



# How to Manage a Strabismus Clinic During the COVID-19 Pandemic; What is Really Urgent, What is Not?: A Single-Center Case Series from Turkey

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## Abstract

**Objectives:** To evaluate the management of the pediatric ophthalmology and strabismus clinic when strict quarantine conditions were adopted during the coronavirus disease 2019 (COVID-19) pandemic in Turkey.

**Materials and Methods:** The study presents a review of the patients examined during the quarantine period. All patients were assessed with the highest possible level of personal protection.

**Results:** Ten patients (6 girls, 4 boys) with a mean age of 9 years (range: 2-16) were evaluated. The patients presented 3-20 days after symptom onset. Ocular misalignment and diplopia were the main symptoms. Four of the 10 patients were diagnosed with sixth cranial nerve palsy and three patients were diagnosed with acute-onset comitant esotropia. Six patients had significant cranial magnetic resonance imaging findings.

**Conclusion:** Acute-onset neurological conditions are more common during the COVID-19 pandemic. These reports will contribute to global experience and understanding of COVID-19.

**Keywords:** COVID-19, acute-onset strabismus, neuro-ophthalmology

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## Introduction

No one predicted that the world would face an outbreak of such magnitude when the first cases of coronavirus disease 2019 (COVID-19) were reported in Wuhan, China.<sup>1,2</sup> The World Health Organization announced on 11 March 2020 that COVID-19, caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), was a pandemic<sup>3</sup> and later identified several SARS-CoV-2 variants of concern (alpha, beta, gamma, delta, and omicron). Three criteria are required for a disease to be declared a pandemic. First, the disease must be caused by a factor that society has not previously been exposed to. Second, this factor should be easily transmitted to humans and easily spread from person to person. Third, it must cause serious illness.<sup>4,5</sup>

Beginning in China, the number of COVID-19 cases steadily increased and spread rapidly to other countries, causing infections all around the world, including in Turkey.<sup>6,7,8,9,10,11</sup> According to current statistics, there have been 9,300,000 confirmed cases and 81,000 deaths in Turkey.<sup>6</sup> As in other countries, sweeping measures were taken in Turkey to control the outbreak.<sup>5</sup> Triage practices were introduced in hospitals. Fever assessment and symptom questioning were conducted at hospital entrances and any background of suspicious and international contact investigated. These precautions taken in Turkey and the rest of the world aimed to prevent uncontrolled spread, reduce morbidity and mortality, and thus reduce overcrowding in hospitals. In the ophthalmology department, only emergency cases were assessed. The pediatric ophthalmology and strabismus clinic was one of the departments in which ophthalmological emergencies were most frequently assessed during this period. The purpose of the present study was to evaluate patient management during the COVID-19 pandemic in the pediatric ophthalmology and strabismus clinic, to present and discuss the cases evaluated, and to share our center's experience of the fight against the pandemic with ophthalmologists around the world who deal with strabismus.

## Materials and Methods

The present study provides an analysis of patients examined in the Faculty of Medicine of Hacettepe University Pediatric Ophthalmology and Strabismus Unit early in the COVID-19 pandemic. This retrospective study was conducted according to the Declaration of Helsinki and was approved by Hacettepe University Faculty of Medicine Ethics Committee (decision number: 2020/14-36). Informed consent was obtained from the legal guardians of the patients. All patients who were admitted to the clinic underwent a complete ophthalmological and orthoptic evaluation, including dynamic and static retinoscopy, best corrected visual acuity, anterior and posterior segment examination, prism cover test, and ocular motility evaluation, performed with maximum personal protective measures.

## Results

Ten patients (6 girls, 4 boys) with a mean age of 9 years (range: 2-16) presented between 13 March 2020 and 1 June

2020, when strict quarantine conditions were being applied in Turkey. They presented within 3-20 days of symptom onset. The leading symptoms were ocular misalignment and diplopia. The cases are summarized below and detailed clinical information is given in Table 1.

### Case 1

A 4-year-old boy was admitted to the emergency department for inward deviation of the right eye. His medical history was significant in that he had undergone surgical excision, chemotherapy, and radiation therapy for an atypical teratoid rhabdoid tumor detected at the C5-7 level 3 years previously. The patient had 40 prism diopters (PD) of esotropia. Abduction of the right eye was -4 limited. The patient also had papilledema. Cranial and spinal magnetic resonance imaging (MRI) performed for right sixth nerve palsy revealed leptomeningeal metastases.

