COVID-19 impact in a public ophthalmology service – Report 1

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ABSTRACT: The COVID-19 pandemic forced a concerted response from health services to lead to a reduction in care activity. It is a strategy to respond to this health problem centered on clinical provision and, simultaneously, on the protection of the community and health professionals. However, the direct and indirect impact on eye care is still unclear. **Objective:** To characterize the impact of COVID-19 in the complementary means of diagnosis and treatment (MCDT) at the ophthalmology service of a monovalent hospital. **Methods:** Cross-sectional study to quantify MCDT production before and after the reorganization of the services by COVID-19. Through the consultation of the informatics records of the Dr. Gama Pinto Institute of Ophthalmology (IOGP), the different MCDTs carried out in support of the care practice in the same period of 30 days (March 11 to April 11) of 2019 were compared to 2020. **Results:** In the study period, there was a marked decrease with mean values of 93.5% (general consultations of Ophthalmology and Pediatric Ophthalmology) and about 76.8% (Retinal Vitreous Consultations, Ocular Diabetes, Genetics, and Visual Impairment and Rehabilitation). **Discussion/Conclusion:** The sharp drop in clinical production due to the COVID-19 pandemic will require a reorganization of health services in order to respond to postponed clinical situations and, simultaneously, to respond to COVID-19 ophthalmological sequelae that are unknown as retinal toxicity due to the use of chloroquine and/or hydroxychloroquine.

Keywords: COVID-19; Ophthalmology service; Visual health

O impacto do COVID-19 num serviço público de oftalmologia – Relatório 1

RESUMO: A pandemia do COVID-19 obrigou a uma resposta concertada dos serviços de saúde, levando a uma redução de atividade assistencial. É uma estratégia de resposta a este problema de saúde centrada na prestação clínica e, simultaneamente, na proteção da comunidade e profissionais de saúde. No entanto, o impacto direto e indireto na saúde ocular ainda não é claro. **Objetivo**: Caracterizar o impacto do COVID-19 nos meios complementares de diagnóstico e tratamento (MCDT) do serviço de oftalmologia de um hospital monovalente. **Métodos:** Estudo transversal para a quantificação da produção de MCDT antes e pós a reorganização dos serviços pelo COVID-19. Através da consulta dos registos informáticos do Instituto de Oftalmologia Dr. Gama Pinto (IOGP) foi feito o registo dos diferentes MCDT realizados em apoio à prática assistencial em período homólogo de 30 dias (11 de março a 11 de abril) de 2019 comparativamente a 2020. **Resultados:** Durante o período estudado observou-se uma diminuição acentuada com valores médios a oscilar entre os 93,5% (consultas geral de oftalmologia e oftalmologia pediátrica) e os cerca de 76,8% (consultas de retina-vítreo, diabetes ocular, genética e deficiência visual e reabilitação). **Discussão/Conclusão:** A queda abrupta da produção clínica devido à pandemia do COVID-19 vai obrigar a uma reorganização dos serviços de saúde de forma a responder às situações clínicas adiadas e, simultaneamente, a responder a sequelas oftalmológicas do COVID-19 que estão por conhecer, como a toxidade retiniana pelo uso de cloroquina e/ou hidroxicloroquina.

Palavras chave: COVID-19; Serviço de oftalmologia; Saúde visual

Introduction

At the end of 2019, a new coronavirus (COVID-19) was reported in Wuhan, a city in China[1] characterized by the existence of 'living markets'. It was the emerging of an epidemic that quickly crossed borders and February 21th 2020, less than a month before the World Health Organization (WHO) declared an international public health emergency, it had already been reported in about 27 countries[2].

With Europe as the epicenter of the pandemic, Portugal, which according to the General Directorate of Health (GDH) has about 18,091 confirmed cases on the 40th day (1,700 cases/million inhabitants), opted early for a set of measures of social distance[3] and closure of schools[4] and other public spaces legitimized by the state of emergency enacted on March 18th[5].

