

Telemedicine and Ophthalmology Amidst covid-19: A Descriptive Study

Telemedicina y oftalmología en tiempos de covid-19: un estudio descriptivo

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ANDREA CAYCEDO^a

Ophthalmologist, Clínica Oftalmosanitas, Bogotá, Colombia
ORCID: <https://orcid.org/0000-0001-6677-0313>

ALEJANDRO SERRANO

Ophthalmologist, Clínica de Oftalmología San Diego, Medellín, Colombia
ORCID: <https://orcid.org/0000-0002-3098-1159>

ALFONSO UCRÓS

Corneal specialist, director of the Clínica Oftalmosanitas, Bogotá, Colombia

ABSTRACT

Introduction: Doctors have had to adapt to an unknown and unexpected situation and within these changes it was necessary to use tools to which they have been a little reluctant to use, such as telemedicine to continue with the assessment of patients from different medical specialties such as ophthalmology. **Aim:** To show the results of the description of the experience of the practice of telemedicine in ophthalmology as a useful tool for access to a specialized consultation that would be decisive, during the time of the covid-19 pandemic in an ophthalmological center in Bogota Colombia. **Materials and methods:** A descriptive cross-sectional study was carried out including pediatric and adult patients who attended a telemedicine consultation with some of the 16 ophthalmologists of Oftalmosanitas, in the services of general ophthalmology, retina, glaucoma, cornea, pediatrics and uveitis, between 15 April and August 31, 2020. Variables such as age, sex, type of consultation, treating specialty, diagnosis and management plan were included. **Results:** Information was collected from 23,629 consultations, the average age was 53.6 years, 62.29% were women and 92.52% were of legal age. Regarding the perception of physicians, 100% considered that this consultation modality has been useful for the current contingency and that the majority of patients are satisfied with the care. **Conclusions:** The exercise of ophthalmology telemedicine in our institution managed to attend and solve a large number of consultations. In addition, this experience was widely accepted by doctors and patients as they gained access to specialized care that was able to solve most of the reasons for consultation by requesting diagnostic tests.

Keywords

telemedicine; ophthalmology; pandemics; social isolation.

RESUMEN

Introducción: Los médicos se han tenido que adaptar a una situación desconocida e inesperada por causa del coronavirus, y dentro de esos cambios estuvo usar la telemedicina, una modalidad a la cual estuvieron obligados a recurrir para continuar con la valoración de pacientes

^a Corresponding author: ancaicedo@colsanitas.com

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de diferentes especialidades médicas como la oftalmología. **Objetivo:** Mostrar los resultados de la experiencia del ejercicio de la telemedicina en oftalmología como una herramienta útil para el acceso a una consulta especializada, durante la época de pandemia de covid-19 en un centro oftalmológico en Bogotá (Colombia). **Materiales y métodos:** Estudio descriptivo de corte transversal que incluyó pacientes pediátricos y adultos que asistieron a consulta de telemedicina en los servicios de oftalmología general, retina, glaucoma, córnea, pediatría y uveítis, entre el 15 de abril y el 31 de agosto de 2020. Se caracterizaron variables como edad, sexo, tipo de consulta, especialidad tratante, diagnóstico y plan de manejo. **Resultados:** Se recolectó información de 23.629 consultas, el promedio de edad fue de 53,6 años, el 62,29 % fueron mujeres y el 92,52 % eran mayores de edad. El 43,55 % de los pacientes fueron atendidos para valoración de primera vez y el 78,43 % recibieron atención por oftalmología general. **Conclusiones:** El ejercicio de la telemedicina de oftalmología logró atender y resolver un gran número de consultas de diferentes especialidades oftalmológicas. Esta experiencia obtuvo una gran aceptación por parte de los médicos y pacientes al lograr tener acceso a una atención especializada.

Palabras clave
telemedicina; oftalmología; pandemias; aislamiento social.

Introduction

The current health care crisis due to the SARS-CoV-2 coronavirus pandemic has made it necessary to consider new methodologies for ophthalmologic evaluation. The Centers for Disease Control and Prevention now recommend telemedicine, rather than on-site clinic visits, in anticipation of a prolonged period of social distancing (1).

Telehealth is defined as the provision of medical care at a distance using information technologies and telecommunication services, with the objective of improving access to medical care, quality, resolution and patient satisfaction. Telehealth includes activities such as tele-counseling, tele-medicine and tele-support (1,2).

Telemedicine, in turn, is defined as the provision of health services at a distance in the components of promotion, prevention, diagnosis, treatment, and rehabilitation, by health professionals using information and communication technologies (1). Within it are categories such as:

Interactive telemedicine: remote relationship using information technologies in real-time between the professional and the user.

