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## Original article

# COVID-19 pandemic: Impact on the rate of viral conjunctivitis<sup>☆</sup>



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### ABSTRACT

**Objective:** The COVID-19 pandemic led Spain to order a state of alert with the cessation of non-essential activities on 14 March 2020, and to implement public health interventions (such as home confinement) and other health recommendations to prevent the spread of the SARS-CoV-2 virus (hand washing and the obligation to wear face-masks). These factors could have influenced the rate of viral conjunctivitis.

**Method:** In this retrospective, noninterventional, descriptive study, the incidence of viral conjunctivitis in an emergency department of a national hospital is compared over two distinct time periods: pre-COVID (13 March-30 September 2019, one year before the start of the pandemic) and COVID (13 March-30 September 2020).

**Results:** In the first period there were 436 cases of conjunctivitis, of which 168 (38.5%) were confirmed cases of viral conjunctivitis 168 (38.5%), while in the second period there were 121 recorded cases, of which the most frequent were allergic and traumatic (23 cases; 19% each group), bacterial (15 cases; 12.3%) and viral (15 cases; 12.3%). The diagnosis of viral conjunctivitis is the one that suffered the most significant relative reduction (48.5%), while other types of conjunctivitis hardly changed their relative frequency between these two periods of time.

**Conclusions:** Viral conjunctivitis is the most frequent infectious disease of the eye and has a transmission rate similar to that of coronavirus, so the measures implemented could positively affect its incidence.

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## Pandemia COVID-19: impacto sobre la tasa de conjuntivitis virales

### RESUMEN

#### Palabras clave:

Conjuntivitis viral  
Conjuntivitis adenovírica  
Infección respiratoria  
Pandemia  
COVID-19

**Objetivo:** La pandemia COVID-19 condujo a España al decreto de estado de alarma con cese de actividades no esenciales el 14 de marzo de 2020 y a intervenciones de salud pública, como el confinamiento domiciliario y otras recomendaciones sanitarias para evitar la propagación del virus SARS-CoV-2: la higiene de manos y la obligatoriedad de portar mascarillas. Estos factores podrían haber influido en la tasa de conjuntivitis virales.

**Método:** En este estudio descriptivo retrospectivo no intervencionista se compara la incidencia de conjuntivitis virales en un servicio de urgencias de un hospital nacional sobre dos periodos de tiempo: pre-COVID (13 de marzo a 30 de septiembre de 2019, un año antes del inicio de la pandemia) y COVID (13 de marzo a 30 de septiembre de 2020).

**Resultados:** En el primer periodo hubo 436 conjuntivitis, de las cuales 168 (38,5%) fueron casos confirmados de conjuntivitis viral 168 (38,5%), mientras que en el segundo periodo hubo 121 registros, de los cuales los más frecuentes fueron las conjuntivitis alérgicas y las traumáticas, con 23 casos (19% cada grupo); las conjuntivitis bacterianas, con 15 casos (12,3%), y las conjuntivitis virales, con 15 casos (12,3%). El diagnóstico de conjuntivitis viral es el que experimenta una reducción relativa más importante (48,5%), mientras que otros tipos de conjuntivitis apenas cambian su frecuencia relativa entre estos dos periodos de tiempo.

**Conclusiones:** La conjuntivitis viral, como patología infecciosa más frecuente del ojo, tiene una transmisión similar a la del coronavirus, por lo que las medidas implantadas podrían afectar positivamente a su incidencia.

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## Introduction

In late December 2019, patients with viral pneumonia due to an unidentified microbial agent were reported in Wuhan, Hubei Province, Central China. This disease outbreak, called COVID-19, increased substantially and was declared a pandemic by the WHO on March 11, 2020<sup>1</sup>. The causal microorganism is a type 2 coronavirus, a positive single-stranded RNA virus that originates the severe acute respiratory syndrome, SARS-CoV-2. Transmission pathways between humans is similar to that of other coronaviruses, through infected people's secretions; mainly respiratory droplets, hands or fomites contaminated with secretions, followed by contact to the mouth, nose or eyes' mucous membrane<sup>2</sup>.

