wuhan, capital of Hubei, China, in December 2019.^{3,4} Subsequently, the SARS-CoV-2 incidence dramatically increased worldwide during the first months of 2020⁵ and was declared a global pandemic by the World Health Organization on March 11, 2020.⁶ In the majority of cases, COVID-19 manifests with flu-like illness with mild symptoms, like fever, cough, sore throat, fatigue, myalgia,

dyspnea, occasional diarrhea, and vomiting. In selected groups of patients, such as elderlies and immune-compromised individuals, the condition can deteriorate to acute respiratory distress syndrome (ARDS), septic shock, and

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multi-organ failure resulting in mortality.⁷ According to the Italian Surveillance Group Italy, the patients dying for COVID-19 as of April 2020 had a mean age of 79 years, of male gender in 74.2% of cases, and having three or more comorbidities in 60.7% of cases.⁸ The danger related to the SARS-CoV-2 infection was amplified due to the lack of a vaccine and effective proven therapy against this new virus.⁹

From the beginning of the pandemic until now, more than 66 million confirmed cases of COVID-19 with over 1.5 million deaths have been reported worldwide.¹⁰ The first reported case of COVID-19 in Italy was on February 21, 2020.⁸ Infection spread rapidly in Italy, particularly in the North, with over 2 million case of COVID-19 and over 75,000 related death registered in Italy up till the beginning of January 2021.¹⁰

In order to limit the spreading of the infection and to reduce the pressure on the national health service, the Italian Government imposed a national total lockdown of all non-essential services between the March 10, 2020 and May 3, 2020.^{10,11} The restrictions during this period included: strict home isolation unless strictly necessary; travel restrictions between different municipalities except for emergencies, work, or health reasons; and closure of all commercial and productive activities, with the exception of those strictly necessary for survival. Hospitals were forced to halt all elective activities, limit the access of patients, and dedicate most resources to treat symptomatic COVID-19 patients.

With regards to ophthalmic services, all elective visits, procedures, and surgeries were deferred. Ophthalmology departments nationwide only provided mandatory assistance for acute and chronic sight-threatening conditions and emergency eye care service. The effects of the restrictive measures taken during the pandemic lockdown on ophthalmological patients remain unclear and require further assessment. If the fear of the pandemic, risk of infection, and lockdown related restrictions can influence patient behavior in seeking emergency treatments,^{12,13} it is likely that patients with visual function threatening disorders are not seeking imperative medical assistance during the lockdown, with devastating irreversible visual function consequences.

The purpose of our multi-center study was to assess the impact of the COVID-19 pandemic related lockdown in 2020 based on the number and type of ocular pathologies admitted and treated in the emergency eye departments (EEDs) in Italy, and to compare the data with patients admitted in the EEDs 1 year prior during the same period in 2019.

Materials and methods

All patients admitted to the emergency eye departments (EEDs) during the phase I of the national Italian lockdown,

from March 10 to May 3, 2020, were enrolled in this multi-center retrospective observational study. The same data were collected for the equivalent period in 2019. The study was conducted at two tertiary-care Ophthalmological Departments at the Azienda Sanitaria “Friuli Occidentale,” Pordenone, and the University Hospital of Udine, Italy. The two eye centers cover a geographic area of approximately 7300 km², situated in the northeast part of Italy, with a population of about 846,000 individuals. The EEDs receive emergency patients and consults from primary care physicians and primary care ophthalmologists, in addition to walk-in patients requiring ophthalmic urgent assistance prior assessed and sent for consult from the General Emergency Departments of the hospitals.

According to the World Health Organization (WHO) recommendations regarding identification and isolation of COVID-19 suspected cases,⁶ containment measures were taken to prevent access by potentially infected patients and personnel during the pandemic lockdown. Checkpoints were established at every hospital entrance and individuals entering the hospital, both staff and patients, were evaluated for body temperature, respiratory symptoms, and anamnesis of suspected contacts. With a temperature higher than 37.5°C, respiratory symptoms, or positive anamnesis for contact with infected or suspected individuals, or recent travel in outbreak areas, hospital access was denied and patients or staff members were invited to go home and contact the family doctor. Before entering the EED, all persons were invited to clean their hands with alcoholic solution and wear a new surgical mask provided by the hospital. No accompanying persons were permitted, with the exception to disabled, minors, and oncological patients. In the ophthalmological department, staff received personal protection equipment, such as filtering masks KN-95 and/or PFF2, gloves, protective eyewear, and long-sleeved disposable aprons. Protective plastic breath shields were also installed on all slit-lamps. Social distancing was enforced, thus reducing the number of patients in waiting areas and exam lanes. All elective procedures and office activities were cancelled. Urgent ophthalmological visits and surgery, and intravitreal injections were continued in order to avoid irreversible visual loss. Calls and video-consultations were not provided by our EEDs.

The study was in compliance with the tenets of the Helsinki’s Declaration and with the Institutional Review Boards (IRBs) and HIPAA requirements. Due to the retrospective nature of the study, the IRBs waived the need for formal approval and informed consent from participants.

Main outcome measure

Electronic records of all patients attending the EED of both eye centers during the COVID-19 pandemic lockdown in Italy (approximately 8 weeks, from March 10 to May 3,

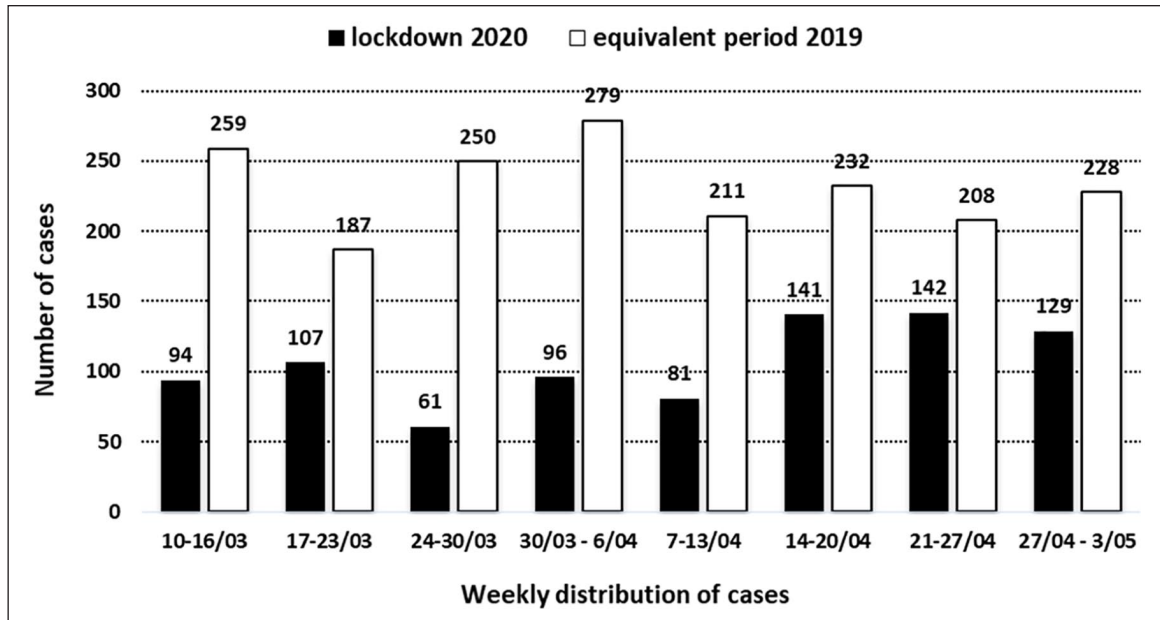


Figure 1. Bar chart showing the average number of patients presenting to the Emergency Eye Department per week during the COVID-19 related pandemic lockdown in Italy (March 10–May 3, 2020), compared to the equivalent period in 2019.

