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Mydriasis and Ophthalmoplegia in a 10-Year-Old Girl: A Diagnostic Predicament

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Authors' contributions

This work was carried out in collaboration among all authors. Author MH prepared the case presentation, drafted the treatment options and contributed significantly to the discussion section of the manuscript. Author KG contributed to the research, drafting the discussion and editing as part of the manuscript preparation. Author AK led the case management, conducted all ophthalmologic examinations and supervised the preparation of this manuscript. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

This case reports a 10-year-old girl who presented with sudden-onset diplopia and bilateral mydriasis following a recent upper respiratory infection. Ocular examination showed poor light response and mild abduction deficits. Initial low-resolution MRI was normal, but a high-resolution MRI revealed bilateral enhancement of the abducens and oculomotor nerves. Viral-induced cranial

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nerve palsies were suspected. The use of systemic steroids was considered but concerns about side effects in children led to a conservative approach. Patient achieved full recovery four months later. This case highlights the importance of high-resolution imaging in diagnosing cranial nerve palsies in children and raises questions about the role of corticosteroids in managing viral-induced neuropathies. Further research is needed to determine optimal treatment strategies for such cases.

Keywords: Mydriasis; ophthalmoplegia; lateral rectus palsy; viral-induced; paediatrics; paediatric ophthalmology; neuro-ophthalmology.

1. INTRODUCTION

Mydriasis is due to stimulation of the iris dilator muscle, compromise of the parasympathetic tone of the iris sphincter muscle, or both (Rathnasiri et al., 2024). Bilateral mydriasis typically arises when sympathetic innervation exceeds parasympathetic innervation (Kang et al., 2024). This is frequently associated with systemic disorders such as Miller-Fisher syndrome or Botulism, pharmaceutical agents, midbrain lesions (specifically in the pretectal area and third nerve nuclei), iris ischaemia due to vasculitis or atherosclerosis, or autoimmune autonomic ganglionopathy (Xu et al., 2021).

Ophthalmoplegia refers to the condition of the paralysis of eye muscles, which can be caused by various factors such as nerve damage, systemic diseases, or genetic mutations (Park et al., 2019; Albayram et al., 2006; Kobayashi et al., 2017). Viral aetiologies of mydriasis and ophthalmoplegia are rare. This study is a case of acute mydriasis and ophthalmoplegia in a girl.

2. CASE PRESENTATION

A 10-year-old Caucasian girl presented to an eye center with sudden onset diplopia and bilateral mydriasis. One week earlier, while on holiday, she became unwell with lethargy, headaches, fever and progressive cough. She was diagnosed with upper respiratory tract infection and was managed conservatively with gradual resolution of her systemic symptoms. She had no previous ocular history and denied any trauma.

On examination, best-corrected Snellen visual acuity was 6/6 either eye. There was bilateral symmetrical mydriasis with poor response to light and accommodation (Fig. 1A). There was no ptosis. On extra-ocular muscle testing the child exhibited -2 abduction deficit in the right and -1 abduction deficit in the left. Anterior segments appeared healthy and dilated fundoscopy was unremarkable. There were no other neurological findings on examination.

Blood investigations including infectious screen, autoimmune screen, aquaporin-4 and myelin oligodendrocyte glycoprotein and anti-gangliosides antibodies were all negative. Low-resolution magnetic resonance imaging (MRI) of the brain and orbits with contrast enhancement did not reveal any abnormality. Lumbar puncture demonstrated normal cerebrospinal fluid (CSF) studies, including infections screen and oligoclonal bands, and the opening pressure was 21cmH20.

