


A case of retinal vascular involvement in a 6-year-old patient with Covid-19

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Abstract

Purpose: This study evaluated fundus changes in a 6-year-old child who contracted Sars-CoV-2 without developing symptoms of the disease.

Materials and methods: The patient underwent a complete ophthalmic evaluation, which included assessment of visual acuity with and without correction, extensive ophthalmological examination, cycloplegic refraction by retinoscopy and funduscopic examination, OCT, and angio-OCT examination.

Results: Fundoscopic examination in a young patient with previous Sars-CoV-2 infection showed marked vascular tortuosity, evident both at the posterior pole and retinal periphery, especially on the arterial vasculature, and cotton wool spots along the retinal vessels, highlightable also at OCT and angio-OCT examination. These alterations persist at a 6-month follow-up.

Conclusions: In COVID-19 infection, even in asymptomatic pediatric patients, vasculitis develops also affecting the retinal vessels, appreciable on fundus examination. A thorough eye examination in all COVID-19 patients with close follow-up is therefore important. This is the first case report on retinal changes in a pediatric patient.

Keywords

Cotton wool spots, COVID-19, eye, fundus, retina, vascular tortuosity, vasculopathy

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Introduction

In December 2019, a cluster of cases of pneumonia of unknown etiology was reported in the Chinese city of Wuhan, attributable to a new coronavirus (SARS-CoV-2) as the causative agent of the respiratory disease later called COVID-19. Notification rates of COVID-19 cases have steadily increased to reach 100 million confirmed cases worldwide since the start of the pandemic, with over two million deaths attributable to COVID-19.

To penetrate inside the body, COVID-19 uses the angiotensin-converting enzyme 2 (ACE2) receptor, widely spread throughout the body and in particular expressed with a high density by vascular endothelial cells of lung, heart, kidney, intestine, and brain.¹ ACE2 receptor is also expressed by retinal endothelial cells.

We report the case of a patient who contracted COVID-19 and, visited after clinical recovery (i.e. after two negative throat swabs) showed fundus changes.

Case description

We reported a case of a 6-year-old boy, followed at the Pediatric Ophthalmology Clinic of the Salerno Hospital for mixed astigmatism.

The study was conducted according to the criteria set by the declaration of Helsinki and the parents of the minor patient provided a written informed consent before participating to the study.

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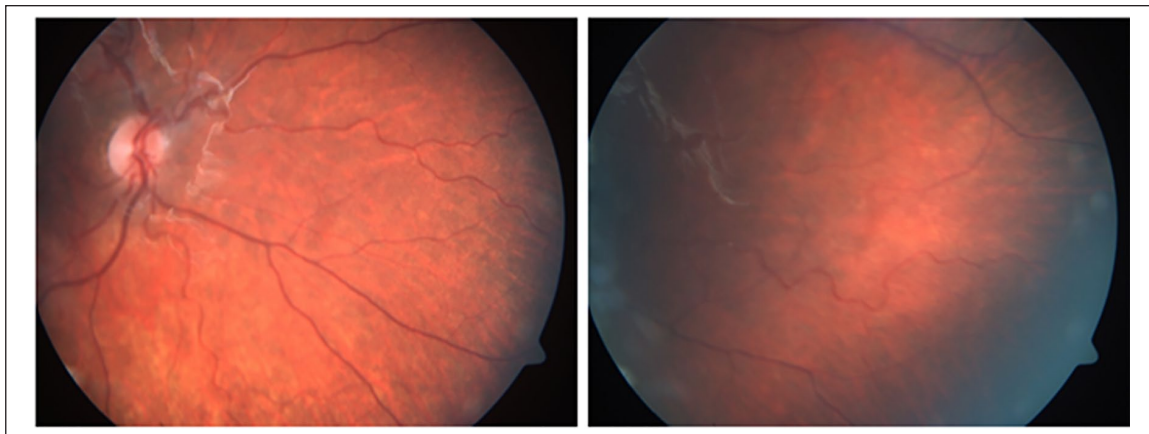


Figure 1. Ocular fundus of both eyes at the first post-Covid 19 visit, showing marked vascular tortuosity, equally visible at the posterior pole and retinal periphery, especially on the arterial vasculature, and cotton wool spots along the retinal vessels.