The current pandemic has forced a concerted response by health services leading to a reduction or even a close down in assistance activity[6]. It is a strategy to respond to this health problem in order to focus on clinical provision and simultaneously a way to protect the community and health professionals at a time marked by unpredictability[7].

It is known that COVID-19, a potentially lethal disease, affects the lungs and respiratory tract causing severe watery respiratory syndrome (SARS)[8]. However, due to the fragility of knowledge and therapeutic limitations, it is essential to promote knowledge regarding potential protection health strategies and disease prevention. In this sense, it is important to remember that one of the first warnings for this disease was made by an ophthalmologist from Wuhan, where during the clinical activity he was infected with COVID-19 and died[9].

This and other facts end up raising doubts about the importance of the ocular surface in the transmission and/or contagion in COVID-19. In previous situations by other CoVs, ocular impairment had already been reported[2]. But due to the complications, lethality, and high dissemination capacity of this new COVID, the attention to contact with the ocular surface as a potential gateway and/or contagion gains special relevance.

With a direct and indirect impact on eye health (disease sequelae and therapeutic options) to be known, through close contact with a health care professional (conjunctiva, lacrimal and respiratory secretions)[8] and by the large influx of patients seen in daily clinical practice. This work intends to characterize the impact of COVID-19 in the MCDT of ophthalmology service.

Methods

Based on the consultation of the informatics records of the Institute of Ophthalmology Dr. Gama Pinto (IOGP), a cross-sectional study was carried out to quantify the production impact in the different complementary means of diagnosis (MCDT) among the different ophthalmology sub-specialties before and after COVID-19. The information record will initially be grouped into three areas: **general consultation of ophthalmology and pediatric ophthalmology** (autorefractometer, air-puff tonometry (APT), frontofocometer, coordimetry, binocular vision (BV) assessment, oculomotor motility BV assessment without synoptophore, visual acuity (VA) children technical Dif., AV special techniques); **consultations glaucoma, ocular surface, cornea and contactology** [standard automated perimetry (SAP), kinetic perimetry, ocular response analyzer (ORA), chromatic vision, laser biometry, contact biometry, specular microscopy, pachymetry, keratic topography, optical coherence tomography (OCT) anterior segment (AS), anterior segment photography, contact lenses]; and **retina-vitreous consultations, ocular diabetes, genetics and visual impairment and rehabilitation** (technical training aids, ETDRS vision charts, OCT, OCTA, polychromatic retinography, fluorescein angiography, ERG full field, VEP pattern).

In order to assess the impact on the MCDT before the post-COVID-19, the data studied and compared refer to a homologous period of 30 days starting on March 11th (date of entry of internal regulations) until April 11th.

The study protocol was presented and approved by the IOGP ethics committee and all procedures follow the Helsinki principles.

Initially, the data analysis and treatment will be structured according to the groups mentioned above, where the use of descriptive statistics will be used to analyze the variability and the presence of missing values in the database. The exploratory and inferential data analysis will be carried out in order to present the absolute frequency in the MCDT in the two periods under study making the difference obtained (2019 vs. 2020). The Wilcoxon non-parametric test will be used to study the paired data (after checking the applicability assumptions).

Statistical analysis will be done using the IBM Statistical Package for the Social Sciences for Windows software (SPSS Statistics), v. 22 for a 95% CI.

Results

For the studied period, data were obtained regarding more than 2,500 consultations carried out during the period of 2019 (March 11th to April 11th) compared to the current period of 2020 (March 11th to April 11th).

In relation to Table 1, all MCDTs associated with the different consultations had a statistically significant drop. The autorefractometer, air-puff tonometry, and frontofocometer exams stand out, reflect the unequivocal decrease (p<0.001) in general ophthalmology consultations with around 85.8%, 99.5%, and 86%, respectively.

