CASE REPORT

A Puzzling Ocular Motility Disorder: Apparent Up-Gaze Fatigability in a Patient With Oculomotor Nerve Compression

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ABSTRACT

We report the case of a woman who developed right third nerve dysfunction with synkinesis and ocular neuromyotonia secondary to a compressive arterial aneurysm. Surprisingly, our examination showed a downward drift of the right eye in sustained up-gaze resulting in transient hypotropia, suggesting either fatigability of the superior rectus or contraction of the inferior rectus. We believe this ocular motility pattern is secondary to a co-contraction of the inferior rectus in up-gaze caused by synkinesis (explaining the downward drift), followed by failure of the inferior rectus to relax upon return to primary position caused by ocular neuromyotonia (explaining the hypotropia).

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Case report

A 58-year-old woman complained of transient binocular vertical diplopia and fluctuating position of the right eyelid for five months. These episodes occurred several times per day after looking to the left or up, and they fully resolved after 30 seconds. There was no prior ophthalmic or neurological history, and her neurologic examination was unremarkable. Visual acuities were 20/20 with normal fundusoscopic examination and full visual fields in both eyes. There was slight ptosis in the right eye (OD) in primary position (Figure 1). The ocular motor examination showed mild limitation of elevation (Figure 2A) and depression OD with comitant vertical misalignment in up- and down-gaze, as well as slight upper eyelid retraction in down-gaze (Figure 2B), and full eye movements in the left eye. She had a 2-diopter hypophoria OD in primary position. Pupils were round, equal, and reactive to light in dark and light. Sustained left eccentric gaze resulted in delayed eyelid retraction followed by transient esotropia with right hypotropia (Figure 3, see video 1) and limitation of abduction OD upon return to primary position, which fully resolved after a few seconds.

Surprisingly, sustained up-gaze showed a delayed and slow downward drift OD (Figures 2A and 4, see video 2), ultimately leading to a subtle right hypotropia with eyelid retraction (Figure 5) upon return to primary position. There was no abnormality in sustained right gaze, change in pupillary size, or globe retraction throughout the examination.

Interpretation and discussion

Ptosis OD with eyelid retraction in down-gaze, suggesting synkinesis, associated with a deficit of elevation and depression OD raised concern for third nerve dysfunction secondary to a compressive lesion. Brain magnetic resonance imaging (MRI) with MR angiography showed a right posterior communicating artery aneurysm abutting the right third cranial nerve (Figure 6). In addition to the limitation of vertical ocular motility, our patient's medial rectus and levator palpebrae OD failed to relax following normal contraction in adduction and up-gaze, respectively. This ocular motor pattern is diagnostic for ocular neuromyotonia (ONM) involving the third cranial nerve,^{1–3} which is commonly associated with eyelid

Figure 1. Primary position at rest. The patient has slight ptosis in the right eye, and there was no difference in pupil size.

Figure 2. Ocular motility pattern in vertical gaze. (A) Limitation of elevation of the right eye. (B) Mild limitation of depression with slight eyelid retraction in the right eye in down-gaze.

Figure 3. Ocular motility pattern after sustained left eccentric gaze upon return to primary position showing esotropia, hypotropia, and eyelid retraction in the right eye.

synkinesis.^{1,2,4-6} The patient was started on carbamazepine 200 mg twice daily which reduced the frequency of the spells by the 3-week follow up. A coil embolisation of the aneurysm was ultimately performed, but the patient was lost to follow up.

In this report, our patient presented with an unexpected ocular motor pattern in sustained up-gaze consisting of a delayed and slow downward

Figure 4. Ocular motility pattern during sustained up-gaze. The picture was taken 15 seconds after the picture of Figure 2A. Sustained up-gaze revealed gradual downward drift of the right eye.

Figure 5. Ocular motility pattern after sustained up-gaze. Upon return to primary position, there was an obvious upper eyelid retraction with subtle hypotropia (not visible on the figure).