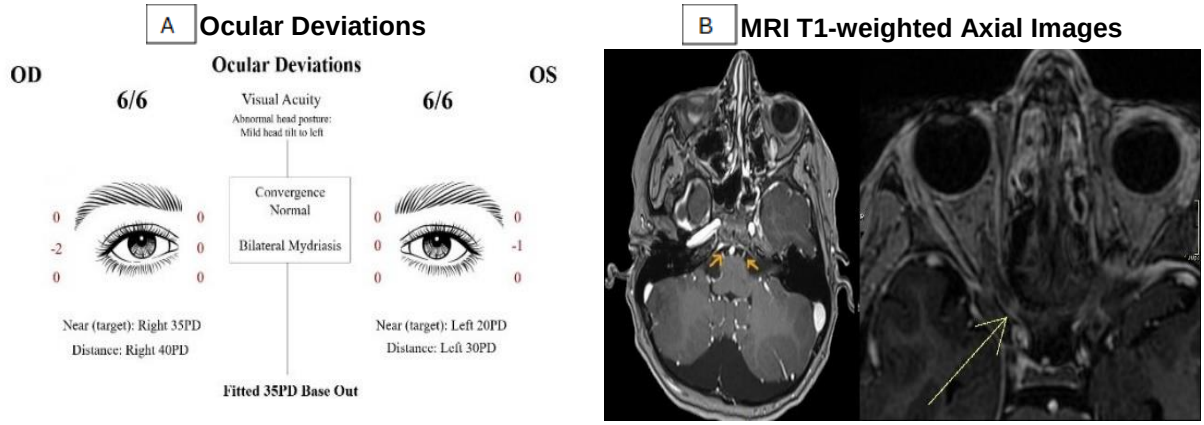

Fig. 1. A. The patient displayed bilateral esotropia and bilateral mydriasis; B. MRI T1 weighted axial images demonstrating bilaterally enhancing abducens nerves (left) and right oculomotor enhancing nerve (right)

Diagnosis: Suspected Viral Induced Cranial Nerve Palsies.

Next Step: Repeat high-resolution MRI of brain with contrast.

3. DISCUSSION

Acquired third, fourth, and sixth cranial nerve palsies are rare in children and often signal serious pathologies (Merino et al., 2010). Neoplasia and trauma are the leading causes in this age group for all three palsies. Prompt diagnostic work-up is crucial due to the potential for long-term loss of function and life-threatening conditions.

The initial diagnostic work-up of the patient did not confirm a diagnosis. Even though an infectious aetiology was suspected due to the temporal association with the preceding upper respiratory tract infection, it was necessary to exclude the possibility of neoplasia. The primary low-resolution MRI was reported as normal with no space occupying lesion or raised intracranial pressure but was considered inadequate in visualising cranial nerve pathways. Therefore, a multiplanar high resolution 3T MRI with contrast enhancement was requested which demonstrated bilateral abducens and oculomotor nerve enhancement (Fig. 1B).

Palsies of abducens, oculomotor or trochlear nerve may arise from disease processes which affect them at any point along their anatomical pathways. Each nerve travels along a highly stereotypical path beginning at the individual cranial nerve nuclei in the brain and terminating at the neuromuscular junction, where they innervate their respective extraocular muscle(s). Three-dimensional MRI steady-state free precession sequences and modified fully refocused steady-state sequences such as constructive interference in steady state (CISS) should be requested to allow detailed visualization of the cranial nerve pathways in patients with unexplained cranial nerve palsies.

A lumbar puncture was performed to rule out intracranial hypertension, which is rare in paediatric patients, as well as to assess for inflammatory, infectious, or infiltrative processes through CSF studies.Viral serology for common viruses was also undertaken and was negative. Due to the COVID-19 pandemic and recent travel history, COVID infection was suspected. The child had a negative rapid test on holiday but could not undergo a polymerase chain reaction (PCR). A PCR was performed 12 days after the onset of her systemic symptoms and was also negative. She did have though high levels of COVID antibodies with no previous history of vaccination and last confirmed COVID infection almost a year ago.

The treatment for viral-related oculomotor and abducens nerve palsy remains unclear. The palsy is often self-limiting, usually within months, and therefore a more conservative approach may be warranted (Merino et al., 2010). For symptomatic relief Fresnel prisms were fitted and the patient was asymptomatic in primary position.

There was a debate among the patient's physicians whether systemic steroids should be prescribed. The role of steroids in children with viral-induced cranial nerve palsy is not clear. Steroids have been used successfully in pediatric populations to treat oculomotor and abducens nerve palsies (Park et al., 2019). Steroids have been shown to hasten recovery in cranial nerve neuropathies caused specifically by COVID-19 (Zhang and Tang, 2021; Elenga et al., 2021). However, children are more susceptible to steroid side effects than adults (Deshmukh, 2007). Given the self-limiting nature of the palsies, the risk of significant adverse effects may not outweigh the benefits of corticosteroid administration. Nevertheless, more research is required to determine suitability of corticosteroids as a treatment.

Patient Outcome:

The repeat high-resolution MRI imaging helped localize the inflammation along the pathways of the oculomotor and abducens cranial nerves. The most likely diagnosis was viral related cranial nerve palsy, as most other aetiologies were excluded and there was a close temporal association with the preceding upper respiratory tract infection. COVID-19 was suspected but could not be proven. The patient attained full recovery four months from the onset of symptoms and remained symptom-free two years later.

4. CONCLUSION

Virally induced mydriasis and ophthalmoplegia is rare but important complication. Neoplasia and other causes of raised intracranial pressure must be excluded. Treatment was conservative with Fresnel prism lenses and the condition ultimately resolved four months after symptom onset. The specific viral aetiology was unclear although COVID-19 was suspected.

CONSENT

As per international standards, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

ACKNOWLEDGMENT OF DATA ACCESS

All authors had full access to the data in this case and take responsibility for the integrity of the data and the accuracy of the analysis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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