NON-interactive telemedicine: remote relationship using asynchronous information technologies between professional and user. It does NOT require an immediate response.

Telexpertise: two health professionals, one attending in person and the other at a distance. It can also be a medical board that performs interconsultation.

Telemonitoring: a synchronous or asynchronous method in which health personnel and the user, by using technological infrastructure, remotely collect and transmit clinical data. This can be synchronous or asynchronous (2).

In Colombia, these modalities of care are contemplated under the legal framework of Law 1419 of 2010, according to which the guidelines for telehealth are presented; Resolution 2654 of 2019, which deals with the enabling of telemedicine, and Resolution 521 of 2020, which adapts the Action Plan for the Provision of Health Services during the containment and mitigation stages of the covid-19 pandemic (2).

However, in ophthalmology, the use of telemedicine is infrequent, because it has not been widely accepted by specialists, even though the standards required to improve the provision of health services in this modality have already been established (3,4).

Meanwhile, it has been reported that telemedicine services can be used for screening and follow-up of ocular pathologies in both outpatient and emergency departments (5,6). Similarly, studies have been published on the advantages of teleophthalmology in patients diagnosed with diabetic retinopathy (7-9), follow-up of patients with glaucoma (3), and in postoperative oculoplastic procedures (10), which confirm its usefulness in the timely diagnosis and appropriate management of these patients.

Despite innovations and advances, telemedicine continues to be a challenge due to the usual obstacles faced by the technology in terms of access, quality of service and

safety (6,11-13). These limitations mean that in developing countries such as Colombia there may be barriers to the implementation of telemedicine in specialties such as ophthalmology.

This article presents the results of the experience of implementing teleophthalmology, expressed in the number of consultations attended (access) and resolved through the practice of telemedicine during the covid-19 pandemic in a high complexity ophthalmology center (Oftalmosanitas) in Bogota (Colombia). It aims to propose this model of care as another tool in the ophthalmology consultation service, with application in times of contingency, since it can reduce access times to specialized consultation and manage to serve isolated or vulnerable populations.

Materials and methods

This was a descriptive cross-sectional study that included information from consultations with pediatric and adult patients who attended telemedicine consultations for ophthalmologic pathologies at Oftalmosanitas between April 15 and August 31, 2020.

Selection criteria:

Inclusion criteria: patients who attended the telemedicine consultation for ophthalmologic pathologies and who had accepted the virtual consultation model.

Exclusion criteria: patients who did not have complete information in the Avicenna 7.6.0 system medical history.

Data collection strategy. The medical records of patients who attended telemedicine consultation for ophthalmologic pathologies between April 2020 and August 2020 in the general ophthalmology, retina, glaucoma, cornea, pediatrics, and uveitis services were reviewed. The main investigator and co-investigators collected data of interest from the digital medical record within the clinic facilities. The data were entered into an Excel database for the exclusive use of the investigators and, thus, the principle of confidentiality was maintained. Table 1 describes the variables included in the study.

Table 1
Description of variables

Variable	Conceptual definition	Operational definition (indicator)	Name	Type (according to level of measurement)	Coding
Demographic variables					
Identification	Unique patient identifier	ID card number	ID	Quantitative, rate	
Age (years)	Time elapsed since the birth of an individual.	Difference between the date of the medical history and the date of birth	AGE	Quantitative, rate	Years completed
Gender	Organic condition, male or female, of animals and plants	Biological sex manifested	SEX	Nominal	1 = male 2 = female
History					
Arterial hypertension	Chronically elevated blood pressure numbers	Blood pressure >140/90 mmHg from repeated measurements	HTA	Nominal	0 = no 1 = yes
Diabetes mellitus	Metabolic disorder characterized by hyperglycemia and increased risk of cardiovascular disease	Classic symptoms together with fasting blood glucose >126 mg/dl or positive glucose tolerance test	DM	Nominal	0 = no 1 = yes
History of coronary heart disease	Dysfunction of the coronary arteries due to cholesterol deposits and inflammation.	Record of history of coronary artery disease in medical record	CHD	Nominal	0 = no 1 = yes
Chronic kidney disease	Renal insufficiency that affects its function and reduces the glomerular filtration rate.	GFR less than 60 ml/min calculated by the formula CKD - EPI	ERC	Nominal	0 = no 1 = yes
Liver disease	Disease that generates incapacity to carry out the synthetic and metabolic function of the liver.	Recording of history of liver disease in medical records	EH	Nominal	0 = no 1 = yes
Telemedicine consultation					
Ophthalmologic diagnosis	Primary diagnosis for which the patient is being assessed	Main diagnosis recorded in medical record	DX	Nominal	
Management plan	Defined behavior following medical assessment	Management plan recorded in medical record	PLAN	Nominal	
Treating speciality	Specialty that assesses the patient in the consultation room	Ophthalmology service treating speciality	SPECIALTY	Nominal	1 = General ophthalmology 2 = Pediatric ophthalmology 3 = glaucoma 4 = retina 5 = oculoplastics 6 = anterior segment
Solved consultation			SOLVED CONSULTATION	Nominal	0 = no 1 = yes