2020) and the equivalent 2019 period (March 10 to May 3, 2019) were retrospectively evaluated. Data extracted from the patient electronic record included: demographic data (age and gender) and diagnostic code, based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM). The diagnoses considered in our assessments are listed in online Supplemental Appendix 1. The patient demographics, number and type of diagnosis (number of cases and percentages of total caseload) and need of emergency interventions and hospital admission were compared between the two study periods.

In accordance to the National Health System RAO (Homogeneous Waiting Groups) classification criteria, as defined by AGENAS (National Agency for Regional Sanitary System),¹⁴ patients were classified as urgent or not urgent according to clinical condition (signs and referred symptoms). Urgent cases, which must be assessed within 72 h, included the presence of one of the following signs and/or symptoms: ocular trauma, ocular inflammations, ptosis, lagophthalmus, diplopia or exophthalmos, visual loss, scotoma, phosphenes and floaters, amaurosis, and eye pain.

Statistical analysis

Data distribution was analyzed using the Kolmogorov-Smirnov test. Unpaired Student *t*-test was used for comparisons of continuous variables. Categorical variables were recorded in numbers and percentages. Poisson regression for count analysis was used for comparisons of counts of

categorical variables and to assess the effect of independent variables (age and gender) on dependent variables (patient diagnoses). Differences between proportions were evaluated using the chi-square test or the Fisher's exact test (when $E < 5$; where E is the expected frequency). The statistical analysis was performed using SPSS 20.0 for Windows (SPSS Inc, Chicago, IL). Statistical significance was defined as $p < 0.05$.

Results

The total number of patients admitted to the EEDs were respectively 851 (15 ± 7.5 patients per day, 106.4 ± 29.1 patients per week) during the 2020 COVID-19 related lockdown, and 1854 (mean 34 ± 13 patients per day, mean 232 ± 30 patients per week) during the corresponding period of 2019, with a significant overall decrease of the 54.1% in the total number of patients during the lockdown period (Poisson regression for count, $p < 0.0001$).

Figure 1 shows the number of patients examined at the EEDs for each of the 8 weeks of the two study periods. The total number of visits performed weekly during of the 2020 national lockdown were significantly lower than those performed during the equivalent period of the previous year in each of the 8 weeks considered (Poisson regression for count, $p < 0.05$). There was a significant increase in the number of patients presenting weekly at the EEDs during the last 3 weeks of the lockdown period (chi-square test, $p < 0.05$); on the other hand, during the correspondent period of the 2019, irregular high levels of EED attendances were registered (chi-square test; $p < 0.05$).

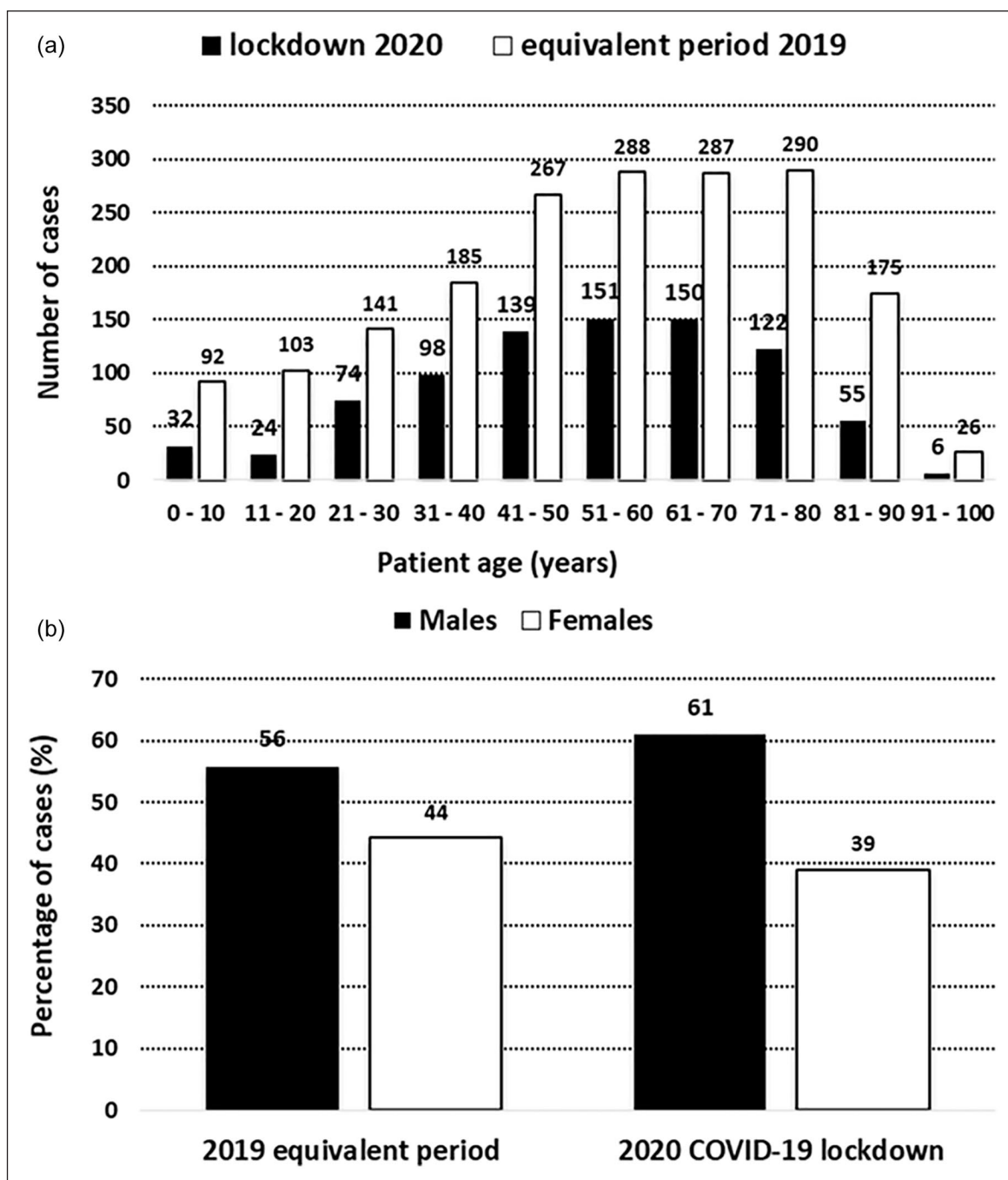


Figure 2. (a) Bar chart of age distribution (number of cases in each age rank) of patients presenting to the Emergency Eye Department during the COVID-19 related pandemic lockdown in Italy (March 10–May 3, 2020), compared to the equivalent period in 2019. (b) Bar chart of gender distribution (% of total caseload) of patients presenting to the Emergency Eye Department during the COVID-19 related pandemic lockdown in Italy (March 10–May 3, 2020), compared to the equivalent period in 2019.

Age and gender distributions of patients presenting at the EEDs during of the two study periods are shown in Figure 2. The mean patient ages were respectively 52.8 ± 20.4 years (range 4 months–101 years) during the 2020 lockdown, and 53.3 ± 22.6 years (range 1–98 years) in 2019, showing no significant differences between the two study periods (unpaired Student's *t*-test; $p=0.52$). The

majority of patients of both study periods aged between 40 and 80 years (chi-square test, $p < 0.05$) (Figure 2(a)). The total number of patients examined during of the 2020 lockdown were significantly lower than those seen during the equivalent period of the previous year per each of the 10 age ranks (Poisson regression for count, $p < 0.05$), excepted for patients older than 90 years ($p=0.81$) (Figure 2(a)).