After its arrival in Spain (estimated date, February 14, 2020), there was a significant COVID-19 progression that led to public health interventions. The state of emergency and closure of schools and non-essential activities was decreed on March 14, 2020 confining the population in their homes<sup>3</sup>. No previous public health intervention can compare to the magnitude of restriction established by this epidemic. Compulsory outdoors mask mandates and other recommendations such as social distancing and maintaining hand hygiene, washing them with water and soap or hydroalcoholic gel, were implemented. Reports show that this unusual situation in Spain could be associated with a strong decrease in both pediatric and adult infectious diseases, which are usually spread in social gatherings through respiratory and contact pathways. In this sense, a decrease in both incidence and prevalence of diseases such as

bronchiolitis, common cold or seasonal flu processes during the epidemic has been published<sup>4,5</sup>. In addition, the decrease in the incidence of conjunctivitis associated to these processes or standalone has been observed, albeit empirically.

At ocular level, one of the most frequent infections is viral conjunctivitis (1% of all primary care visits and emergencies). Viral conjunctivitis is the most frequent cause of conjunctivitis, representing up to 80% of all cases. Most are caused by adenoviruses (especially subtypes 7, 11 and 18), and produce two of the clinical entities commonly associated to viral conjunctivitis: pharyngoconjunctivitis and epidemic keratoconjunctivitis<sup>6</sup>. Viral conjunctivitis can appear as an isolated disease or associated with systemic viral infections, such as upper respiratory tract infections (URTIs) and measles. Most infections are caused indirectly after respiratory inhalation, while the conjunctiva rarely serves as a virus entry point for the guest<sup>7</sup>, and in these cases local infection can be initiated through direct inoculation after ophthalmological procedures (tonometry and other ocular explorations), by contact with secretions of an infected patient, or in certain locations with higher viral concentration (for example, swimming pools)<sup>8</sup>. After an incubation period of 5-15 days, the patient exhibits red eyes, itching, burning, a foreign body sensation and often secretion and ocular discomfort that persist from 5 to 15 days<sup>7</sup>. Under slit lamp exploration, most patients have unilateral or bilateral acute follicular conjunctivitis, and unilateral cases frequently become bilateral a few days later. Preauricular lymphadenopathy might be present, and a history of URTIs is common. The symptomatic picture is usually acute and self-limiting, although very contagious.

Treatment is merely a support and aimed at improving patient discomfort<sup>6</sup>. The most important element is infection spread prevention. To achieve this, doctors should wear gloves while examining infected patients and practice frequent and careful hand wash. Any equipment and instruments used during exploration must be cleaned with disinfectant solutions such as 10% sodium hypochlorite, hydrogen peroxide or alcohols such as 70% isopropyl alcohol<sup>9</sup>. Furthermore, patients and their families have to be instructed to act with caution at home, washing their hands often and keeping the patient's towels and bed sheets separated from the rest. Children must be kept out of schools from 5 to 7 days since the onset of symptoms.

In this work, the hypothesis of possible reduction of viral conjunctivitis cases in the national emergency system during the COVID-19 pandemic is considered, and attempts to relate this fact to the use of the hygienic-social measures mandated during the pandemic.

## Methods

A retrospective, non-interventional descriptive study that compares the incidence of viral conjunctivitis in an emergency room service admission from a third-level Spanish hospital over two different periods of time: before COVID (March 13 to September 30, 2019, a year before the pandemic) and COVID (March 13 to September 30, 2020) is presented. A search on the hospital Electronic Clinical History Application (Hcis, DXC-HCIS<sup>®</sup>) within the emergency listings from both adults and children, including diagnoses (ICD-10)<sup>10</sup> generally used in clinical trials to describe this pathology (Table 1) by the emergency ophthalmologist, in both written and coded diagnostic boxes was performed.

As a result, two spreadsheets were obtained (Microsoft Office Excel<sup>®</sup> 2007), one corresponding to the 13/03-30/09/2019 period and another corresponding to the 13/03-30/09/2020 period, generated by the program and called *Excel diagnóstico 2019* and *Excel diagnóstico 2020*, that contained the clinical history number, patient name, date of birth, age, emergency room admission date and diagnosis.

