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Bilateral Optic Nerve Transection Following Ballistic Trauma: A Case Report

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Abstract | **Case Report**

Complete optic nerve transection is an exceptional neuro-ophthalmic emergency that results in irreversible blindness. We report the case of a 71-year-old man presenting with bilateral no light perception after a self-inflicted ballistic cranio-orbital injury caused by a handgun. The projectile followed a transcranial trajectory extending from the right temple to the left temple. The patient was discovered approximately 24 hours after the suicide attempt and was brought to the emergency department. Cerebro-orbital computed tomography demonstrated bilateral pre-chiasmatic optic nerve transection associated with orbital fractures and intraorbital foreign bodies. Bilateral ophthalmic surgical exploration revealed no scleral wound. Subsequent left-eye B-scan ultrasonography showed total retinal detachment with vitreous hemorrhage, whereas day-1 fundus examination of the right eye disclosed a flat retina with a small inferior vitreous hemorrhage. Management was multidisciplinary and involved intensive care, neurosurgery, ENT, maxillofacial surgery, psychiatry, and ophthalmology teams. This case highlights the devastating visual consequences of penetrating cranio-orbital trauma and the importance of rapid imaging, multidisciplinary care, and psychiatric evaluation in self-inflicted injuries.

Keywords: optic nerve; ballistic trauma; traumatic optic neuropathy; bilateral blindness; cranio-orbital trauma; suicide prevention.

INTRODUCTION

Traumatic optic neuropathy encompasses a spectrum of optic nerve injuries ranging from mild contusion to complete transection. Complete optic nerve transection is rare and most frequently occurs following penetrating trauma or ballistic injuries involving the cranio-orbital region. In such situations, visual prognosis is extremely poor and recovery is exceptional. Case reports remain important for documenting unusual mechanisms of injury and improving understanding of the anatomical and pathophysiological mechanisms involved. We report a case of bilateral pre-chiasmatic optic nerve transection following a self-inflicted ballistic transcranial injury with a right-to-left trajectory.

CASE REPORT

A 71-year-old man was admitted to the emergency department for a self-inflicted ballistic head injury caused by a handgun; no additional information regarding the firearm or caliber was available. According to the available history, the patient was discovered approximately 24 hours after the suicide attempt by a neighbor and was subsequently transported to the hospital.

On arrival, the patient was conscious and hemodynamically and respiratory stable. Consciousness was assessed at 11/15 on the Glasgow Coma Scale; however, evaluation of eye opening was impossible because of marked bilateral eyelid edema and ecchymosis preventing spontaneous eye opening. General examination revealed bilateral periorbital ecchymosis.

Ophthalmologic examination revealed bilateral no light perception. Both pupils were dilated and non-reactive. Bilateral hemorrhagic chemosis was present, more pronounced on the left side, together with a grade III hyphema in the left eye. Fundus examination could not be reliably performed in the acute setting because of severe anterior segment trauma. Intraocular pressure was assessed during surgical exploration and was within normal limits. B-scan ultrasonography was not available

in the immediate emergency setting. A subsequent left-eye B-scan ultrasonography demonstrated total retinal detachment associated with vitreous hemorrhage. Fundus examination of the right eye performed at day-1 follow-up showed a flat retina with a small inferior vitreous hemorrhage.

Figure 1. Clinical photograph on admission showing bilateral periorbital ecchymosis

Figures 2 and 3. Bilateral hemorrhagic chemosis, more pronounced on the left, with left grade III hyphema

In the setting of penetrating cranio-orbital trauma, imaging is a decisive step before any therapeutic decision is made. Computed tomography with thin slices is the first-line examination because it rapidly delineates the trajectory, skull base and orbital wall fractures, intracranial hemorrhage, and the presence and location of foreign bodies. CT angiography should be considered when a vascular injury is suspected, such as in the presence of an expanding hematoma, a trajectory close to major vessels, or signs of bleeding. MRI, which is more informative for soft tissues, should be reserved for selected situations and only after ferromagnetic metallic fragments have been excluded. [7-13]

Cerebro-orbital computed tomography demonstrated a transcranial projectile trajectory responsible for bilateral pre-chiasmatic optic nerve transection, associated with orbital wall fractures and multiple intraorbital foreign bodies. At the cerebral level, small bubbles of pneumocephalus were observed without other associated intracranial lesions. [7,8]

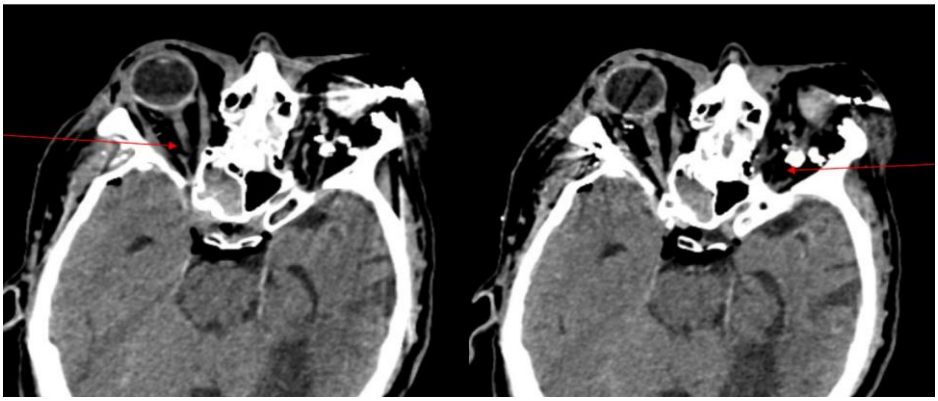

Figure 4. Cerebro-orbital computed tomography (axial sections): red arrows showing bilateral optic nerve transection