Males were significantly more numerous than females both during the 2020 lockdown (520 vs 331, $p < 0.0001$) and during the equivalent 2019 period (1034 vs 820, $p < 0.0001$) (Figure 2(b)). The proportion of males presenting at the EEDs was significantly higher during the lockdown (61.1% vs 55.8%; chi-square test, $p = 0.009$) (Figure 2(b)). Males were significantly younger than females in both the 2020 lockdown period (mean age of 49.6 ± 19.6 years vs 57.8 ± 20.6 years; t -test, $p < 0.001$) and in the 2019 equivalent period (mean age of 50.9 ± 21.9 years vs 56.4 ± 23.1 years; t -test, $p < 0.001$).

The number of cases, gender distribution, and mean age of patients affected by the most frequent diagnoses seen in the EEDs during the COVID-19 related 2020 lockdown and the equivalent time period of 2019 are listed in Table 1. The most common pathologies for which patients presented to the EEDs included: eye inflammations, especially conjunctivitis, and blepharo-conjunctivitis; trauma-related pathologies, especially foreign bodies of the external eye; corneal abrasions and eyeball contusions; and spontaneous acute vitreous detachment.

In both study periods, male gender and younger age were risk factors for trauma-related diagnoses, especially foreign body of the external eye and corneal abrasions; conversely, female gender and older age appeared significantly associated with spontaneous acute vitreous detachment and active choroidal neovascularization associated to age-related macular degeneration or to other pathologies (Poisson regression for count, $p < 0.05$) (Table 1).

With the exception to the neurological disorders, the total number of cases appeared reduced during the 2020 COVID-19 related lockdown period when compared to the equivalent period of 2019 for all diagnostic categories, with a decrease ranging between 22.2% and 93.3% of the total caseload in 2019. The reduction in the number of cases, however, appeared statistically significant for the following diagnoses: all types of eye inflammations and trauma-related diagnoses, blepharo-conjunctivitis, foreign bodies on the external eye, headache/hemicrania, and spontaneous subconjunctival hemorrhage (Poisson regression for count, $p < 0.05$) (Table 1).

Histograms and counts of the top diagnoses expressed as a percentage of the total caseload seen in the EEDs during the two study periods are shown in Figure 3 and Table 2. The proportions of the eye inflammations (especially blepharo-conjunctivitis), headache/hemicrania, and spontaneous subconjunctival hemorrhages were significantly lower, whereas the proportions of the trauma-related diagnoses, in particular of foreign bodies of the external eye, appeared significantly higher during the 2020 lockdown as compared to the equivalent period of the previous year (chi-square test, $p < 0.05$).

After careful anamnesis and full ocular examination, patients classified as having non-urgent cases appeared significantly lower during the 2020 lockdown (8%) than during the equivalent 2019 period (17%) (chi-square test, $p < 0.001$) (Figure 4).

The emergency interventions after the EED assessments, that were performed in all patients having immediate risk of visual loss, slightly decreased (but not significantly) from 129 in 2019 to 73 in 2020 (Poisson regression for count, $p = 0.71$) (Table 3). The percentage of the total caseload requiring an emergency surgical or laser intervention after the EED visit slightly increased (but not significantly) from 7% in 2019 to 8.6% in 2020 (chi-square test, $p = 0.72$).

During the lockdown period in 2020, none of the patients presenting to the EEDs and none of the health-care workers of the EED showed any signs or symptoms of COVID-19 disease.

Discussion

The SARS-CoV-2 pandemic imposed extraordinary restriction measures and a complete re-organization of the different National Health Systems. Based on the demonstration that the human-to-human transmission of the COVID-19 occurs primarily through droplets, contacts, and fomites,¹⁵ social distancing measures to prevent the spread of the infection were taken in different periods and ways in several countries. The COVID-19 related nation lockdown imposed in Italy between March 10 and May 3, 2020 to contain the pandemic, caused a complete halt of all public transport services; closure all non-essential activities; and restriction of public movement for non-essential work. The national government advised the public to use the hospitals only in strict cases of emergency, especially in high-risk patients.¹⁰

At the same time, the pandemic posed a number of challenges for all health-care workers, including ophthalmologists. Close proximity to the patient nose and mouth, particularly during slit lamp examination, characterize ophthalmologists as a “high risk category” requiring personal protection devices and environmental precautions to reduce risk of infection via droplets and fomites.^{16,17} COVID-19 transmission directly involving the eye, although rare, has been reported in literature due to the presence of the SARS-CoV-2 virus in tears and conjunctival sac,¹⁸ and several reports have described the possibility of aerosol viral transmission to the conjunctiva when no eye protection was worn.^{19,20} The first physician alerting the world of the new infection was a Chinese ophthalmologist, Li Wenliang, who probably contracted the virus from a patient affected by COVID-19 related conjunctivitis on February 2020 and succumbed to the disease in March 2020.²¹ Moreover, conjunctivitis has been described as the first feature of COVID-19 by several authors.^{22,23}

On February 14, 2020, the Italian Ophthalmological Society (SOI)²⁴ suggested the adoption of recommended procedures for the assistance of ophthalmic patients during the COVID-19 outbreak, aiming to reduce the risk of COVID-19 transmission in both patients and health-care workers. Suggested measures that should be adopted in

Table 1. Incidence of the top diagnoses presenting at the Emergency Eye Department.

