

# Trochlear nerve palsy in a boxer after a bout

## Abstract

Superior oblique palsy as a result of injury to the cranial nerve (CN) IV (trochlear nerve) is the most frequent isolated CN palsy due to its long intracranial course. Isolated CN IV palsy has not been reported in combat sports. We report here a case of isolated CN IV palsy occurring after a boxing bout. Isolated CN IV palsy may present very subtly in a combat sports athlete and ringside physicians should be aware of its clinical presentation.

**Keywords:** double vision, diplopia, cranial nerve palsy, head trauma, contact sports, boxing

Volume 4 Issue 4 - 2020

Nitin K Sethi, MD,<sup>1</sup> John Boccio, DO<sup>2</sup>

<sup>1</sup>Department of Neurology, New York–Presbyterian Hospital, Weill Cornell Medical Center, USA

<sup>2</sup>NYU Winthrop Medical Affiliates, USA

**Correspondence:** Nitin K Sethi, MD, Associate Professor of Neurology, Comprehensive Epilepsy Center, New York–Presbyterian Hospital, Weill Cornell Medical Center, 525 East, 68th Street, New York, NY 10065, USA, Tel + 212–746–2346, Fax + 212–746–8845, Email [sethinitind@hotmail.com](mailto:sethinitind@hotmail.com)

**Received:** August 14, 2020 | **Published:** October 20, 2020

## Case report

After a 6-round professional boxing bout, a 24-year-old boxer complained of double vision in the right eye and a sensation of dragging of the right eye when asked to look towards the left. He denied any headache, nausea, dizziness, neck pain or weakness in the arms or legs. Neurological evaluation in the post-fight area revealed a conscious, alert and oriented boxer. When asked to look to the left, there was full abduction of the left eye. The right eye adducted but drifted upward relative to the left. Rest of the CNs and neurological evaluation was non-focal. The fighter was transported to the nearest Level I trauma center via ambulance for a complete neurological and ophthalmological evaluation.

## Discussion

The trochlear nerve (CN IV) is a pure motor CN (somatic efferent nerve) that innervates the superior oblique (SQ) eye muscle. It is the smallest CN in terms of the number of axons contained, has the longest intracranial course and exists from the dorsal aspect of the brainstem to innervate the SQ muscle contralateral to its nucleus.<sup>1</sup> The lateral rectus eye muscle is supplied by abducens nerve (CN VI) and the rest of the extra-ocular muscles are supplied by the oculomotor nerve (CN III). The trochlear nerve runs along the lateral wall of the cavernous sinus where it lies in close proximity to CN III, CN VI, V1 (ophthalmic) and V2 (maxillary) divisions of trigeminal nerve (CN V) as also the internal carotid artery. It enters the orbital via the superior orbital fissure to supply the SQ muscle. Due to its long intracranial course, the trochlear nerve is prone to compression and stretching injuries. Head trauma is the most common cause of acute CN IV palsy. Even minor head trauma as sustained during a close head injury such as a concussion can transiently stretch the nerve by displacing the brainstem relative to the posterior clinoid process causing SQ palsy. The nerve may also be affected by other intracranial processes which increase intracranial pressure or affect the cavernous sinus (cavernous sinus thrombosis) and superior orbital fissure (Tolosa-Hunt syndrome). Usually in the above cases the CN palsy is not isolated and various grades of ophthalmoplegia are documented

depending upon the extent of CN III and CN VI involvement. The SQ muscle intorts, depresses and abducts the globe. Hence patients with acquired SQ palsy present with complaints of vertical, torsional or oblique diplopia. Diplopia is worse on downgaze and gaze away from side of affected muscle.

Extraocular movement nerves (CN III, IV and VI) palsy is at times encountered after mild head trauma. Li et al. in a retrospective review of medical records at the First Hospital of Jilin University reported 31 patients (17 females, 55%). Cranial nerves III, IV, and VI were involved in 54.8%, 3.2%, and 45.2% of their patients, respectively.<sup>2</sup> All the patients in their case series experienced complete resolution but only 54.6% experienced complete resolution in a time course of 10 days to 13 months. In the vast majority of patients (74.2%), they found no positive intracranial finding on imaging. Isolated CN IV palsy has been uncommonly reported within the realm of sports injuries. Stiller-Ostrowski reported trochlear nerve palsy in a collegiate lacrosse player who was struck on the right side of the head during a lacrosse game and presented with initial complaints of headache, dizziness, blurred vision and delayed complaint of diplopia. MRI orbits was read as normal. The player was only later diagnosed with right SQ palsy secondary to right CV IV palsy based on a positive Bielschowsky head-tilt test, the double Maddox rod test and test of planes of vision. The player was disqualified from contact lacrosse activities and at 5 months postinjury the player reported no diplopia about 90% of the time.<sup>3</sup>

Isolated trochlear nerve injury after a boxing bout has not been reported before. Ringside physicians should be aware of this injury which may occur after a minor closed head injury such as a concussion and in isolation (no other CN palsy and no brainstem signs). Also important to remember is that this injury may not be reported or detected immediately following a bout and may be very subtle in its initial clinical manifestation. Thorough CN screening should be carried out by the ringside physician following a bout especially if the boxer complains of double vision or blurring of vision. Most CN IV palsies are benign especially in an awake, alert boxer with an otherwise normal neurological examination but the boxer should

undergo neuroimaging study either computed tomography or preferably a MRI brain and orbits to better characterize the injury. A referral to a neurologist and an ophthalmologist should also be given. The natural history of this injury is usually benign with full recovery of SQ function over time. Temporary prisms may help to adjust the patient's visual fields as the nerve heals. Alternatively patching one eye may also reduce the distress of diplopia.<sup>3</sup>

## Conclusion

Traumatic trochlear nerve injury is difficult to diagnose clinically during a boxing bout. If a fighter complains of double vision during the bout; traumatic trochlear nerve injury should be suspected among other differential diagnoses and the fight should be stopped on medical grounds.

## Author contributions

NKS evaluated the boxer, conceived, drafted and revised the manuscript. JB evaluated the boxer and revised the manuscript.

## Study funding

No targeted funding reported.

## Disclosures

NKS serves as Associate Editor, The Eastern Journal of Medicine. He also serves as the Chief Medical Officer, New York State Athletic Commission (NYSAC). The views expressed are his and do not necessarily reflect the views of the NYSAC. JB serves as ringside physician for the NYSAC.

## Data sharing statement

The authors have no additional data to share. This case report has been submitted for consideration for publication in the *South African Journal of Sports Medicine*.

## References

1. Trochlear nerve palsy. 2018.
2. Li G, Zhu X, Gu X, et al. Ocular Movement Nerve Palsy After Mild Head Trauma. *World Neurosurg*. 2016;94:296–302.
3. Stiller-Ostrowski JL. Fourth cranial nerve palsy in a collegiate lacrosse player: a case report. *J Athl Train*. 2010;45(4):407–410.