To avoid the loss of cases without ICD-10 diagnosis by this system, a decision to expand the search within these emergency listings also selecting reason for consultation was made (which is found in 100% of patients, since it is mandatory data for Manchester staging and subsequent filtering for the emergency specialist). As reasons for consultation, the most frequently used by the triaging emergency staff were chosen: red eye, ocular secretion, rheum, conjunctivitis, ocular infection and ocular swelling. Two other new Excel<sup>®</sup> sheets generated by the program were obtained, called *Excel motivo de consulta 2019* and *Excel motivo de consulta 2020* that contained the same basic data. The two spreadsheets of each year were merged in a third Excel sheet called *Excel fusión* (one for 2019 and another for 2020). A total of 436 conjunctivitis records were obtained for the 2019 analyzed period (before COVID) and 121 records for the 2020 analyzed period (COVID).

In this study, no samples of conjunctival exudate or serology were collected for the determination of causal microbiological diagnosis. Diagnosis was based on anamnesis, the

epidemiological survey, regional lymph nodes exploration by palpation and slit lamp ocular exploration of both eyes with anesthetic eye drops and fluorescein instillation performed by the emergency ophthalmologist.

## Results

The first analysis was carried out with the 436 before COVID period records and the 121 COVID period records.

Out of the 436 before COVID period conjunctivitis records, 168 (38.5%) remained as confirmed cases of viral conjunctivitis, the second most frequent type being allergic with 64 cases (14.5%), bacterial with 25 cases (5.7%), irritant with 23 cases (5.25%), traumatic with 20 cases (4.6%), inflammatory with 11 cases (2.5%), herpetic with 10 cases (2, 3%) and phlyctenular with 2 cases (0.5%); the rest were diagnostic errors (subconjunctival bleeding, uveitis, keratitis, etc.) (Table 2).

In the 121 COVID period conjunctivitis records, the most frequent types were allergic and traumatic with 23 cases in each group (19%), viral and bacterial with 15 cases (12.3% each), irritant with 12 cases (9.9%), herpetic with 10 cases (8.3%), inflammatory with 7 cases (5.8%) and phlyctenular with 2 cases (1.65%); the rest were diagnostic errors. It should be noted that out of the 121 cases of conjunctivitis, 4 of them were confirmed cases of COVID-19, but only one of them manifested acute follicular conjunctivitis; the remaining 3 cases did not manifest follicles and could not be confirmed viral conjunctivitis (Table 2).

If the worldwide emergency activity of the year 2020 compared to 2019 is estimated based on these data, the number of ophthalmology emergency consultations suffered a drop from 2019 to 2020 of 72.24%, which affected all diagnoses, i.e., the number of patients with a viral, allergic, etc. conjunctivitis diagnosis, was theoretically decreased by 72.24% due to home confinement and other pandemic-related effects. However, viral conjunctivitis diagnosis is the type that experiences the greatest drop in absolute numbers of all possible conjunctivitis diagnoses during the analyzed COVID period (153 less cases than the previous year), the second diagnosis in numerical decrease being allergic conjunctivitis (41 less cases in 2020 compared to 2019). If this absolute numerical value is relativized in relation to the global decrease in ophthalmological visits in emergency care numbers (315 less patients attended in 2020 compared to 2019) the diagnosis with the most important percentage drop remains viral conjunctivitis, with 48.5% less emergency consultations. In second place, other diagnostic errors cataloged as conjunctivitis in a first screen is observed, with 31.4% less prevalence, and in third place allergic conjunctivitis, with a 13% less.

To avoid the influence of diagnostic errors mistaken with conjunctivitis (which constitute up to 25.9% of *Excel fusión 2019* and 11.5% of *Excel fusión 2020*), a second screen of the spreadsheets was performed, so that in all cases obtained by searching reason for consultation, the final diagnoses given to the patient by the ophthalmologist were all confirmed one by one (which was written in the free text space of the emergency discharge report in the clinical history itself but it did not appear in the written diagnostic boxes as a coded diagnosis),

**Table 1 – Most used diagnoses in the study to describe acute viral conjunctivitis according to the International Catalog of Diseases Version 10 (ICD-10)<sup>10</sup>.**