| Diagnoses | 2019 Equivalent period (10th March 2019–3rd May 2019) | | | | 2020 COVID-19 lockdown (10th March 2020–3rd May 2020) | | | | Inter-group differences | | |
|--|---|------------------------|---------------------------|--------------|---|---------------------------|--------------|--------------------|--------------------------|-----------------------------|-------------------------------------|
| | No. of cases | Males/ females (%) | Age (years), (mean ± SD) | No. of cases | Males/ females (%) | Age (years), (mean ± SD) | No. of cases | Males/ females (%) | Age (years), (mean ± SD) | 2020 minus 2019 | No. of cases (p value) [§] |
| | | | | | | | | | | No. of total cases of 2019) | |
| Total number of cases | 1854 | 55.8/44.2 | 53.3 ± 22.6 | 851 | 61.1/38.9 | 52.8 ± 20.4 | -54.1 | | | <0.000* | |
| All types of eye inflammation | 702 | 51.7/48.4 | 55.6 ± 21 | 242 | 43.4/56.6 | 50 ± 24 | -65.5 | | | <0.000* | |
| All types of eye trauma | 541 | 67.7/32.2 [^] | 45.5 ± 21.4 ^{^^} | 334 | 74/26 [^] | 45.1 ± 23 ^{^^} | -38.3 | | | 0.026* | |
| Blepharoconjunctivitis/conjunctivitis | 360 | 48.9/51.1 | 53.3 ± 22.8 | 143 | 47.4/52.6 | 47.7 ± 22.5 ^{^^} | -60.3 | | | 0.015* | |
| Foreign body on external eye | 327 | 81.1/18.8 [^] | 46 ± 16.6 ^{^^} | 200 | 88.5/11.5 [^] | 44.6 ± 15.2 ^{^^} | -38.8 | | | 0.045* | |
| Spontaneous acute vitreal detachment | 132 | 31.1/68.9 [^] | 66.4 ± 8.9 ^{^^} | 62 | 32.3/67.7 [^] | 63.6 ± 10.1 ^{^^} | -53.0 | | | 0.88 | |
| Corneal abrasion | 117 | 63.2/36.8 [^] | 45.5 ± 20.3 ^{^^} | 45 | 68.9/31.1 [^] | 47.3 ± 16 ^{^^} | -61.5 | | | 0.31 | |
| Eyeball contusion | 108 | 72.7/27.3 [^] | 39.4 ± 28.3 ^{^^} | 39 | 50/50 | 43.3 ± 29.3 ^{^^} | -63.9 | | | 0.97 | |
| Headache/hemicranic aura | 93 | 46.8/53.2 | 25.8 ± 24.6 ^{^^} | 22 | 75/25 [^] | 26 ± 28.1 ^{^^} | -76.3 | | | 0.001* | |
| Spontaneous subconjunctival hemorrhage | 82 | 50/50 | 65.2 ± 16.8 ^{^^} | 14 | 71.4/28.6 [^] | 67.7 ± 9.9 ^{^^} | -82.9 | | | 0.001* | |
| Chalazion | 61 | 39.3/60.7 [^] | 48.3 ± 21.8 ^{^^} | 23 | 52.2/47.8 | 49.1 ± 21.6 | -62.3 | | | 0.42 | |
| Eyelid/conjunctival/corneal wound | 61 | 53.6/46.4 | 51.2 ± 20.5 | 30 | 62/38 | 50.4 ± 16.6 | -50.8 | | | 0.75 | |
| AMD- or other causes-related active CNV | 47 | 28.9/71.1 [^] | 76.9 ± 14 ^{^^} | 29 | 22.2/77.8 ^{^^} | 76 ± 11.4 ^{^^} | -38.3 | | | 0.08 | |
| Herpes zoster ophthalmicus | 41 | 51.2/48.8 | 61.7 ± 19.5 ^{^^} | 26 | 38.5/61.5 | 63.7 ± 17.9 ^{^^} | -36.6 | | | 0.2 | |
| Keratitis/corneal ulcer | 37 | 64.9/35.1 [^] | 60.3 ± 19.9 ^{^^} | 26 | 69.2/30.8 [^] | 47.3 ± 22.1 ^{^^} | -29.7 | | | 0.1 | |
| Ocular hypertension/glaucoma | 36 | 40/60 | 77.1 ± 9.3 ^{^^} | 11 | 33.3/66.7 [^] | 72.3 ± 12.7 ^{^^} | -69.4 | | | 0.36 | |
| Refractive errors | 27 | 33.3/66.7 [^] | 39.7 ± 25.7 [^] | 5 | 80/20 ^{na} | 37.4 ± 19.9 ^{na} | -81.5 | | | 0.06 | |
| Retinal ruptures/degenerations | 25 | 56/44 | 63.6 ± 15 ^{^^} | 13 | 61.5/38.5 | 54.6 ± 12.4 | -48.0 | | | 0.71 | |
| Vitreous floaters | 24 | 58.3/41.7 | 55.7 ± 17 | 6 | 50/50 ^{na} | 48.5 ± 15 ^{na} | -75.0 | | | 0.18 | |
| Cataract/posterior capsule opacification | 23 | 46.7/53.3 | 67.7 ± 14.2 ^{^^} | 12 | 50/50 | 76.5 ± 12.8 ^{^^} | -47.8 | | | 0.73 | |
| Optic nerve/retinal vascular occlusion | 20 | 42.9/57.1 | 71.3 ± 12.7 ^{^^} | 14 | 80/20 [^] | 66.4 ± 9 ^{^^} | -30.0 | | | 0.48 | |
| Dry eye | 19 | 15.8/84.2 [^] | 70.3 ± 16.1 ^{^^} | 3 | 33.3/66.7 ^{na} | 56.7 ± 10.3 ^{na} | -84.2 | | | 0.09 | |
| Uveitis | 18 | 52.9/47.1 | 50.5 ± 19.3 | 12 | 50/50 | 48.7 ± 23.4 | -33.3 | | | 0.25 | |
| Retinal detachment | 18 | 86.7/13.3 [^] | 65.6 ± 12.7 ^{^^} | 14 | 58.3/41.7 | 59.9 ± 12.8 ^{^^} | -22.2 | | | 0.15 | |
| Neurological disorders | 17 | 52/48 | 32.2 ± 30 ^{^^} | 20 | 83.3/16.7 [^] | 50 ± 24.3 | 17.6 | | | 0.11 | |
| Trichiasis | 17 | 52.9/47.1 | 69.6 ± 20.3 ^{^^} | 8 | 50/50 | 70.5 ± 10.6 ^{^^} | -52.9 | | | 0.95 | |
| Post-operative complications | 15 | 20/80 [^] | 69.7 ± 15.3 ^{^^} | 1 | 0/100 ^{na} | 53 ^{na} | -93.3 | | | 0.06 | |
| Vitreous hemorrhage | 12 | 60/40 | 73.5 ± 19.8 ^{^^} | 8 | 25/75 [^] | 73 ± 14.1 ^{^^} | -33.3 | | | 0.82 | |

SD: standard deviation; CNV: choroidal neovascularization.
[^]Statistically significant effect of gender on the diagnose (Poisson regression for count).
^{^^}Statistically significant effect of age on the diagnose (Poisson regression for count).
[§]Poisson regression for count.
^{*}Statistically significant difference in the number of cases between study periods.
^{na}Not applicable for low number of cases.