In relation to the pediatric ophthalmology/strabismus consultation, a similar behavior was observed with a significant MCDT decrease where the assessment of binocular vision without synoptophore (98.8%), visual acuity of children with different techniques (90.2%) and VA with special techniques (95.6%) illustrate the impact that occurred in these consultations.

Table 1. Absolute frequency and the percentage variation of MCDT related to the general consultation of ophthalmology and pediatric ophthalmology in the studied period (base line)

	2019 (*n*)	2020 (*n*)	2019-2020 (%)	Valor *p**
Autorefractometer	2,316	328	85.8	**<0.001**
Air-puff tonometry	2071	11	99.5	**<0.001**
Frontofocometer	322	45	86.0	**<0.001**
Coordimetry	13	1	92.3	**0.001**
BV oculomotor motility	4	1	100.0	0.046
BV without synoptophore	242	3	98.8	**<0.001**
VA differentiated techniques	102	10	90.2	**<0.001**
VA special techniques	136	6	95.6	**<0.001**

Legends: *n* = Values expressed in absolute numbers; % = percentage difference registered in the same period under study; BV = Binocular vision; VA = Visual acuity. * Wilcoxon non-parametric test for paired samples.

Table 2. Absolute frequency and the percentage variation of the MCDT associated with glaucoma, ocular surface, cornea, and contact lenses consultations in the studied period (baseline)

	2019 (*n*)	2020 (*n*)	2019-2020 (%)	Valor *p**
Standard automated perimetry (SAP)	293	31	89.4	**<0.001**
Kinetic perimetry	21	3	85.7	**<0.001**
ORA	4	1	75.0	0.083
Chromatic vision	11	2	81.8	**0.003**
Biometry (LASER)	323	36	88.9	**<0.001**
Contact biometry	50	0	100.0	**<0.001**
Specular microscopy	472	44	90.7	**<0.001**
Pachymetry	497	47	90.5	**<0.001**
Keratic topography	33	6	81.8	**<0.001**
OCT AS	9	0	100.0	**0.003**
Anterior segment photography	2	2	0.0	1
Contact lenses	27	3	88.9	**<0.001**

Legends**:** *n* = Values expressed in absolute numbers; % = percentage difference registered in the same period under study; ORA = Ocular response analizer; OCT = Optical coherence tomography; AS= Anterior segment. * Wilcoxon non-parametric test for paired samples.

In Table 2, with regard to glaucoma, ocular surface, cornea, and contact lens consultations, there was also a decrease in the majority of MCDT. The performance of SAP (associated with glaucoma consultation) showed a drop of 89.4% compared to 2019 (p<0.001). Other areas particularly affected (p<0.001) were MCDT procedures associated with cataract surgery such as LASER biometry (88.9%), contact biometry (100%), specular microscopy (90.7%), and keratic topography (81.8%).

Regarding the retina-vitreous and ocular diabetes consultations (Table 3), there was also a marked decrease (p<0.001) in the associated MCDT, such as visual acuity by ETDRS chart (87.8%), OCT (86.3%) and OCTA (92%).

Table 3. Absolute frequency and the percentage variation of MCDT associated with retina-vitreous consultations, ocular diabetes, genetics, and visual impairment and rehabilitation in the studied period (baseline)

	2019 (*n*)	2020 (*n*)	2019-2020 (%)	Valor *p**
Technical training aids	37	4	89.2	**<0.001**
ETDRS	930	113	87.8	**<0.001**
OCT	1,111	152	86.3	**<0.001**
OCTA	50	4	92.0	**<0.001**
Polychromatic retinography	42	17	59.5	**<0.001**
Fluorescein angiography	24	0	100.0	**<0.001**
ERG full field	2	2	0.0	1
VEP pattern	2	0	100.0	**<0.001**
Mean value			76.8	

Legends: *n* = Values expressed in absolute numbers; % = percentage difference registered in the same period under study; ETDRS = Visual acuity scale in the Early Treatment Diabetic Retinopathy Study scale; OCT = Optical coherence tomography; OCTA = Optical coherence tomography angiography; ERG = Electroretinogram; VEP = Visual evoked potentials. * Wilcoxon non-parametric test for paired samples.