The patient contracted COVID-19 infection in March 2020, but he did not manifest any symptoms.

The last pre-COVID visit was carried out in January 2020, while the first post-COVID visit was carried out in August 2020.

On both occasions, the patient underwent a complete ophthalmic evaluation, which included assessment of visual acuity with and without correction, extensive ophthalmological examination, cycloplegic refraction by retinoscopy and funduscopy examination.

The patient had no pre-existing pathologies.

The patient was followed every 6 months, and he never manifested a decreased visual acuity.

In January 2020 fundus examination was within normal limits, characterized by a normal appearance of optic disc, macular reflex, retinal vasculature, and retinal periphery.

After COVID-19 infection, the patient's ocular fundus appeared altered: we found a marked vascular tortuosity, evident both at the posterior pole and retinal periphery, especially on the arterial vasculature (Figure 1).

Therefore, we decided to carry out an OCT (Figure 2(a)) and angio-OCT (Figure 2(b)) examination.

In addition, the patient performed coagulation blood tests, including pro-thrombin time (PT) and partial thromboplastin time (PTT). All exams were within normal limits.

After 2 months from the first recognition we repeated ophthalmic and funduscopy examination, and no differences were found (Figure 3).

The main ocular manifestations identified in COVID-19 patients are conjunctivitis, hyperemia, chemosis, epiphora, or increased ocular secretions. These symptoms were found in 31.6% of the patients studied by Wu et al.² in a work on 38 patients. According to this study, patients with ocular symptoms are more likely to experience neutrophilic leukocytosis, and increased procalcitonin, C-reactive protein (CRP) and lactic acid dehydrogenase (LDH).

Indeed, it appears that COVID-19 can affect both conjunctiva and retina, because they both have proteins

which the virus binds to. In addition to the ACE2 receptor, COVID-19 can also bind Transmembrane Serine Protease 2 (TMPRSS2), CD147, and Cathepsin L (CTSL).³ These evidences are confirmed by an autopsic study conducted by Casagrande et al.,⁴ who performed retinal biopsies on 14 patients who died from COVID-19. Among them, viral RNA was identified in retinal biopsies of three patients.

The SERPICO-19 study involved 54 patients affected by COVID-19, evaluating the fundus changes, and having as a control group subjects not exposed to the virus. From this study, it emerges that the main alterations seen in the COVID-19 group are dilated veins (27.7%), tortuous vessels (12.9%), hemorrhages (9.25%), and cotton wool spots (7.4%).⁵ Comparing the two groups, the difference in mean arteries diameter (MAD) and in mean venous diameter (MVD) was statistically significant. MVD was larger in severe cases.⁵

A case report conducted on 12 adult patients, symptomatic but with normal blood chemistry parameters, allowed to evaluate the subclinical alterations of the retina. All patients showed bilateral hyper-reflective lesions at the level of ganglion cell and inner plexiform layer, especially at the papillomacular bundle. Subtle cotton wool spots and microhaemorrhages along the retinal arcade, observed on fundus examination, were evident in one third of patients.⁶

Vascular tortuosity and cotton wool spots were found also in our 6-year-old patient.

The mechanism behind retinal vascular dilation in patients with COVID-19 is not entirely clear. Both the veins and the arteries could dilate because of the inflammatory mediators released, as a response of the host against the virus.⁷

Variation of the retinal arteries can occur in response to an increase in CO₂, a decrease in O₂,⁸ or secondary to compromised drainage.⁹

Laboratory parameters more frequently altered in COVID-19 patients, especially in high severity disease,