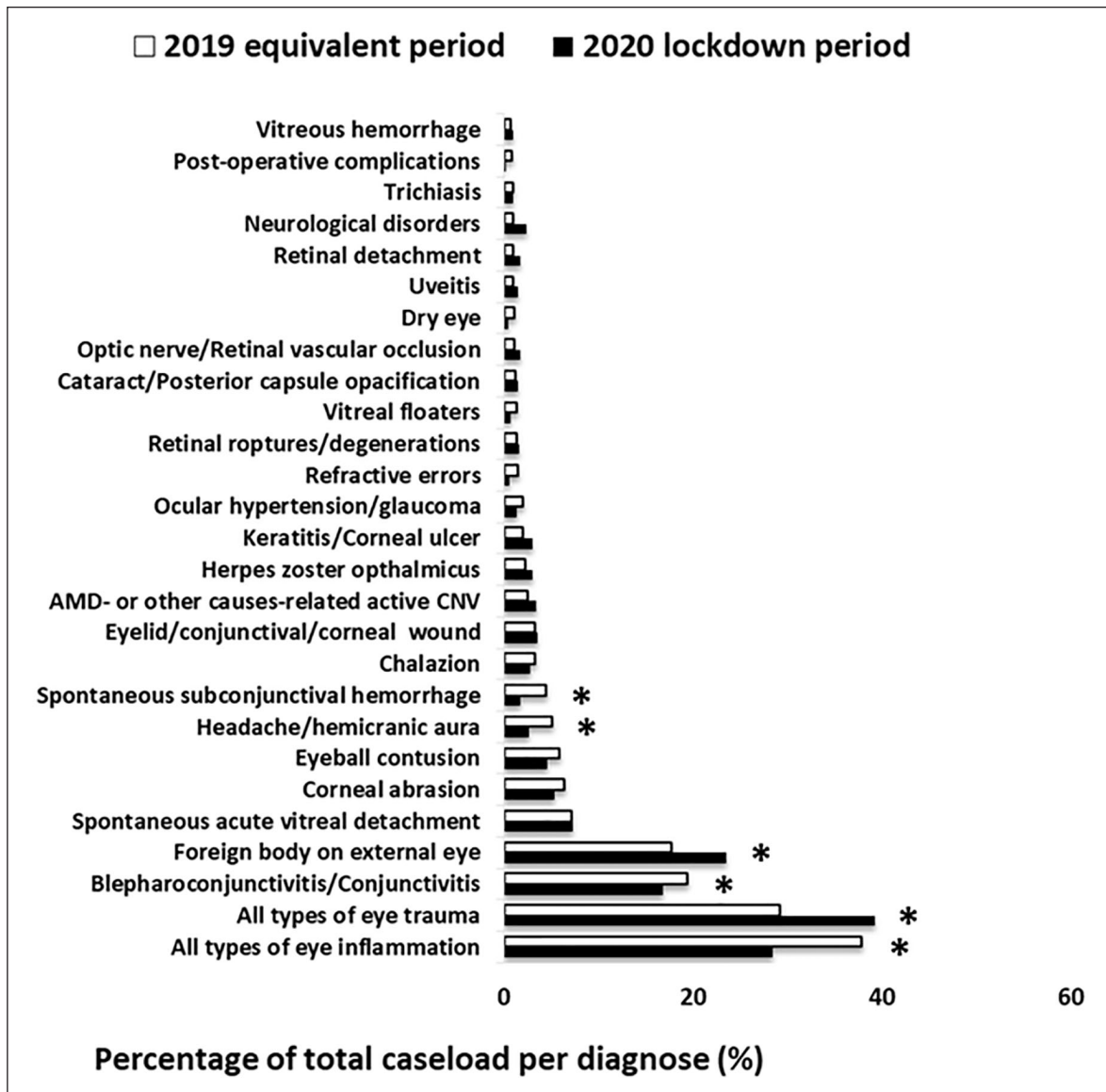


Figure 3. Bar chart of the most frequent diagnoses (as percentage of total caseload) of patients presenting to the Emergency Eye Department during the COVID-19 related pandemic lockdown in Italy (March 10–May 3, 2020), compared to the equivalent period in 2019.

*Statistically significant difference between groups.

the ophthalmological department in order to control the COVID-19 transmission during the Italian lockdown have been first extensively reported by Borrelli et al.²⁵

On March 18, 2020, the American Academy of Ophthalmology emanated an alert for ophthalmologists with guidelines, with recommendations to ophthalmologists to provide only urgent care in the presence of slit-lamp barriers and PPD for patients and physicians.²⁶

The social distancing measures and medical guidelines imposed during the lockdown, which have reduced the ability of the public care centers to deal with a large number of individuals, along with the patient fear of infection or difficulties to reach the hospitals, have resulted in

a dramatic reduction of all ophthalmic visits, including the emergency eye services. The balance between SARS-CoV-2 infection control and adequate ophthalmology service is critical, considering that some ocular pathologies such as glaucoma, wet age-related macular degeneration, and retinal detachment can cause irreversible loss of visual function if treatment is delayed.

The aim of the study was to evaluate the impact of COVID-19 related lockdown on emergency eye department accesses. Studies that assess the changing trends of ophthalmological patients presenting to an EED during the COVID-19 pandemic related lockdown in Italy are limiting and can be of clinical use in this new field of literature.

Table 2. Incidence of the top diagnoses presenting at Emergency eye Department shown as percentages of total caseload.

| Diagnoses | 2019 | 2020 | Chi ² test |
|--|------------------|-------|-----------------------|
| | % of total cases | | p Value |
| All types of eye inflammation | 37.86 | 28.44 | 0.018 |
| All types of eye trauma | 29.18 | 38.25 | 0.016 |
| Blepharoconjunctivitis/conjunctivitis | 19.42 | 16.8 | 0.032 |
| Foreign body on external eye | 17.64 | 23.5 | <0.0001 |
| Spontaneous acute vitreal detachment | 7.12 | 7.29 | 0.87 |
| Corneal abrasion | 6.31 | 5.29 | 0.34 |
| Eyeball contusion | 5.83 | 4.58 | 0.42 |
| Headache/hemicranic aura | 5.02 | 2.59 | 0.49 |
| Spontaneous subconjunctival hemorrhage | 4.42 | 1.65 | <0.0001 |
| Chalazion | 3.29 | 2.7 | 0.47 |
| Eyelid/conjunctival/corneal wound | 3.29 | 3.53 | 0.20 |
| AMD- or other causes-related active CNV | 2.54 | 3.41 | 0.08 |
| Herpes zoster ophthalmicus | 2.21 | 3.06 | 0.23 |
| Keratitis/corneal ulcer | 2.00 | 3.06 | 0.10 |
| Ocular hypertension/glaucoma | 1.94 | 1.29 | 0.40 |
| Refractive errors | 1.46 | 0.59 | 0.06 |
| Retinal ruptures/degenerations | 1.35 | 1.53 | 0.73 |
| Vitreous floaters | 1.29 | 0.71 | 0.23 |
| Cataract/posterior capsule opacification | 1.24 | 1.41 | 0.82 |
| Optic nerve/retinal vascular occlusion | 1.08 | 1.65 | 0.53 |
| Dry eye | 1.02 | 0.35 | 0.11 |
| Uveitis | 0.97 | 1.41 | 0.31 |
| Retinal detachment | 0.97 | 1.65 | 0.15 |
| Neurological disorders | 0.92 | 2.35 | 0.11 |
| Trichiasis | 0.92 | 0.94 | 1.00 |
| Post-operative complications | 0.81 | 0.12 | 0.18 |
| Vitreous hemorrhage | 0.65 | 0.94 | 0.10 |

CNV: choroidal neovascularization.

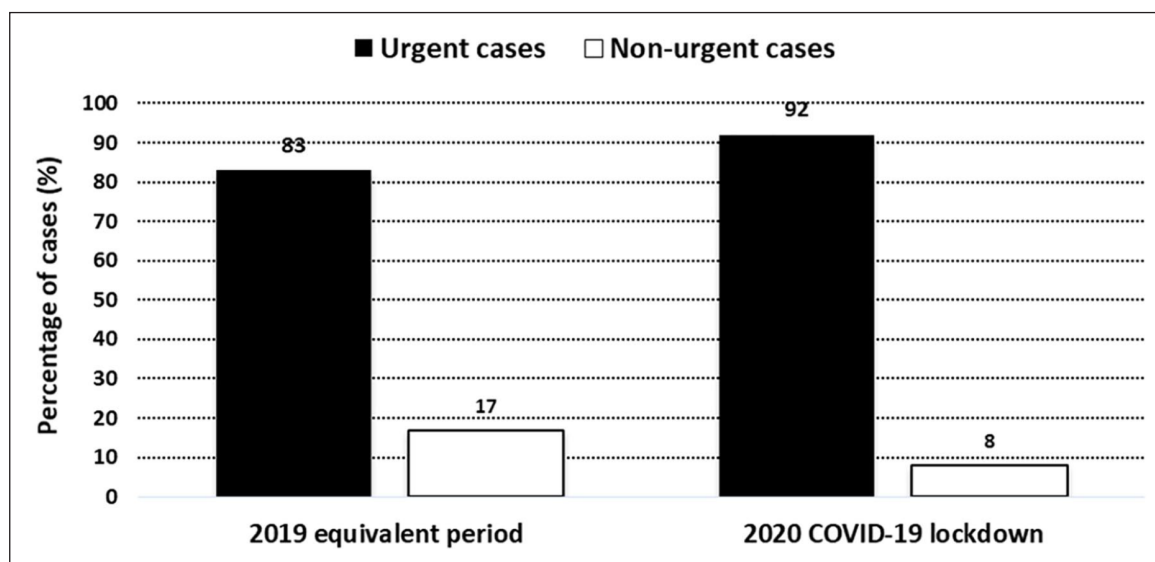


Figure 4. Bar chart of the percentages of patients presenting to the Emergency Eye Department during the COVID-19 related pandemic lockdown in Italy (March 10–May 3, 2020) and the equivalent period in 2019 classified as having urgent and non-urgent cases.