Figure 6. MR imaging, axial cut, constructive interference in the steady state (CISS) sequence. A right posterior communicating artery aneurysm (long arrow) abuts the right third cranial nerve (short arrow).

drift OD, ultimately resulting in hypotropia upon return to primary position. In the context of ONM and synkinesis, how could we explain such an ocular motility pattern? Although the clinical presentation is stereotyped when the fourth or the sixth cranial nerves are involved, ONM involving

the third cranial nerve includes a wider range of clinical presentations, with full^{2,4,7,8} or partial^{1,5,9–11} contraction of ocular muscles, with or without pupil involvement. We would have expected the patient to be able to sustain up-gaze with subsequent transient hypertropia (reflecting the failure of relaxation of the superior rectus) instead of her slow downward drift OD followed by hypotropia upon return to primary position. This ocular pattern was somewhat atypical, suggesting either fatigability of the superior rectus or paradoxical contraction of the inferior rectus in sustained up-gaze.

Gaze fatigability remains a hallmark of ocular myasthenia gravis.^{12,13} However, we do not believe that our patient had superimposed myasthenia gravis. First, she did not respond to pyridostigmine and had a negative workup, including electromyography, chest computerised tomography scan, and an absence of acetylcholine receptor antibodies. Second, eyelid retraction following sustained up-gaze (instead of ptosis) would be atypical for myasthenia gravis, indicating the levator palpebrae failed to relax, the hallmark of ONM. Finally, according to the law of parsimony, superimposed myasthenia gravis was unlikely, as each of these conditions is rare. Other differential diagnoses, including early thyroid disease, acquired Brown syndrome, and cyclic oculomotor nerve paresis and spasms were also unlikely, as she had normal thyroid function with normal appearance of the ocular muscles and the orbit on MRI, no worsening of the limitation of elevation in adduction, no prior history of strabismus in her childhood, and we failed to notice any continuous and predictable cycles of paresis and spasms.

As previously reported,¹⁴ some patients with third nerve dysfunction may have mild vertical restriction (without palsy) secondary to synkinesis-related co-contraction of the superior and inferior recti, occasionally associated with retraction of the eyeball. This phenomenon can be easily mistaken for a partial third nerve palsy. A key to understanding this peculiar ocular pattern is to consider our patient's mild limitation of vertical motility as a restrictive process related to co-contraction of the vertical recti, and not as

a third nerve palsy *per se*. Although we did not check the eye pressure in up-gaze and our examination did not show any retraction of the eyeball,¹⁴ we hypothesize that the pseudo-gaze fatigability ultimately resulting in transient hypotropia upon return to primary position was secondary to a co-contraction of the inferior rectus in up-gaze caused by synkinesis (explaining the downward drift), followed by failure of relaxation of the inferior rectus caused by ONM (explaining the resulting hypotropia upon return to primary position). The delayed and greater contraction of the inferior rectus still remains unclear but might stem from progressive recruitment of the axons involved with the inferior rectus in up-gaze at the site of the lesion (ephaptic neural transmission, i.e., axon-to-axon crosstalk¹⁴).

Conclusion and take-home message

Although myasthenia gravis, early thyroid eye disease, and decompensated heterophoria are by far the most common causes of transient binocular diplopia, ocular neuromyotonia should be considered when the episodes of diplopia always occur under the same circumstances, usually when sustaining gaze to a specific eccentric direction. Patients report a history of radiation therapy in the head area in 50% of cases, but chronic compression of the ocular motor nerves is not entirely exceptional, as seen in this report. In this setting, compression of the third cranial nerve may yield a complex ocular motility pattern resulting from different mechanisms, including oculomotor palsy, restriction phenomenon, synkinesis, and ocular neuromyotonia, which might lead to confusion during examination. There is not definite cure for ocular neuromyotonia, but carbamazepine therapy has been proposed to reduce the frequency of spells.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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