A successful consultation was defined as one in which communication with the patient was achieved and which allowed an anamnesis to be performed and, if possible, some findings to be obtained by means of a photo, video call or the interpretation of paraclinical examinations. And, from this, a diagnosis and management plan has been provided.

Information collection techniques. All patients had to verbally and voluntarily accept the consultation scheme using a consent form before the beginning of the consultation. The purpose of

the consultation was proposed as an alternative to provide a solution to the reason for the patient's current consultation or complaint, as well as to identify warning signs that merit urgent or priority attention, following the recommendations given by scientific societies.

Data analysis plan. Subsequently, the information recorded was reviewed to avoid possible inconsistencies or duplicates. We also verified that the data recorded corresponded to the type of variable, its definition, the corresponding unit and the coding, if applicable. With the data collected from the variables characterizing the population, the distribution of frequencies and percentages was obtained for the categorical variables, and for the continuous variables, measures of central tendency and dispersion were obtained. The statistical software STATA version 15 was used for data analysis.

Ethical considerations. The protocol was approved by the Research Committee and the Research Ethics Committee of the Fundación Universitaria Sanitas.

Results

Characteristics of patients seen

The sample collected was 23,629 consultations performed by telemedicine to pediatric and adult patients, with one of the 16 Oftalmosanitas specialists, between April 15 and August 31, 2020. Most of the patients assessed by this virtual consultation modality were located in the country's capital city (Table 2).

Table 2
Description of the telemedicine experience

Feature	
Number of consultations performed	23,629
Number of patients evaluated only once	21,393
Number of ophthalmologists who performed telemedicine	30
Patient geolocation	n = 23,629
Bogotá, n (%)	21,087 (89.24)
Soacha, n (%)	651 (2.76)
Chía, n (%)	637 (2.70)
Facatativá, n (%)	249 (1.05)
Other locations in the country, n (%)	1005 (4.25)

The mean age of the patients was 53.6 ± 21.3 years, with a standard deviation of 21.3 years. In terms of sex, the percentage of women was 62.29 % (n = 14,718). Of the patients seen, 92.52 % (n = 21.3) were of legal age and 43.55 % (n = 10,290) of them were seen for first-time assessment (Table 3).

Table 3
Description of patients seen in consultation

Feature	n = 23,629
Age, mean (SD)	53.6 (21.3)
Women, n (%)	14,718 (62.29)
Type of patient	
Minor patients, n (%)	1767 (7.48)
Adult patients, n (%)	21,862 (92.52)
Type of consultation	
Control, n (%)	13,339 (56.45)
First time, n (%)	10,290 (43.55)
Treating specialty	
General ophthalmology	18,532 (78.43)
Glaucoma clinic, n (%)	1827 (7.73)
Retina clinic, n (%)	1245 (5.27)
Anterior segment, n (%)	1100 (4.66)
Pediatric ophthalmology, n (%)	736 (3.11)
Oculoplastics	189 (0.80)
Ophthalmologic diagnosis	
Glaucoma or suspected glaucoma, n (%)	4966 (21.01)
External pathology, n (%)	3162 (13.38)
Visual pathology, n (%)	3135 (13.26)
Posterior segment, n (%)	2313 (9.79)
Cornea, n (%)	2189 (9.26)
Anterior segment, n (%)	2109 (8.92)
Ocular surface, n (%)	2082 (8.81)
Normal examination, n (%)	1562 (6.61)
Systemic pathology, n (%)	1052 (4.45)
Orbital and tumor pathology, n (%)	614 (2.60)
Uveitis and other inflammatory, n (%)	209 (0.88)
Neurological pathology, n (%)	166 (0.70)
Error in recording-no diagnosis recorded, n (%)	70 (0.29)
Medical consultation solved	
Yes, n (%)	18,302 (77.46)
No, n (%)	2162 (9.15)
Not registered, n (%)	3165 (13.39)
Management plan	
Control, n (%)	13,452 (56.93)
Ophthalmology discharge, n (%)	5692 (24.09)
Priority evaluation, n (%)	956 (4.05)
Referral to another medical specialty, n (%)	257 (1.09)
Referral to emergency department, n (%)	136 (0.58)

When analyzing the ophthalmologic diagnoses recorded in the clinical history, the most frequent was glaucoma, with 21.01 % (n = 4966); followed by external pathology, represented by 13.38 % (n = 3162), including pathologies of the lacrimal apparatus and eyelids. The least frequent diagnosis was neurological pathology, with only 0.70 % (n = 166) (Table 4).