Table 3. Incidence of emergency interventions and hospitalizations of patients presenting at the Emergency Eye Department.

| Procedures | 2019 equivalent period (10th March 2019–3rd May 2019), (number of cases) | 2020 COVID-19 lockdown (10th March 2020–3rd May 2020), (number of cases) | ρ Value* |
|--|--|--|---------------|
| Laser barrage for peripheral retinal breaks | 25 | 13 | 0.71 |
| Panretinal photocoagulation for proliferative diabetic retinopathy | 4 | 1 | na |
| Laser iridotomy for acute angle closure attack or occludible angle | 6 | 1 | na |
| Intravitreal anti-VEGF injection for | | | |
| Neovascular glaucoma | 4 | 1 | na |
| Active choroidal neovascular membrane | 47 | 29 | 0.08 |
| Ischemic retinal vein occlusion | 13 | 8 | 0.69 |
| Diabetic macular edema | 9 | 2 | 0.22 |
| Hospitalization for ocular surgery in | | | |
| Retinal detachment | 18 | 14 | 0.15 |
| Corneo-scleral sutures for traumatic eye perforation | 1 | 3 | na |
| Amniotic membrane application for corneal ulcer | 2 | 1 | na |
| Total number of cases | 129 | 73 | 0.71 |

VEGF: vascular endothelial growth factor; na: not applicable for low number of cases.

*Poisson regression for count.

Moreover, due to the large number of cases included, the cohort of patients relative to the 2019 study period can be considered as representative of the typical clinical practice of an emergency eye department in our region.

Our study included 851 patients presenting to the EED during the 55 days of the phase 1 pandemic lockdown in 2020 in Italy, and 1854 subjects that were examined during the equivalent period of the 2019. A statistically significant reduction of patients presenting at our EEDs (-54.1%) was noted during the 2020 lockdown as compared to the corresponding period of the previous year. The reasons for the overall decrease in attendance at the EEDs, as reported by other Italian emergency departments,²⁷ may be multifactorial, including: logistic and financial issues directly related to the lockdown; reduction of public transports; decrease of work accidents related to the halt of non-essential activities; closure of most territorial ophthalmologist practices and re-organization of most hospital to treat COVID-19 patients. Moreover, considering that risk perception can influence behaviors,^{28,29} fear of contracting the infection in the hospital structures or during travel, and governments advices on shielding, could have lead patients to neglect or underestimate the risk related to less debilitating symptoms (flashes, floaters, or metamorphopsia) as compared with fever or dyspnea COVID-19 related. This may have led some patients to turn to the territorial healthcare system or to avoid accessing to treatments. Our data are in agreement with those reported by several previous authors: Poyser et al.³⁰ noted a 53% reduction in EED attendance during the lockdown in UK; Wickham et al.³¹ reported a reduction of the activity of the acute ophthalmology services of the Moorfields Eye Hospital in London during the lockdown period of $>50\%$; Babu et al.³² registered a decrease of 96.5% of outpatient visits in a tertiary-care

ophthalmology institute during the 2020 lockdown in India (between March 25 and May 3, 2020); Legrattaglio et al.³³ observed an overall 76.4% decrease of the activity of the General Ophthalmological Service during the 2020 Italian lockdown. Comparing the activity during the first 2020 lockdown in Italy with that of the equivalent period of 2019, Pellegrini et al.³⁴ reported an overall reduction of 73.3% of the total number of ophthalmological emergency department visits; Borrelli et al.³⁵ observed an overall decrease of 75.2% of the outpatients visits at the medical retina referral center and a reduction of 53.6% of the total intravitreal injections. Moreover, Toro et al.³⁶ reported a dramatic contraction of all ophthalmological surgical procedures during the COVID-19 pandemic lockdown in Italy and in several other European countries, with a mean reduction of cataract phacoemulsification, keratoplasty, glaucoma surgery, pars plana vitrectomy, and intravitreal injection procedures of 97%, 95%, 91%, 76%, and 72%, respectively.

In accordance with several previous authors,^{32,34} our results show a higher male-gender bias among patients presenting during the lockdown compared to the corresponding period of the previous year, which could be due to higher probability of females remaining at home with children and parents during the lockdown. Moreover, the majority of foreign bodies in the eye due to work related incidents, which represents a large portion of patients admitted to EEDs, tend to be male, considering that manual labor jobs are typically still male dominated positions in Italy.

Although the elderly are considered at higher risk of developing serious clinical forms of COVID-19 infection, and were therefore suggested to stay at home as much as possible during the lockdown, our data show unexpected

comparable mean patient age between the two study periods, with most frequent cases ranging between 40 and 80 years. In disagreement with our results, several previous authors showed a significant higher percentage of young patients during the 2020 lockdown as compared with the same period of the 2019.^{32,34}

The most frequent pathologies found in our EEDs during both study periods were inflammations, especially conjunctivitis and blepharo-conjunctivitis, trauma-related, in particular foreign bodies of the external eye, corneal abrasions and eyeball contusions, and spontaneous acute vitreous detachment. These data suggest that the COVID-19 pandemic related lockdown did not show a significant impact on the range of the pathologies presenting at the emergency eye department. Moreover, in both study periods, male gender and younger age were risk factors for trauma-related diagnoses, whereas female gender and older age appeared significantly associated with spontaneous acute vitreous detachment and active choroidal neovascularization in age-related macular degeneration.

In comparison with the corresponding 2019 period, reductions in the total number of cases for all diagnostic categories (excepted for the neurological disorders) were noticed during the 2020 COVID-19 related lockdown period, which appeared statistically significant for inflammations, trauma-related diagnoses, headache/hemicrania, and spontaneous subconjunctival hemorrhage. In particular, ocular inflammations and trauma-related diagnoses showed an overall reduction during the lockdown of –65.5% and –38.3%, respectively.

The decrease of the total number of ocular flogosis, especially the less severe ones such as the blepharoconjunctivitis, could suggest a tendency, in time of pandemic, to a self-medication or consultation-call with the personal physician or ophthalmologist to avoid access to hospital.

The significant decrease of the trauma-related diagnoses can be attributed to the reduction of movements with own vehicles, outdoor sports activities, and the stop of non-essential commercial and productive activities, which are the main risk factors for traumatic events.^{37,38} In agreement with our results, Pellegrini et al. reported a 68.4% reduction in ocular trauma during the COVID-19 pandemic in Italy,³⁸ whereas Poyser et al.³⁰ found a 53.1% drop in cases of ocular trauma during the lockdown in United Kingdom. Male gender and youth represented the main risk factor for eye injury during both study periods: the percentage of male gender and mean age in ocular trauma were respectively 74% and 45.1 ± 23 years during the 2020 lockdown, and 67.7% and 45.5 ± 21 years in 2019, with comparable mean age but significantly higher proportion of males during the lockdown period.

Although a reduction in the number of cases of almost all diagnostic categories was registered, a significantly lower proportion of cases presenting eye inflammations, spontaneous subconjunctival hemorrhage and headache/hemicrania,

and a significantly higher proportion of patients with trauma-related diagnoses, were found during the lockdown in comparison to the 2019 equivalent period.

In accordance with previous authors,³⁴ our data showed a significant lower proportion of conjunctivitis and blepharoconjunctivitis during the lockdown, suggesting that the measures applied to stop the spread of COVID-19 pandemic could have a role in reducing the spread of infective conjunctivitis. In disagreement with our results, other authors³⁹ found a high proportion of conjunctivitis during the lockdown, and attributed this observation to the use of alcohol-based sanitizers during the pandemic or to the fact that a conjunctivitis has been described as the first feature of COVID-19.^{22,23} This could also be due to increased dry eye syndrome and inflammation due to excessive or incorrect use of facial masks in 2020.