Diagnosis at discharge		Reason for consultation
Code (ICD-10)		
H10.01	Acute follicular conjunctivitis	Red eye
H10.22	Pseudomembranous conjunctivitis	Eye discharge
H10.3	Acute non-specified conjunctivitis	Rheum
H11.43	Conjunctival hyperemia	Conjunctivitis
H16.2	Keratoconjunctivitis	Ocular infection
B30	Viral conjunctivitis	Ocular swelling
B30.0	Adenovirus Keratoconjunctivitis	
	Epidemic keratoconjunctivitis	
B30.1	Conjunctivitis by adenovirus	
	Adenovirus acute follicular conjunctivitis	
B30.2	Viral pharyngoconjunctivitis	
B30.3	Acute epidemic hemorrhagic conjunctivitis (enterovirus)	
	Enterovirus conjunctivitis	
	Coxsackie virus conjunctivitis	
	Hemorrhagic (acute) (epidemic) conjunctivitis	
B30.8	Other viral conjunctivitis	
	Newcastle virus conjunctivitis	
B30.9	Viral conjunctivitis, unspecified	

**Table 2 – Most frequently diagnosed conjunctivitis in emergencies (prior to ICD-10 coding) in the period before COVID (March 13 to September 30, 2019) and during COVID (March 13, 2020 to September 30, 2020).**

Emergency diagnosis	Before COVID	COVID	% of change from before COVID to COVID (regarding total number of patients in the period)	Absolute change in patient numbers	% relative change (absolute change/total absolute change)
Viral conjunctivitis	168 (38.5%)	15 (12.3%)	-26.2	-153	-48.5
Allergic conjunctivitis	64 (14.5%)	23 (19%)	+4.5	-41	-13
Bacterial conjunctivitis	25 (5.7%)	15 (12.4%)	+6.7	-10	-3.2
Irritant conjunctivitis	23 (5.25%)	12 (9.9%)	+4.65	-11	-3.4
Traumatic conjunctivitis	20 (4.6%)	23 (19%)	+14.4	+3	+0.9
Inflammatory conjunctivitis	11 (2.5%)	7 (5.6%)	+3.1	-4	-1.2
Herpetic conjunctivitis	10 (2.3%)	10 (8.3%)	+6.0	0	0
Phlyctenular conjunctivitis	2 (0.5%)	2 (1.65%)	+1.15	0	0
Other diagnoses <sup>a</sup>	113 (25.9%)	14 (11.5%)	-14.4	-99	-31.4
TOTAL	436	121	-72.24%	-315	-100%

<sup>a</sup> Diagnostic errors mistakenly cataloged as conjunctivitis in a first screening; including hyposfagma, uveitis, keratitis, stye, pterygion. etc.).

and if they did not correspond to any of those selected from the ICD-10 code, were deleted. After also eliminating duplicate patients, files that had basic information missing or incongruous diagnoses, a total of 168 viral conjunctivitis patient records were obtained for the period 13/03-30/09/19 (*Excel fusión 2019 final*, before COVID period) and a total of 15 viral conjunctivitis patient records the period 13/03-30/09/20 (*Excel fusión 2020 final*, COVID period) These two new spreadsheets only include diagnoses compatible with ICD-10 for viral conjunctivitis diagnosis (Table 1). The patient distribution by diagnosis is shown in Table 3.

This second analysis shows that during the 6-month period between 13/03/2020 (COVID-19 pandemic became official) up

to the data collection closure date on 09/30/2020, 15 diagnoses compatible with ICD-10 standards for viral conjunctivitis, without no cases registered during the months of March or September 2020, and with a maximum number of patients per month in the months of May and June (the distribution of diagnosed viral conjunctivitis cases per month in each period is shown in Figs. 1 and 2). This contrasts significantly with the number of diagnosed and collected cases in the same time frame from the previous year (13/03-30/09/2019), in which the average number of patients diagnosed with viral conjunctivitis was 26.5 patients (not taking the month of March into account, since it is not a complete month and therefore the average cannot be performed).