### Case 2

A 16-year-old girl with complaints of dizziness and diplopia for 20 days was referred to the strabismus unit by the emergency department. The patient reported no systemic condition. She exhibited right head tilt and was diplopic on left gaze and down gaze. Best corrected visual acuity was 20/20 in both eyes. She had horizontal nystagmus that increased in amplitude on left gaze. She had 5 PD left hypertropia and 10 PD left esotropia. The anterior segment structures appeared normal on slit-lamp examination. The temporal quadrant of the left optic disc was pale. Active multiple demyelinating plaques were detected in the infra- and supratentorial regions by cranial MRI. The patient was diagnosed with left third and fourth nerve palsy. She was subsequently diagnosed with multiple sclerosis.

### Case 3

A 12-year-old girl was referred to the strabismus unit because of diplopia lasting 20 days. Best corrected visual acuity was 20/20 in both eyes. She had 14 PD left esotropia. Abduction was limited bilaterally. Anterior and posterior segment structures were all normal. MRI revealed an increase in density in the calvarial bones suggesting leukemic infiltration. Fortunately, no pathology was found in the bone marrow biopsy. Bilateral herniation of the cerebellar tonsils and swelling of the upper pituitary surface were interpreted as intracranial hypotension. The patient was diagnosed with bilateral sixth cranial nerve palsy and was followed up frequently by the pediatric neurology department.

### Case 4

A 3-year-old boy was referred to the strabismus clinic for diplopia and left eye crossing for 7 days. Visual acuity was 20/32 bilaterally. He had 25 PD left esotropia. Ocular motility was normal. Cranial MRI revealed a minimal increase in the perioptic cerebrospinal fluid distance in both eyes. However, fundus examination and neurological assessment were normal. The patient was diagnosed with acute-onset comitant esotropia and underwent full correction of the refractive error, despite having mild hyperopia.

**Table 1. Clinical characteristics of the patients admitted/referred to the strabismus unit during COVID-19 pandemic**

Patient no.	Age (years)	Gender	Initial complaint	Diagnosis	MRI	Etiology	Treatment
1	4	M	Ocular deviation	Right sixth CN palsy; papilledema	Leptomeningeal metastases	Atypical teratoid rhabdoid tumor	Chemo-radiation therapy
2	16	F	Double vision	Left fourth CN palsy	Supratentorial demyelinating plaques	Multiple sclerosis	Interferon beta 1a
3	12	F	Double vision	Bilateral sixth CN palsy	Herniation of the cerebellar tonsils, swelling of the upper pituitary surface	Intracranial hypotension	Follow-up
4	3	M	Ocular deviation	Acquired comitant esotropia	Increased perioptic cerebrospinal fluid distance	N/A	Follow-up
5	2	F	Ocular deviation	Acquired accommodative esotropia	Normal	Post-viral	Refraction
6	15	F	Double vision	Acquired comitant esotropia	Normal	N/A	Prism
7	3	M	Ocular deviation	Bilateral sixth CN palsy	Normal	Mycoplasma infection	Refraction
8	10	F	Ocular deviation and droopy eyelid	Left third CN palsy	Paramedian- mesencephalic infarction	Behçet's disease	Immunosuppressive therapy
9	10	F	Double vision	Bilateral sixth CN palsy; papilledema	Normal	Pseudotumor cerebri	Lumbar puncture, oral carbonic anhydrase inhibitors
10	15	M	Double vision	Right third and fourth CN palsy	Mesencephalic and pontine infarction	Neuro-Behçet's disease	Immunosuppressive therapy

M: Male, F: Female, CN: Cranial nerve, MRI: Magnetic resonance imaging, N/A: Not available

#### Case 5

A 2-year-old girl was assessed in the strabismus clinic due to ocular deviation lasting 3 days. She had a previous history of respiratory system infection 3 months before. Fixation preference was grade 4 and she had 30 PD right esotropia. Dynamic retinoscopy revealed no accommodative response in either eye. Ocular motility was normal bilaterally. The anterior and posterior segments were normal. Refraction errors in the right and left eyes were +4.75 and +5.00 diopters (D), respectively. Neurological examination and MRI were normal. The patient was diagnosed with acute-onset accommodative esotropia and underwent full refractive correction.

#### Case 6

A 15-year-old girl with double vision for 8 months was evaluated. Visual acuity was 20/20 with -1.00 D refractive correction. She had 10 PD left esotropia with a fixation preference of grade 1. Abduction was -0.5 limited in both eyes. Neurological evaluation and MRI were normal. The patient was diagnosed with acute comitant esotropia and prismatic glasses were prescribed.

#### Case 7

A 3-year-old boy complaining of double vision was diagnosed with bilateral sixth nerve palsy. He had 30 PD left esotropia

with a fixation preference of grade 1 and -0.5 abduction limitation bilaterally. Neurological examination and imaging were completely normal. The only significant finding was positive immunoglobulin M for mycoplasma. The patient was followed up in the pediatric infection department.