As expected, a statistically significant reduction of improper access to the EED was noticed during the lockdown, with the percentage of patients classified as having non-urgent cases decreasing from 17% in the 2019 period to 8% during the 2020 lockdown. The percentage of non-urgent visits performed in our EEDs in both study periods was significantly lower than that reported by other authors, suggesting an appropriate use of the EED and an efficient activity of general medicine and ophthalmology in our region. In disagreement with these data, a previous study describing the activity in the EEDs in the United States based on nationwide data showed that only 41.2% of the visits were truly urgent in 2018.⁴⁰ Furthermore, a nationwide survey conducted in Taiwan regarding the use of emergency ophthalmology services between 2008 and 2012 reported a percentage of urgent visits of 48.2%.⁴¹ Considering the situation during the pandemic in Italy, Babu et al.³² and Pellegrini et al.³⁴ and reported that respectively 60% and 57.3% of cases presenting during the lockdown were unlikely to be emergency cases.

Our study shows that the proportion of most serious pathologies, that is those trauma-related, was significantly higher during the lockdown, increasing from 29.2% in 2019 to 38.2% in 2020. In accordance with our results, other authors reported a prevalence of trauma-related pathologies during the 2020 lockdown in the UK.³⁰

Mostly important, patients having sight-threatening conditions, such as retinal detachment and ruptures, uveitis, keratitis or corneal ulcers, vascular occlusions, active CNV, slightly decreased (but not significantly) in number and increased in proportion of the total caseload during the 2020 lockdown; moreover, the percentage of the total caseload requiring an emergency surgical or laser intervention after a EED visit slightly but not significantly increased from 7% in 2019 to 8.6% in 2020. These results suggest a correct use of the EED during pandemic in our region and seem to exclude the feared delayed presentation in these cases; a delay that may have implications on the long-term health of our population.

In disagreement with our observations, previous authors reported that the number of patients presenting with retinal detachment and retinal ruptures fell significantly during the lockdown period^{30,31,34} Wickham et al.³¹ reported that the number of patients presenting with retinal detachment at the Moorfields Eye Hospital in London fell an average of 62% during the lockdown when compared with the same period of 2019. Poyser et al.⁴² reported a 60% reduction in the number of retinal tears and a 65.7% reduction in number of retinal detachments during the lockdown period in UK as compared with the equivalent period of 2019. Moreover, Wickham et al.³¹ and Schimansky et al.⁴³ showed a noticeable decline in wet AMD with active choroidal neovascularization referrals during the COVID-19 related lockdown as compared with the previous year in UK. On the contrary, our data fortunately suggest an almost stable presentation rate of patients having sight-threatening conditions during the lockdown, indicating that our population seems to be able to recognize symptoms that could potentially lead to sight loss.

During the 2020 lockdown, we reported a non-significantly reduction in number of urgent surgical e laser treatments following an eye emergency access, with a slightly but not significantly increase of percentage of the total caseload requiring an emergency surgical or laser intervention after a EED visit (from 7% in 2019 to 8.6% in 2020). These data can be explained by the overall reduction of the number of accesses to the EED and, in some cases, such as for anti-VEGF intravitreal injections for active CNV, which preferably did not show delay in treatments. These data are in agreement with those reported by previous authors. A multicenter study conducted in Italy reported an overall reduction of 76.7% of the eye surgical procedures, included the urgent ones, performed during the lockdown as compared with the equivalent 2019 period.⁴⁴ Pellegrini et al.³⁴ reported that the number of patients requiring hospital admission after a EED visit decreased significantly in the 2020 lockdown period.

In this time of pandemic, when social distancing norms need to be followed and hospitals functioning must be changed in order to make sure that patients with high-risk diseases may receive immediate in-person attention, some ophthalmologists have suggest to focus on quickly identifying patients of low risk and encourage them to be visited with the help of video consultations, that allows for the anamnesis and a superficial examination of the ocular adnexa and anterior segment.^{45,46} The virtual-consultations are limited by the inability to perform visual acuity, detailed ocular examination, fundus examination, and other investigations; moreover concerns regarding medical and methodological repercussion in cases of diagnostic errors in the absence of a traditional exam have to be properly addressed. For these reasons, and considering that less than 20% of patients referring to our EEDs were

classified as non-urgent cases in previous years, we did not provided video-consultations in our EEDs during the 2020 lockdown. Considering, however, that the COVID-19 pandemic will probably change the way we practice medicine, we are planning to provide alternative distant evaluations of patients in the near future and to assess the efficacy of these modern alternative methods in the management of patients with various ophthalmic diseases.

Our study has several limitations. Firstly, it is a retrospective study with all the limitations related to such a study design. Although being a multi-center study, it is possible that our data do not reflect the overall nation emergency eye department situation during the lockdown period. Moreover, the conclusions of our study are not applicable to other countries in the world, in which restrictions imposed during the lockdown period may have been somewhat different. In addition, the design of our study is not original considering that similar studies in this field have already been reported in literature.^{30,34}

In conclusion, we observed a significant reduction of accesses to the eye emergency department during the 2020 lockdown, especially due to non-urgent pathologies. Diagnoses associated with potentially visual function threatening conditions at high risk of permanent vision loss if treatments are delayed, such as trauma-related pathologies, retinal detachment or ruptures, wet AMD, showed a lower number of cases but higher proportion relative to the total caseload during the 2020 lockdown, thus suggesting a correct and efficient access to emergency ophthalmic health care during the pandemic. Resources that promote the use of territorial healthcare system, educational programs for patients to recognize potentially sight-threatening sign and symptoms, and video-consulting could be beneficial in the future to improve the quality of treatment and the efficiency of public health care for patients, especially during times of need.

Acknowledgements

We would like to thank Leonardo Macor and Simonetta Del Bianco from the GESPEC Department at the University Hospital in Udine for the assistance with the diagnosis grouping and data retrieval system developed for the Udine data collection.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Supplemental material

Supplemental material for this article is available online.