**Table 3 – Number of final patients attributed to each ICD-10 diagnosis for viral conjunctivitis in each time period analyzed: period before COVID (March 13 to September 30, 2019) and COVID period (March 13, 2020 to 30 September, 2020), after clearing the initially obtained spreadsheets.**

Diagnoses ICD-10	Before COVID	COVID
Acute follicular conjunctivitis	99	0
Pseudomembranous conjunctivitis	15	7
Acute non-specified conjunctivitis	6	3
Conjunctival hyperemia	2	0
Keratoconjunctivitis	1	0
Viral conjunctivitis	23	1
Adenovirus keratoconjunctivitis		0
Epidemic keratoconjunctivitis	2	0
Adenovirus conjunctivitis	2	0
Adenovirus acute follicular conjunctivitis	6	0
Viral pharyngoconjunctivitis	1	0
Acute epidemic hemorrhagic conjunctivitis (enterovirus)	0	0
Enterovirus conjunctivitis	0	0
Coxsackie virus conjunctivitis	0	0
Conjunctivitis (acute) (epidemic) hemorrhagic	1	0
Other viral conjunctivitis	2	0
Newcastle virus conjunctivitis		
Viral conjunctivitis, unspecified	8	4
TOTAL	168	15

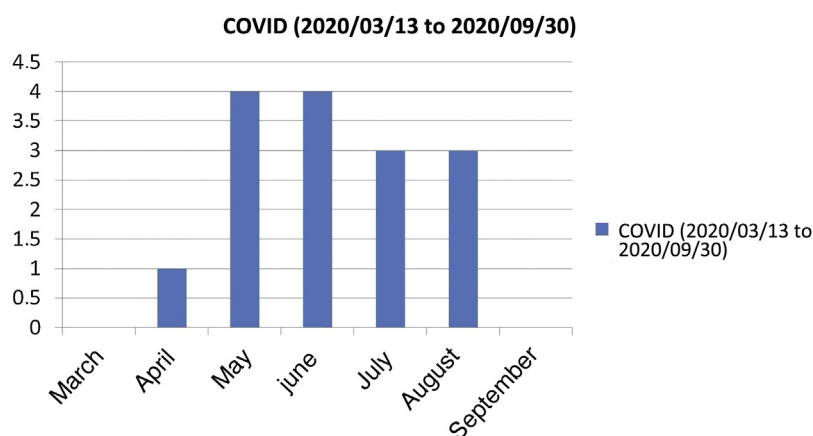
The only case of viral conjunctivitis that complied with ICD-10 diagnostic criteria and microbiologically confirmed as positive for SARS-CoV-2 was a pseudomembranous unilateral conjunctivitis that presented follicles in ophthalmological exploration, diagnosed in May 2020.

## Discussion

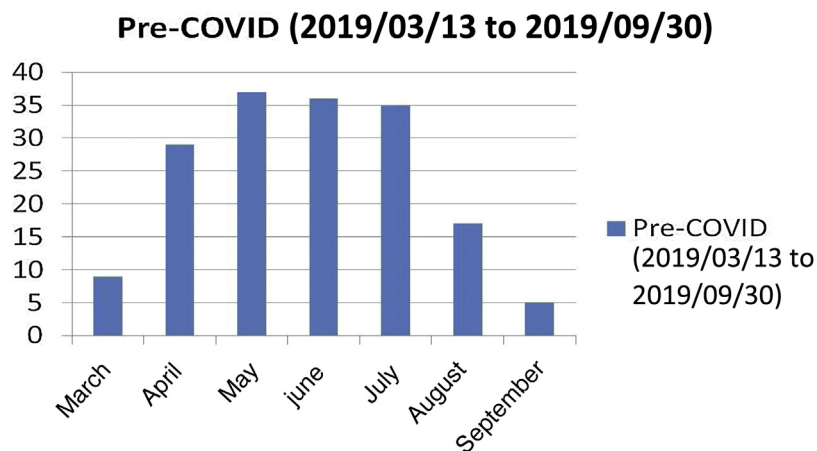
During the COVID-19 pandemic in Spain and mainly motivated by the state of emergency declaration, a restriction on personal and collective circulation was enforced in the population, limited to carrying out exclusively first necessity activities, such as attending health centers or assisting vulnerable people. Transportation, both public and private, was

reduced by at least half, and cultural, artistic, sports and similar activities were suspended. All of this, added to the “fear” of contracting the COVID-19 disease, limited patients visits to the emergency services of health centers and hospitals throughout Spain. This explains the decrease of patients treated in emergencies in all medical specialties, including ophthalmology. Although the data is estimated, in an ophthalmological center similar to that of our study, patient care in the emergency room decreased more than 70% in 2020 compared to 2019.