#### Case 8

A 10-year-old girl with left eye ptosis, diplopia, and ataxic gait was transferred from the emergency department to the strabismus outpatient clinic. The patient had no documented systemic condition. She exhibited right head tilt. Margin reflex distance was 5 mm and 3 mm and best corrected visual acuity was 20/25 and 20/32 in the right and left eyes, respectively. She had 14 PD left hypotropia and 8 PD left exotropia. All ocular movements were -4 limited except abduction (Figure 1). Her pupils were anisocoric and the direct light reflex was weak in the left eye. Fundus examination was normal. The patient was diagnosed with left cranial third nerve palsy and MRI revealed an acute infarction in the left paramedian of the mesencephalon. Incomplete Behçet's disease was suspected.

#### Case 9

A 10-year-old girl with precocious puberty presented to the emergency department due to double vision lasting 10 days.

The patient exhibited a 20° face turn to the left and had 25 PD left esotropia. Ocular movements were -2 limited in abduction bilaterally. Dilated examination of the fundus revealed stage 3 papilledema. The patient had bilateral sixth cranial nerve palsy. She was diagnosed with pseudotumor cerebri following a detailed neurological examination.

#### Case 10

A 15-year-old previously healthy adolescent boy was referred from the emergency department to the outpatient strabismus clinic with a 10-day history of diplopia, loss of balance, nausea, and numbness in the mouth. Best corrected visual acuity was 20/20 in both eyes. He had 30 PD right exotropia and 20 PD hypertropia. With the exception of abduction and depression, all eye movements were -4 limited (Figure 2). He was diplopic in all quadrants except left and down gaze. No convergence was observed in the right eye. The pupils were anisocoric. Relative afferent pupillary defect was observed in the right eye. The structures of the anterior segment and the fundus were normal. The patient had right cranial third and fourth nerve palsy and

MRI showed acute mesencephalon and pons infarction. Neuro-Behçet's disease was suspected in the etiology of the patient's central nervous system vasculitis.

#### Discussion

The major dilemma during the COVID-19 outbreak was whether going to the hospital or staying at home would be better for people's well-being. During the quarantine period, many people with pre-existing conditions requiring follow-up sought ways to manage their conditions without going to hospitals.<sup>12</sup> The most popular of these solutions was self-examination and communication via teleconference with the physician.<sup>13</sup> This approach was adopted in particular by the high-risk group older than 65 years of age and having multiple chronic diseases. However, there are problems that cannot be adequately addressed without going to the hospital. The sudden onset of heterotropia or diplopia is among these conditions. Sudden-onset heterotropia and diplopia is a serious condition that frightens patients and their relatives cosmetically and concerns ophthalmologists etiologically.



**Figure 1.** Nine diagnostic gaze positions of patient 8. Left hypotropia and exotropia in primary position. All ocular movements were -4 limited except abduction in the left eye



**Figure 2.** Nine diagnostic gaze positions of patient 10. Right exotropia and hypertropia in primary position. All ocular movements were -4 limited except abduction and infraduction in the right eye

While people who need glasses can wait a few weeks, those with diplopia prefer to go to the ophthalmologist immediately. However, during the COVID-19 pandemic, the patient or parent was so afraid of being infected with COVID-19 that despite this very disturbing symptom, they decided to delay seeking treatment. In the present study, patients waited 3-20 days before presenting to the hospital.

Due to COVID-19, examinations were postponed for many patients being followed up in the pediatric ophthalmology and strabismus unit. Operations for strabismus cases requiring surgery were also canceled after conducting a risk-benefit analysis.<sup>14</sup>

However, all patients in this report presented to our clinic with sudden-onset clinical pictures that warranted urgent examination, and all were referred to the neurology department. The most common causes of heterotropia or diplopia in this series were acute comitant esotropia and sixth nerve palsy. There are many different causes of abducens palsy. In the pediatric age group, the most common causes of sixth nerve palsy are intracranial tumors and head trauma.<sup>15</sup> Our series also included a case with intracranial etiology.

Acute comitant esotropia may result from acute disruption of fusion due to near work, patching, trauma, illness, or psychophysical stress.<sup>16</sup> The COVID-19 pandemic has created a great deal of tension, especially for children.<sup>17</sup> This stress may have impaired cranial compensation mechanisms and triggered acute comitant strabismus by disrupting motor fusion.<sup>16</sup> In addition, during the quarantine period there was increased exposure to digital screens among the pediatric age group, causing excessive accommodative convergence. This may explain the etiology of heterotropia detected in patients 4 and 6.

Almost all of our patients were diplopic. Diplopia is a very disturbing symptom. Monocular patching is generally advised until the etiology is determined and appropriate treatment can be initiated.<sup>18</sup> Patients are temporarily relieved when monocular patching eliminates one of the discordant images. However, to avoid cortical suppression in children, it is necessary to encourage binocular fusion.