The following table shows the absolute and accumulated values of the eight most representative MCDT in the COVID-19 period at IOGP. It is possible to observe that eight MCDT brings together 91.3% of all activity during this period. The MCDT with the highest relative frequency in the study period was the autorefractometer (37.6%), OCT (17.4%), ETDRS (12.9%). It is important to highlight that the MCDT associated with glaucoma represents 3.5% and the MCDT associated with cataract surgery (LASER biometry, specular microscopy, and pachymetry) represented a total of 14.4% of activity.

Table 4. Absolute and accumulated frequency of the Top 8 MCDT performed in the COVID-19 period (2020)

Exams	Exams (*n*)	Cumulative exams (*n*)	Exams proportion (%)	Cumulative Exams proportion (%)
Autorefractometer	328	328	37.6	37.6
Frontofocometer	45	373	5.1	42.8
SAP	31	404	3.5	46.3
ETDRS	113	517	12.9	59.3
OCT	152	669	17.4	76.8
LASER biometry	36	705	4.1	80.9
Specular microscopy	44	749	5.0	85.9
Pachymetry	47	796	5.3	91.3
Others	75	871	8.6	100
Total	871	871	100	10

Legend**s:** *n* = Values expressed in absolute and accumulated values; % = proportion of examinations performed in an absolute and accumulated manner; PEC = Computerized static perimetry; ETDRS = Visual acuity scale in the Early Treatment Diabetic Retinopathy Study scale; OCT = Optical coherence tomography; Others = all other MCDT referred to in the previous tables.

Discussion

In human history, we find several cases in which human health, society, and health policies are challenged by new viruses. This work, still with preliminary data, illustrates the impact that the internal and external measures had on the MCDT of the ophthalmology service of the IOGP. In view of this pandemic, measures are essential in order to **1) decrease demand** (moderate access to non-priority conditions); **2) enhance health protection and minimize risk factors** (professionals and users); **3) maintain the provision of care for the most relevant visual health needs**; and 4) **study and research promoting**.

1. Decrease in demand (moderate access to non-priority conditions). In relation to the results obtained, it should be noted that all MCDT, regardless of the associated areas, registered a significant decrease when compared to the same period. The decrease, similar to other studies[6], was very sharp and with average values ranging from 93.5% associated with general ophthalmology and pediatric ophthalmology consultations to about 76.8% in retina-vitreous, ocular diabetes, genetics consultations, and visual impairment and rehabilitation.

It was with this principle and following the decreed state of emergency[5] that general non-priority ophthalmology consultations were the first areas to be impacted by COVID-19 and one of the associated MCDTs such as the autorefractometer to have a very sharp decrease. However, it should be noted that air-puff tonometry under normal conditions would have a value close to the autorefractometer since there are two MCDTs associated with the general ophthalmology consultation. In this specific case, the almost total decrease observed (99.5%) is due to the internal regulation that was anticipated by the IOGP Board by the possibility of this examination being associated with aerosol risk and potential contagion.

Despite the weak association of COVID-19 in the younger age groups[10], the remaining MCDT associated with pediatric ophthalmology consultations had an equally sharp drop. This is partly due to the demarcations carried out, but also due to the perception of risk by the Portuguese population that early promoted a social self-distance[4].

Regarding the glaucoma, ocular surface, cornea and contact lenses MCDTs, it appears that, following a similar abrupt impact of care production (88.9%), the areas that verified some functioning were those associated with cataract surgery as well with the glaucoma consultation. With similar behavior, and showing attention to more critical areas and at risk of loss of vision, it was found with the MCDT associated with retina-vitreous consultations, ocular diabetes, genetics, and visual impairment and rehabilitation. However, the assessment of ETDRS visual acuity (12.9%) and structural retinal evaluation by OCT (17.4%) represented a residual activity of MCDT during this period of COVID-19.