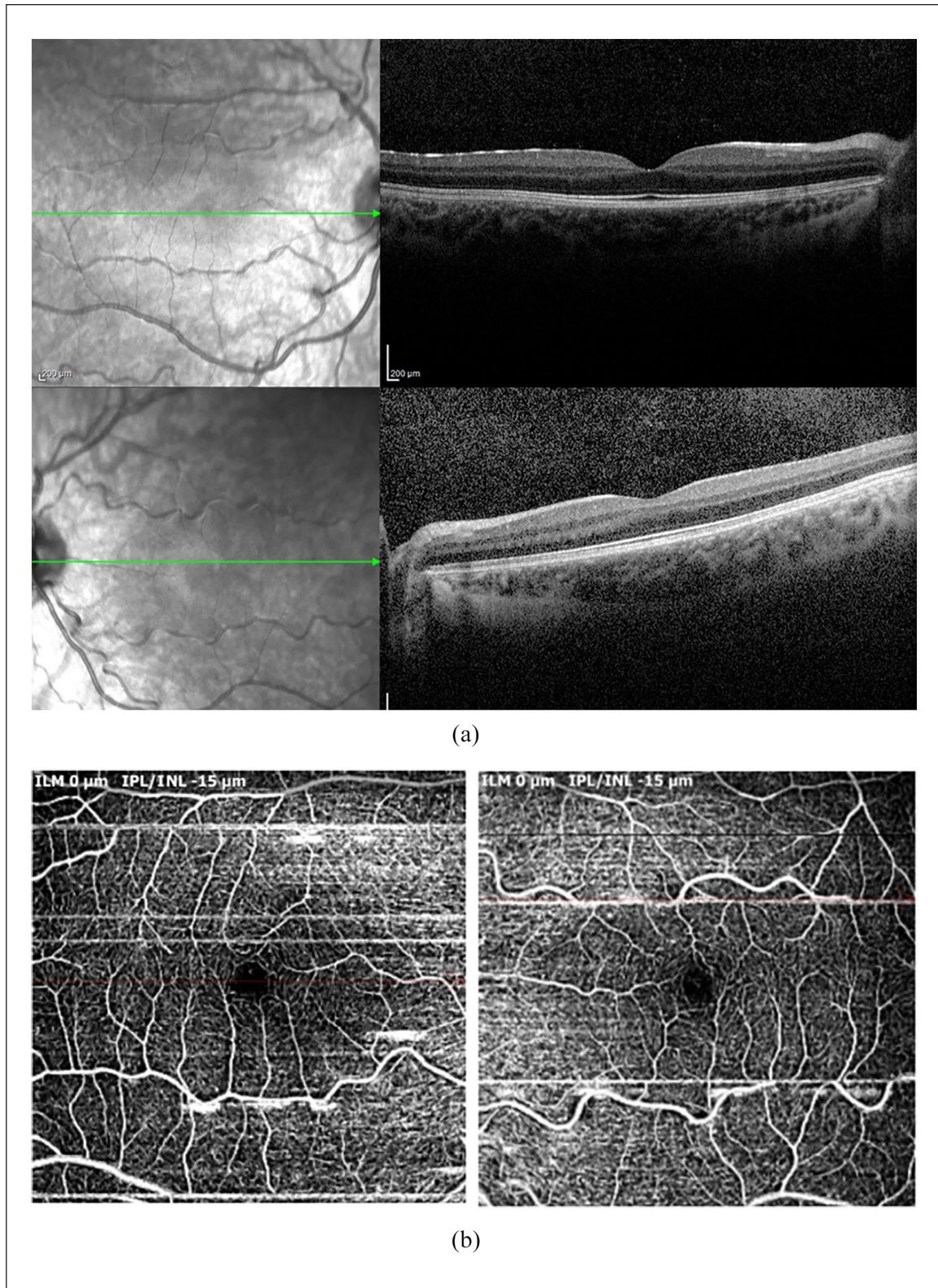


Figure 2. (a) OCT of the right and of the left eye (Heidelberg Spectralis OCT). Cotton wool exudates are visible, as superficial hyper-reflective retinal nodules in contact with the superficial retinal layers. Because of their density, they produce a screen effect on posterior layers. (b) Angio-OCT of the right eye and of the left eye (SOCT Copernicus REVO). Tortuous aspect of the superficial retinal plexus (located in the layer of ganglion cells and nerve fibers) and of the deep retinal plexus (at the internal nuclear and external plexiform layers).