One of the most important aspects of the present study is that numerous cases of acute diplopia or heterotropia were evaluated over a short period, namely 3 months. There may be several reasons for this. First and foremost, COVID-19, which is often asymptomatic in children, may cause an intracranial complication potentially resulting in acute diplopia or heterotropia.<sup>19,20,21,22</sup> Regrettably, the patients in this study were not tested for COVID-19 because diplopia was not included among the COVID-19 screening criteria early in the pandemic. Moreover, most hospitals affiliated with the Turkish Ministry of Health were designated as pandemic hospitals. Consequently, our hospital, which is a university hospital, experienced a sudden increase in admissions. As a result, we may have seen a false rise in the rate of acute diplopia and heterotropia.

It seems like the COVID-19 pandemic will persist for some time longer and nobody knows when it will end. Because of the

shortcomings of long-term isolation and the economical and sociological realities of Turkey, normalization policies have been implemented promptly. The risk of SARS-CoV-2 infection is higher in the pediatric ophthalmology and strabismus unit than in other clinics. This is mainly because the pediatric age group is being examined. It is not always possible to evaluate children without their crying. Adapting the examination environment to the child's interests; wearing colorful scrubs; turning the examination into a game; using colorful stickers, hand-paintings, and exciting and colorful toys; singing; and talking about cartoon characters may prevent the child from crying. These ideas are currently used in pediatric ophthalmology. However, this approach has become even more value during this time. Children cannot adapt to wearing masks as well as adults, and their glasses fog up frequently due to mask use. In our clinic, we addressed the issue of fogging glasses by applying a bandage to the patient's mask. Performing orthoptic tests and retinoscopy are almost impossible at a distance of 6 feet. Therefore, the use of a mask is obligatory for the pediatric ophthalmologist, if not for the child. In our clinic, examinations are performed while wearing a surgical mask over an N95 mask, and the surgical mask is replaced after each patient.

During the COVID-19 pandemic, appointments in our outpatient clinic were scheduled at 30-minute intervals, taking dilation waiting times into account, to ensure that patients did not encounter each other. One day prior to the appointment, the infection status of all patients and their parents was checked in the National Health System of the Turkish Ministry of Health. Additionally, at the entrance of Hacettepe University Hospital, patients were asked for their HES code (a code implemented by the Ministry of Health to monitor SARS-CoV-2 exposure and contact with COVID-19 patients) and their body temperature was measured using thermal cameras. Priority was given to urgent and forensic cases. Parents were reminded that only one parent could accompany the child during the appointment, that mask use was obligatory, and that they should not arrive before the appointment time. On the appointment day, even if the patient's system check was clear, if they exhibited any symptoms consistent with upper respiratory tract infection, the appointment was postponed until the patient's situation was determined and they were directed to the appropriate unit for COVID-19 screening. Only one family was allowed in the waiting room at a time, the examination room was ventilated regularly, the number of people in the examination room was reduced as much as possible, and the patient was instructed to wait outside the hospital for pupil dilation to occur.

#### Study Limitations

Additionally, patients scheduled for occlusion therapy check-ups were interviewed via teleconference one day prior to the appointment date to ascertain their compliance with the occlusion treatment. If the patient was not implementing the recommended occlusion treatment, they were reminded to adhere to occlusion therapy and their appointment was rescheduled to a later date.

## Conclusion

In conclusion, for physicians working in pediatric ophthalmology and strabismus, adaptation to personal protective equipment during the COVID-19 pandemic has been more challenging than in other ophthalmological units because of the close proximity between the ophthalmologist and the patient. Since the end of the pandemic cannot yet be determined, appropriate measures should be taken in terms of personal protective equipment during examinations. It should be borne in mind that acute-onset complaints and underlying neurological conditions seemed to be more frequent during the pandemic. However, different country-based reports and large-scale multicenter studies from all over the world will contribute to global knowledge and experience and help improve our understanding of the pathogenesis of COVID-19.

## Ethics

**Ethics Committee Approval:** Hacettepe University Non-Interventional Clinical Research Ethics Committee (date: 01.09.2020/decision no: 2020/14-36).

**Informed Consent:** Informed consent was obtained from the patients' legal guardians.

**Peer-review:** Externally peer reviewed.

## Authorship Contributions

Surgical and Medical Practices: D.Y., H.T.Ş., Concept: D.Y., H.T.Ş., Design: D.Y., H.T.Ş., Data Collection or Processing: D.Y., H.T.Ş., Analysis or Interpretation: D.Y., H.T.Ş., Literature Search: D.Y., H.T.Ş., Writing: D.Y.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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