Table 4
Description of comorbidities

Comorbidity	n = 2864
Arterial hypertension, n (%)	2041 (71.26)
Hypothyroidism, n (%)	773 (26.99)
Hyperlipidemia, n (%)	676 (23.60)
Diabetes mellitus, n (%)	527 (18.40)
Sleep apnea, n (%)	270 (9.43)
Osteoarthritis, n (%)	257 (8.97)
Chronic obstructive pulmonary disease, n (%)	197 (6.88)
Ischemic cardiomyopathy, n (%)	187 (6.53)
Sjögren's syndrome, n (%)	122 (4.26)
Cardiac arrhythmia, n (%)	93 (3.25)
Heart failure, n (%)	86 (3.00)
Systemic lupus erythematosus, n (%)	66 (2.30)
Migraine, n (%)	44 (1.54)
Osteoporosis, n (%)	42 (1.47)
Rheumatoid arthritis, n (%)	31 (1.08)
Alzheimer's disease, n (%)	19 (0.66)
Rosacea, n (%)	16 (0.56)
Atherosclerosis, n (%)	4 (0.14)

In 77.46% (n = 18,302) of the cases it was recorded that the consultation had been resolved. In 13.39% (n = 3165) of the patients, it was not recorded in the database whether the consultation was resolved or not, because the data was not correctly migrated from the medical record to the database (see Table 3).

With regard to the management plan, 56.93% (n = 13,452) of the cases were indicated to continue monitoring by the specialty in virtual mode; 24.09% (n = 5692) were discharged by the specialty, and 4.05% (n = 956) of the cases were sent for priority evaluation in person. Only 0.58% (n = 136) of cases were referred to the emergency department (see Table 3).

Information on comorbidities was obtained in 2,864 patients. The most frequent were: Arterial hypertension, reported in 2041 patients (71.26 %); hypothyroidism, in 773 patients (26.99 %); hyperlipidemia, in 676 (23.60 %), and diabetes mellitus, in 527 patients (18.4 %) (see Table 4). Most of the consultations made corresponded to referrals from general medicine for retinopathy screening, which were performed by taking posterior pole photographs and, in some cases, by angiography or tomography, which were subsequently reviewed by the physician and the result was reviewed in a control, where the findings were explained and the conduct to be followed, in addition to giving recommendations

to prevent ophthalmologic complications derived from the patient's underlying pathology.

The importance of the interpretation of different paraclinical tests that helped physicians to define behaviors should be emphasized. Some of them are: visual fields, coherent optical tomography of the optic nerve, anterior segment or macula, pachymetry, standardized ocular ultrasound, ultrasonic biomicroscopy (UBM), computed axial tomography or nuclear magnetic resonance of the skull or orbits, retinal angiography, posterior pole and anterior segment photographs, Pentacam, optometry, biopsies or conjunctival impression cytology.

Discussion

Due to the covid-19 pandemic, the practice of medicine has had to adapt and the use of technology has been necessary to continue the evaluation of patients by different specialties, including ophthalmology. In the last year, different articles have been published on the experience of teleophthalmology in several countries and they have agreed that this modality of consultation has an invaluable utility in this type of contingency (1,6,8,9).

The virtual consultation modality has proven to be cost-effective in countries of the region, such as Brazil, where it has made it possible to speed up access to specialized consultation and avoid preventable blindness secondary to delays in care; likewise, the unit cost per evaluation has been reduced (14). In Chile, telemedicine allowed greater detection of diabetic retinopathy and in Iran, it demonstrated that this model can avoid unnecessary referrals in patients with diabetic retinopathy (15,16).

In a descriptive study published in Spain, where they wanted to show the results of the experience during the covid-19 pandemic, they concluded that the number of teleconsultations performed was low due to the novelty of the service and the lack of knowledge on the part of the patients. This result is the opposite of our experience, from which we obtained a massive acceptance by patients (17).