Out of all ophthalmological pathologies, this work analyzed one of the most frequent reasons for consultation, conjunctivitis<sup>7</sup>, and viral conjunctivitis in particular, which at the time of year analyzed (March to September) are the most common, since its frequency is higher in spring and summer<sup>6</sup>. The viruses that cause this pathology most frequently, adenoviruses, share transmission mechanisms and even clinical signs very similar to those of coronavirus<sup>11</sup>, and therefore it can be assumed that measures applied to contain the spread during the COVID-19<sup>12,13</sup> pandemic and the preventing recommendations from various medical organizations and ophthalmological societies<sup>14-18</sup> have also an effect in decreasing viral conjunctivitis propagation. Despite the obvious case decrease due to the emergency state and home confinement, after performing a careful data analysis it can be concluded that from all the types of conjunctivitis admitted in emergency care, viral conjunctivitis experienced the biggest decrease. According to the relative percentage of change analysis (absolute change or difference in total number of patients diagnosed with conjunctivitis of a given type, for example viral, in the period of 2020 relative to the period of 2019 and divided by the absolute change total or difference in number of all conjunctivitis diagnoses in the period of 2020 compared to 2019), viral conjunctivitis decreases by 48.5% in contrast to 2019, far from the second type, allergic conjunctivitis, that only decreased 13%. In absolute values, the number of patients attended with a final viral conjunctivitis diagnosis was reduced by 91% (only 15 cases in 2020 compared to 168 in 2019), while the number of patients with allergic conjunctivitis remains 64% of cases (23 cases in 2020 compared to 64 in 2019). Other conjunctivitis diagnoses do not present as much variation between these two time intervals.



**Fig. 1 – Number of patients that attended the emergency room diagnosed with “viral conjunctivitis” during the first 6 months of COVID-19 pandemic (March 13, 2020 to September 30, 2020).**



**Fig. 2 – Number of patients that attended the emergency room diagnosed with “viral conjunctivitis” during the 6 overlapping months in the COVID-19 pandemic period, but analyzed from 2019.**

The reasons that could explain this marked decrease in viral conjunctivitis compared to other types of conjunctivitis may be in the hygiene measures implemented as a result of the pandemic, which have affected the transmission pathway of SARS-CoV-2 and other respiratory viruses (like the adenovirus that causes most viral conjunctivitis). Among these measures, use of facial masks, washing hands, ventilation of spaces with high concentration of people and surface disinfection with diluted bleach, chlorine or alcohol derivatives at 70% (which have also shown to be effective against adenoviruses<sup>19,20</sup>).

This study would be the first to demonstrate the benefits of the hygienic-social measures implemented during the pandemic for the prevention of community propagation of viral conjunctivitis.

Our study has limitations, since cases of conjunctivitis whose patients have not attended the emergency department but have gone to other health centers or cases where the patients simply decided to stay at home have not been collected in this study. Despite this, it can be acknowledged that the case loss percentage would affect all types of conjunctivitis and not just viral types. Another limitation would be the lack of microbiological confirmation of conjunctivitis diagnoses, although it is not usually necessary, being an ophthalmological clinical diagnosis.

## Conclusions

During the COVID-19 pandemic (a period of 6 months has been analyzed since the beginning of the pandemic in Spain, on March 13<sup>th</sup> 2020) a decrease in conjunctivitis incidence has been observed in comparison to the same period of the previous year, and more notably in viral type conjunctivitis incidence, in relation to other red eye diagnoses made in the emergency service from a third-level Spanish national hospital. This finding is related to the implementation of hygiene-social measures imposed in the emergency state and recommended by multiple health organizations.

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## Conflict of interest

No conflicts of interests have been declared by the authors.

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