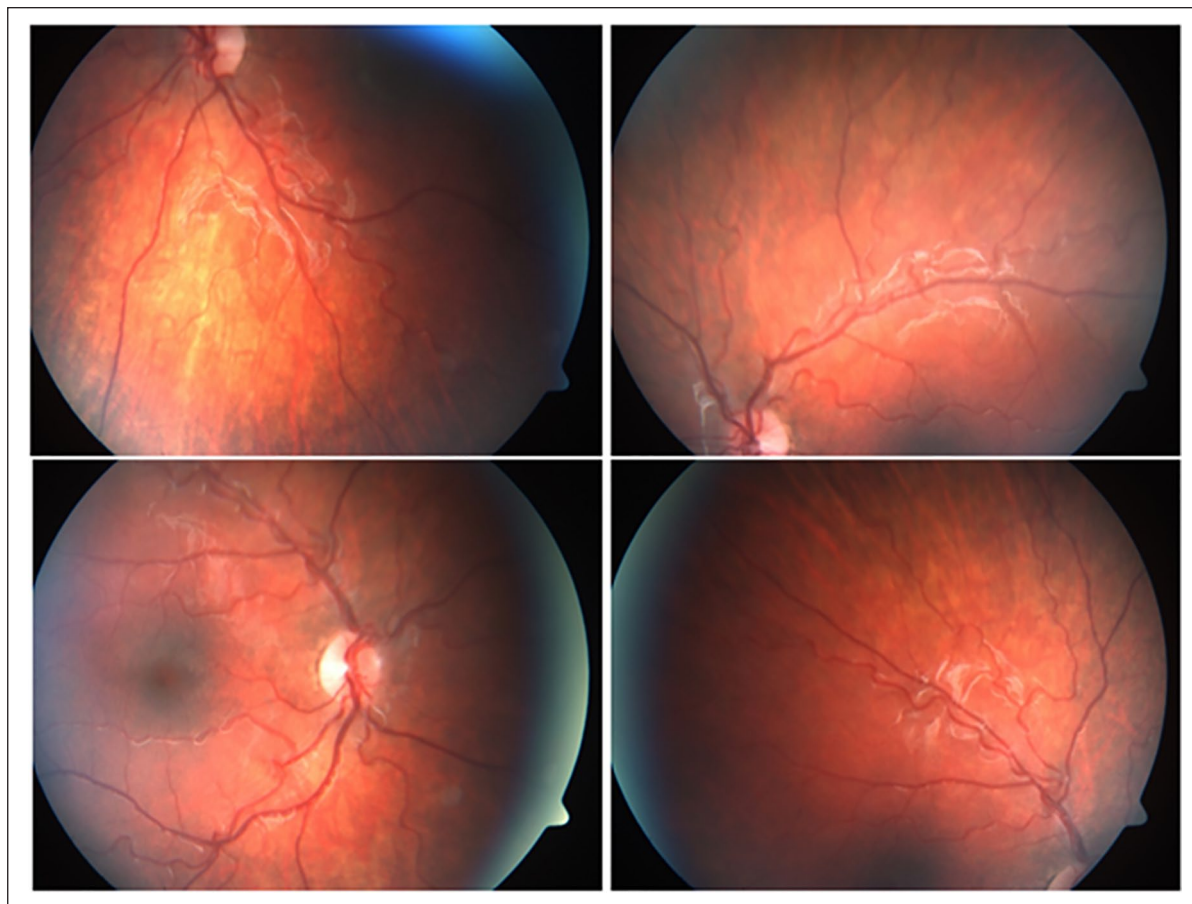


Figure 3. Ocular fundus of both eyes at the first post-Covid 19 follow-up, unchanged from the previous one.

are pro-thrombin time (PT) and partial thromboplastin time (PTT) prolongation and D-Dimer and fibrin degradation products increase.¹⁰

A very recent case report highlighted another retinal vascular disorder in a 46-year-old North African patient with hereditary spherocytosis, who developed bilateral macular hemorrhages after COVID-19 infection. The authors assumed SARS-CoV-2 was involved in the onset of an acute, temporary cold-agglutinin hemolytic anemia, causing endothelial anoxia eventually leading to retinal bleeding.¹¹

Conclusions

In conclusion, this case report suggests to carry out an accurate funduscopy examination in all patients with COVID-19. This evaluation should be conducted in both adults and children, symptomatic and asymptomatic.

At the best of our knowledge this is the first case report of a pediatric asymptomatic patient who shows ocular outcomes of COVID-19.

Nowadays we cannot exclude the reversibility of the findings, and for this reason a complete ophthalmic evaluation, including funduscopy examination, should

be performed on each patient, of any age, affected by COVID-19.

Declaration of conflicting interests

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