References

- COVID-19. World Health Organization Coronavirus disease (COVID-19) dashboard, <https://www.ecdc.europa.eu/en/novel-coronavirus-china> (2020, accessed 22 December 2020).
- Xia J, Tong J, Liu M, et al. Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection. *J Med Virol* 2020; 92: 589–594.
- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395: 497–506.
- Wang C, Horby PW, Hayden FG, et al. A novel coronavirus outbreak of global health concern. *Lancet* 2020; 395: 470–473.
- Wu Z and McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China. *JAMA* 2020; 323: 1239–1242.
- World Health Organization. Coronavirus disease (COVID-19) pandemic, <https://who.int/emergencies/diseases/novel-coronavirus-2019/> (2020, accessed 22 December 2020).
- Team TNCPERE. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) –China, 2020. *China CDC Wkly* 2020; 2: 113–122.
- Characteristics of SARS-CoV-2 patients dying in Italy report based on available data on April 20th, 2020, produced by SARS-CoV-2 Surveillance Group by the college of health, https://www.epicentro.iss.it/en/coronavirus/bollettino/Report-COVID-2019_20_april_2020.pdf (accessed 22 December 2020).
- Shetty R, Ghosh A, Honavar SG, et al. Therapeutic opportunities to manage COVID-19/SARS-CoV-2 infection: present and future. *Indian J Ophthalmol* 2020; 68: 693–702.
- Ministero della Salute, <http://www.salute.gov.it/portale/home.html> (2021, accessed 4 January 2021).
- Gazzetta Ufficiale. Government of Italy decree of the President of the Council of ministers 9 March 2020. <https://www.gazzettaufficiale.it/eli/id/2020/03/09/20A01558/sg> (accessed 4 December 2020).
- De Filippo O, D’Ascenzo F, Angelini F, et al. Reduced rate of hospital admissions for ACS during covid-19 outbreak in northern Italy. *N Engl J Med* 2020; 383: 88–89.
- Chang HJ, Huang N, Lee CH, et al. The impact of the SARS epidemic on the utilization of medical services: SARS and fear of SARS. *Am J Public Health* 2004; 94: 562–564.
- Manuale RAO Agenas - Mega Ellas “aggiornamento Tabelle RAO AGENAS, Roma, Maggio 2019” <http://www.megaellas.it/wp-content/uploads/2019/12/MANUALE-RAO-AGENAS.pdf> (accessed 4 December 2020).
- Lai THT, Tang EWH, Chau SKY, et al. Stepping up infection control measures in ophthalmology during the novel coronavirus outbreak: an experience from Hong Kong. *Graefes Arch Clin Exp Ophthalmol* 2020; 258: 1049–1055.
- Wan KH, Huang SS, Young A, et al. Precautionary measures need for ophthalmologists during pandemic of the coronavirus disease 2019 (COVID-19). *Acta Ophthalmol* 2020; 98: 221–222.
- Romano MR, Montericcio A, Montalbano C, et al. Facing COVID-19 in ophthalmology department. *Curr Eye Res* 2020; 45: 653–658.
- Loon SC, Teoh SC, Oon LL, et al. The severe acute respiratory syndrome coronavirus in tears. *Br J Ophthalmol* 2004; 88: 861–863.
- Lu CW, Liu XF and Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet* 2020; 395: e39.
- Zhou Y, Zeng Y, Tong Y, et al. Ophthalmologic evidence against the interpersonal transmission of 2019 novel coronavirus through conjunctiva. *MedRxiv* 2020.
- Coronavirus kills Chinese whistle blower ophthalmologist. American Academy of Ophthalmology, <https://www.aao.org/headline/coronavirus-kills-chinese-whistleblower-ophthalmol> (accessed 4 December 2020).
- Yu AY, Tu R, Shao X, et al. A comprehensive Chinese experience against SARS-CoV-2 in ophthalmology. *Eye Vis (Lond)* 2020; 7: 19.
- Kumar K, Prakash AA, Gangasagara SB, et al. Presence of viral RNA of SARS-CoV-2 in conjunctival swab specimens of COVID-19 patients. *Indian J Ophthalmol* 2020; 68: 1015–1017.
- Società Oftalmologica Italiana, <https://www.sedesoi.com/> (accessed 4 December 2020).
- Borrelli E, Sacconi R, Querques L, et al. Taking the right measures to control COVID-19 in ophthalmology: the experience of a tertiary eye care referral center in Italy. *Eye (Lond)* 2020; 34: 1175–1176.
- Alert: Important coronavirus context for ophthalmologists. American Academy of Ophthalmology, <https://www.aao.org/headline/alert-important-coronavirus-context> (2020, accessed 18 February 2020).
- Vanni G, Legramante JM, Pellicciaro M, et al. Effect of lockdown in surgical emergency accesses: experience of COVID-19 hospital. *In Vivo* 2020; 34: 3033–3038.
- Betsch C, Wieler LH and Habersaat K; COSMO Group. Monitoring behavioural insights related to COVID-19. *Lancet* 2020; 395: 1255–1256.
- Lazzerini M, Barbi E, Apicella A, et al. Delayed access or provision of care in Italy resulting from fear of COVID-2019. *Lancet Child Adolesc Health* 2020; 4: e10–e11.
- Poyser A, Deol SS, Osman L, et al. Impact of COVID-19 pandemic and lockdown on eye emergencies. *Eur J Ophthalmol* 2020; 19: 1–7.
- Wickham L, Hay G, Hamilton R, et al. The impact of COVID policies on acute ophthalmology services—experiences from Moorfields Eye Hospital NSH Foundation Trust. *Eye* 2020; 34: 1189–1192.
- Babu N, Kohli P, Mishra C, et al. To evaluate the effect of COVID-19 pandemic and national lockdown on patient care at a tertiary-care ophthalmology institute. *Indian J Ophthalmol* 2020; 68: 1540–1544.
- Legrottagnie EF, Balia L, Camesasca FI, et al. Management of an ophthalmology department during COVID-19 pandemic in Milan, Italy. *Eur J Ophthalmol*. Epub ahead of print 22 September 2020. DOI: 10.1177/1120672120960334.
- Pellegrini M, Roda M, Lupardi E, et al. The impact of COVID-19 pandemic on ophthalmological emergency department visits. *Acta Ophthalmol* 2020; 98: e1058–e1059.
- Borrelli E, Grosso D, Vella G, et al. Impact of COVID-19 on outpatient visits and intravitreal treatments in a referral

- retina unit: let's be ready for a plausible "rebound effect". *Graefes Arch Clin Exp Ophthalmol* 2020; 258: 2655–2660.
36. Toro MD, Brézin AP, Burdon M, et al. Early impact of COVID-19 outbreak on eye care: insights from EUROCOVCAT group. *Eur J Ophthalmol* 2021; 31: 5–9.
 37. Cassidy DJ, Carroll LJ, Peloso PM, et al.; WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. Incidence, risk factors and prevention of mild traumatic brain injury: results of the WHO Collaborating Center Task Force on Mild Traumatic Brain Injury. *J Rehabil Med* 2004; 43: 28–60.
 38. Pellegrini M, Roda M, Di Geromino N, et al. Changing trends of ocular trauma in the time of COVID-19 pandemic. *Eye (Lond)* 2020; 34: 1248–1250.
 39. Shetty R, Jayadev C, Chabra A, et al. Sanitizer aerosol-driven ocular surface disease (SADOSD)- A COVID-19 repercussion? *Indian J Ophthalmol* 2020; 68: 981–983.
 40. Wang SY, Hamid MS, Musch DC, et al. Utilization of ophthalmologist consultation for emergency care at a University Hospital. *JAMA Ophthalmol* 2018; 136: 428–431.
 41. Hsu MU, Hsu CA, Hsiao SH, et al. Utilization of emergency ophthalmology services in Taiwan: a nationwide population study. *Sci Rep* 2020; 10: 17703.
 42. Poyser A, Deol SS, Osman L, et al. Impact of COVID-19 pandemic and lockdown on retinal detachment. *Eye*. Epub ahead of print 18 August 2020. DOI: 10.1038/s41433-020-01137-x.
 43. Schimansky S, Javed U and Mohamed Q. Comment on: "The impact of COVID policies on acute ophthalmology services—experiences from Moorfields Eye Hospital NHS Foundation Trust". *Eye*. Epub ahead of print 21 August 2020. DOI: 10.1038/s41433-020-01142-0.
 44. dell'Olmo R, Filippelli M, Semeraro F, et al. Effects of the first month of lockdown for COVID-19 in Italy: a preliminary analysis on the eye care system from six centers. *Eur J Ophthalmol*. Epub ahead of print 24 August 2020. DOI: 10.1177/1120672120953074.
 45. Kang S, Thomas PBM, Sim DA, et al. Oculoplastic visio-based telemedicine consultations. Covid-19 and beyond. *Eye (lond)* 2020; 34: 1193–1195.
 46. Williams AM, Kalra G, Commiskey PW, et al. Ophthalmology practice during the Coronavirus disease 2019 pandemic. The University of Pittsburg experience in promoting clinic safety and embracing video visits. *Ophthalmol Ther* 2020; 9: 1–9.