2. Enhance the protection and minimize risk factors (professionals and users). Due to the fragility of knowledge and therapeutic limitations, it is essential to promote knowledge[11] regarding health protection strategies but also in disease prevention. Due to the non-consensual relationship of contagion with the external ocular surface and its secretions[12] a possible perspective of the infection development at the level of the conjunctiva and to the upper respiratory tract migration through the nasolacrimal canal is present in the scientific community and on the basis of measures of some protective measures[2]. In view of this data, there was an almost complete suspension of air-puff tonometry (99.5%), all professionals started to use appropriate protective equipment and the presence of patients was reduced in space and time.

In a recent study, it was highlighted that in 12 cases of COVID-19 with ocular manifestations more than 66% of these were in a severe or critical situation. The remaining cases were moderate in clinical situations[1]. Whether due to the pandemic character, its transmission capacity, or the severity of severe forms, the relevance of eye protection as an instrument to minimize transmission and contagion is essential. This is valid for the general population, even for health professionals, who have worrying infection rates[13] and are necessary for the continuous provision of direct health care to COVID-19 disease. Without forgetting, of course, the remaining normal co-morbidities of the population and on which regular benefits and care are necessary.

However, it is essential to remember that, even with the current fragility of knowledge, it seems that even with reduced viral loads and asymptomatic conditions of carriers, there is the possibility of contagion. In this sequence and taking into account that the clinical practice of ophthalmology is characterized by professional proximity-user[8], and while social containment relief measures are being prepared, the need for protective measures is essential.

3. Providing care for the most relevant visual health needs. Given the context of the pandemic, it is equally important to be able to respond assertively to the needs of greater risk for vision loss and with the biggest economic impact in developed societies such as cataracts, glaucoma, and retinal pathologies such as retinopathy and age-related macular degeneration[14]. In this sense, the data obtained represent the protection of these main areas with about 91% of the residual activity. Knowing that these pathologies can cause irreversible blindness the MCDT such as the ETDRS scale (12.9%) and structural retinal evaluation through OCT (17.4%) represented about 30% of the activity in the studied period.

4. Study and investigation promoting. Apart from the discussion of the previous points, the promotion of studies on the impact of COVID-19 should be done, not only in consultations but also in terms of postponed surgeries, late diagnoses, and aggravated pathology. This will be a key pathway in the diagnosis of the situation but in the determination and readjustment of needs.

Although much of the attention of the studies is on the impairment of the respiratory tract, for obvious reasons of survival[2] as already mentioned, the involvement of the ocular surface like the tear is also referred to in other CoVs[13]. Thus, this relationship must be valued and studied in our current

situation due to the implications that it may have on normal access to health care but because of the safety in clinical and therapeutic practices between users and health professionals.

Within the scarcity of knowledge, there are already several extra-pulmonary sequelae reported, such as liver dysfunction, cardiac injuries, acute renal dysfunction[15-16]. However, what will be the impact of these complications on eye health? Or what is the secondary impact of the different therapies used, such as chloroquine[17].

In addition to the paralyzing impact that the current pandemic had in health services, and according to the points previously mentioned, four key aspects must be evaluated in the immediate future:

Protection through the use of masks, gloves, hands washing, minimizing social contact and cleaning equipment; **consultations** with an MCDT monitoring component and consultation by phone/ videoconference favors the performance of exams and the patient has a remote consultation; **readjustment of appointments** to the new reality by strengthening the telephone communication line with patients, minimizing waiting times (in presence at the facilities), mismatched consultation times, teleworking in order to contribute to health calls and video consultations; **clinical priorities and risk factors** such as emerging situations already mentioned but also cataract surgery, glaucoma, diabetic retinopathy, and age-related macular degeneration[6] the main causes of blindness worldwide.

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