

Adie's tonic pupil: A potential etiological link with COVID-19

Buse Çağla Ari¹, Zeynep Utku¹, Ali Sarpkaya²

¹Department of Neurology, Bahçeşehir University Faculty of Medicine, İstanbul, Türkiye

²Department of Ophthalmology, Pendik Medical Park Hospital, İstanbul, Türkiye

Adie's pupil, or tonic pupil, is characterized by unilateral or bilateral pupil dilation, reduced or absent light reflexes, and abnormal adjustment reflex. It affects around 2 per 1,000 individuals, predominantly females, with an average onset at 32 years.^[1,2] The asymmetry in Adie's pupil stems from the ciliary body's greater parasympathetic innervation compared to the pupillary sphincter.^[1] A tonic response occurs when the near reflex is activated, leading to an abnormal, prolonged pupillary reaction that mimics accommodation. Reinnervation and postsynaptic receptor upregulation after ciliary ganglion damage cause denervation hypersensitivity, with exaggerated cholinergic responses. Diagnosis involves observing tonic constriction after pilocarpine instillation. Often idiopathic, Adie's pupil may be linked to viral infections, immune disorders, paraneoplastic syndromes, and trauma. Viral infections, such as syphilis, Lyme disease, herpes viruses, and influenza, are commonly implicated.^[1-4] During the coronavirus disease 2019 (COVID-19) pandemic, potential links between COVID-19 and Adie's pupil were reported.^[2,3] Herein, we described a case of Adie's pupil, potentially associated with COVID-19.

A 33-year-old male was admitted with pupil asymmetry and blurred vision. The patient reported a significant dilation of the left pupil without pain, eyelid drooping, or restricted eye movements for four months. After initial evaluation by an ophthalmologist, the patient was

referred with a preliminary diagnosis of third cranial nerve palsy. He had no chronic illness, medication use, smoking, or alcohol consumption history but noted a COVID-19 infection one month before presentation. The family history was normal. Neurological examination showed a 3-mm right pupil and a 5-mm left pupil, with normal light reflexes in the right eye, and absent reflexes in the left. Pursuit and saccadic movements were normal, and the deep tendon reflexes were intact. Contrast-enhanced cranial magnetic resonance imaging, as well as magnetic resonance angiography and venography, were unremarkable, and contrast-enhanced thoracic computed tomography excluded an apical tumor. Paraneoplastic markers were negative, and hemoglobin A1c levels were within normal limits (5.96%). After excluding intracranial pathologies, the patient was referred back to the ophthalmologist for further evaluation of anisocoria. Intraocular pressure was 16 mmHg in the right eye and 15 mmHg in the left. Examination showed vitreous degeneration and a retinal pigment epithelium defect in the left macula, with normal optical coherence tomography results. Fundus fluorescein angiography demonstrated retinal pigment epithelium changes and hyperfluorescence in the mid-periphery and the left parafoveal area, with a normal optic nerve. A 0.1% pilocarpine test indicated a pupillary light reflex in the left eye 45 min after instillation. Based on these findings, the patient was diagnosed with Adie's tonic pupil, with COVID-19 as the suspected

Correspondence: Buse Çağla Ari, MD. Bahçeşehir Üniversitesi Tıp Fakültesi Nöroloji Anabilim Dalı, 34734 Kadıköy, İstanbul, Türkiye.

E-mail: busecaglaari@gmail.com

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etiology, given the lack of other causative factors and the association of imaging findings with viral infections. Symptoms resolved six months later. Written informed consent was obtained from the patient.

This case suggested a link between Adie's tonic pupil and COVID-19. Thorough clinical examination, lab tests, and imaging excluded other causes, implicating COVID-19 based on the infection history. Our observations align with reports of neurological manifestations of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Tonic pupil occurrences were reported with COVID-19, often theorized to result from post-viral, immune-mediated injury rather than direct viral central nervous system invasion. In this case, the tonic pupil developed after COVID-19 symptoms resolved, consistent with the literature.^[2,5] Angiotensin-converting enzyme 2, a receptor for SARS-CoV-2, is expressed in lung mucosa, gastrointestinal tract, and ocular tissues, suggesting infection routes.^[3] Ocular manifestations, including conjunctivitis, were reported, and retinal changes were documented after COVID-19 onset.^[3,6] These findings warrant attention as they contribute to understanding COVID-19's potential ophthalmic implications. Further studies are needed to fully elucidate the peripheral and central neurological effects of COVID-19.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

1. Xu SY, Song MM, Li L, Li CX. Adie's pupil: A diagnostic challenge for the physician. *Med Sci Monit* 2022;28:e934657. doi: 10.12659/MSM.934657
2. Ordás CM, Villacieros-Álvarez J, Pastor-Vivas AI, Corrales-Benítez Á. Concurrent tonic pupil and trochlear nerve palsy in COVID-19. *J Neurovirol* 2020;26:970-2. doi: 10.1007/s13365-020-00909-1.
3. Ortiz-Seller A, Martínez Costa L, Hernández-Pons A, Valls Pascual E, Solves Alemany A, et al. Ophthalmic and neuro-ophthalmic manifestations of coronavirus disease 2019 (COVID-19). *Ocul Immunol Inflamm* 2020;28:1285-9. doi: 10.1080/09273948.2020.1817497.
4. Aslan K, Bozdemir H, Bıçakcı Ş, Demir T, Öztürk İ, Çelik T. Nörosifiliz: Farklı prezantasyonları. *Türk J Neurol* 2012;18:168-172. doi: 10.4274/Tnd.46794
5. Feizi M, R Isen D, Tavakoli M. Neuro-ophthalmic manifestations of coronavirus disease 2019 and its vaccination: A narrative review. *J Ophthalmic Vis Res* 2023;18:113-22. doi: 10.18502/jovrv18i1.12731.
6. Marinho PM, Marcos AAA, Romano AC, Nascimento H, Belfort R Jr. Retinal findings in patients with COVID-19. *Lancet* 2020;395:1610. doi:10.1016/S0140-6736(20)31014-X.