Experience with the use of teleophthalmology during the covid-19 pandemic had not been published in Colombia. This study describes the results of 23,629 consultations made during the contingency in Oftalmosanitas, of which 77.46% of the cases resolved the reason for which the patient was consulting. This suggests that this modality of care is effective in generating a diagnosis and a management plan for patients who are evaluated virtually.

The largest percentage of patients were located in Bogotá. However, we also saw people located in some rural or remote areas, where access to specialized ophthalmology care is limited or non-existent. For this reason, we believe that the virtual consultation service was useful for the resolution of some eye diseases and also provided education regarding recommendations and warning signs of different pathologies.

The reduced number of visits in the pediatric population may be related to the fact that most of the consultations in this age group are for eyeglasses prescription or strabismus evaluations, reasons why a face-to-face appointment is required. Glaucoma was the most frequent ophthalmologic diagnosis in the patients who participated in this study. These data correlate with the percentages of the specialties, where glaucoma and general ophthalmology were among the most requested. The specialty with the lowest number of patients seen was oculoplastics, with 0.8%, which was related to the fact that this specialty was only available for one month (see Table 3). These results are different from those presented in a Spanish publication, with a similar experience to ours, where the most frequent reason for consultation was inflammatory conditions of the ocular surface and eyelids, with 79.4 % (17).

For glaucoma management and follow-up, patients are scheduled for periodic visits for diagnostic tests that are reviewed by the treating physician to adjust the treatment plan. Such tests can be reviewed virtually, as occurred in our study. This experience is similar to that reported by Gan et al. (18), who report that this methodology reduces the number of in-person

provider visits while ensuring oversight of patient care.

Regarding the perception of teleophthalmology by patients, in January 2020 the results of a study conducted in a low-income urban population with a history of type 2 diabetes mellitus in the United States were published, which reported a general acceptance of this consultation modality, except for older adults, who prefer an assessment by their ophthalmologist of choice (19). Telemedicine at Oftalmosanitas was very well received, to such an extent that it became currently part of the portfolio of services offered by the institution, due to the great demand from physicians and patients.

Regarding age groups, in our study more than 90 % of the patients were adults, and of these, 16.26 % were older than 75 years. For this group of patients, teleophthalmology has become increasingly important to detect or follow up pathologies such as glaucoma, diabetic retinopathy, and age-related macular degeneration. This modality of consultation has proven to be both cost-effective and efficient in reducing the burden of visual disability resulting from these diseases (20). In addition, elderly or chronically ill patients are more aware of its usefulness, as they now use it to reduce their exposure (21).

Although the technology for remote ophthalmic monitoring is neither scalable nor ready, it appears that our patients are willing to adopt this approach. This crisis is likely to spur innovation that will transform the delivery of care, improving different tools such as a close focus on smartphone cameras, self-photography accessories, and the application of scalable and more accurate home tests. We can see teleophthalmology finding a more permanent role in the near future (21).

One year after starting the use of teleophthalmology in our institution, we can conclude that the experience of physicians and patients has been satisfactory, by reducing the time of attention, which has allowed early and timely detection of priority and urgent pathologies. This has reduced severe

ophthalmologic complications that could lead to irreversible blindness, in addition to reducing the risk of infection by coronavirus, due to the close contact that occurs during the ophthalmologic consultation. Due to the results obtained and to the request of the patients themselves, we are currently continuing with the practice of telemedicine to provide assistance to patients who live in isolated populations or have difficulty in traveling, improving the time of attention to those patients who require an urgent or priority consultation and providing health education through the virtual consultation.

It is important to define the goals to be achieved with teleophthalmology. There are several methods of non-face-to-face consultation (video, synchronous video, photographs, or audio only), and each one with its advantages as well as disadvantages, sought to fulfill one of the following purposes: 1) to give continuity to the treatment of already diagnosed ophthalmologic pathologies, 2) to reduce the number of patients in face-to-face consultations to respect health restrictions and 3) to refer patients with situations/pathologies considered as urgent to provide timely treatment.

In the non-face-to-face consultation, the ophthalmologist performs an interrogation, and based on his or her clinical judgment, initiates the follow-up required by the patient. This is why the teleconsultation model in ophthalmology is a practice that should continue. At the moment, it is required by health authorities to prevent the spread of SARS-CoV-2; but once this emergency is over, telemedicine will continue to be relevant: scheduling consultations to review requested examinations, observing tolerance/adherence to medications, and even triaging patients (22). More studies of this type should be conducted and financed to promote timely ophthalmologic care and reduce preventable visual disturbances.

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