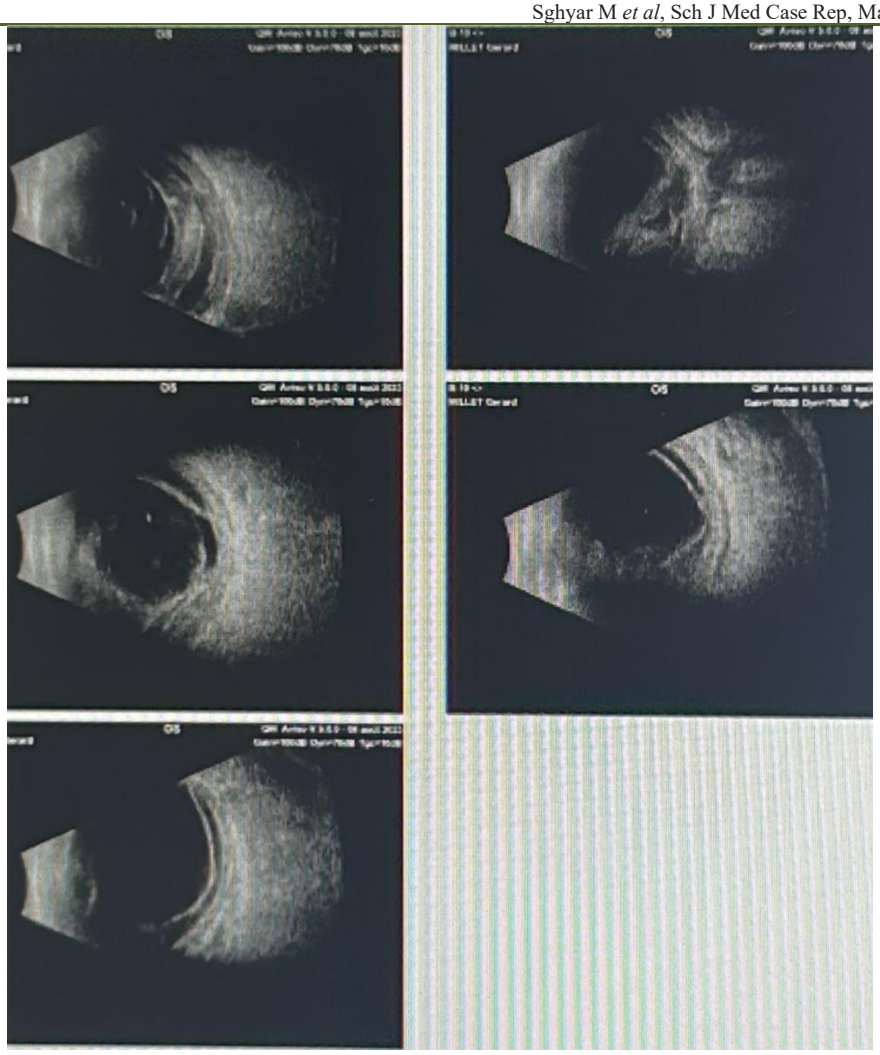

Figure 5: Left-eye B-scan ultrasonography showing total retinal detachment associated with vitreous hemorrhage

MANAGEMENT

After the initial emergency assessment, cerebro-orbital computed tomography was obtained promptly, followed rapidly by neurosurgical, ophthalmologic, and ENT evaluations. Given the patient's initial hemodynamic stability and the severity of bilateral visual loss, he was admitted immediately for ophthalmologic surgical exploration.

Management was multidisciplinary and involved the intensive care, neurosurgery, psychiatry, ENT, maxillofacial surgery, and ophthalmology teams. The patient was first hospitalized in the intensive care unit for 48 hours, allowing close monitoring of neurologic status, hemodynamic parameters, and the evolution of the initial traumatic lesions, before secondary transfer to a psychiatry department. From the neurosurgical, ENT, and maxillofacial perspectives, specialized surveillance was instituted together with general antibiotic prophylaxis. From the ophthalmologic standpoint, the patient was taken to the operating room for bilateral surgical exploration to search for a scleral wound; no scleral breach was found in either globe. The absence of a penetrating ocular injury, together with the imaging findings, confirmed the pre-chiasmatic origin of visual loss. Ophthalmologic treatment subsequently consisted of topical corticosteroid therapy alone, with regular clinical follow-up.

DISCUSSION

Traumatic optic neuropathy covers a spectrum ranging from indirect contusion of the optic nerve to direct injury caused by fracture, foreign body, or projectile. Complete transection remains exceptional and occurs mainly in penetrating and/or transcranial trauma, with a very poor visual prognosis. Clinically, immediate amaurosis with no light perception associated with nonreactive pupils suggests severe injury, even in the absence of a penetrating globe lesion. In firearm-related trauma, oculo-orbital and neuro-ophthalmologic injuries are frequent and may be responsible for major visual sequelae. [1-5,14]

Imaging plays a central role in this diagnostic workup. In the acute phase, thin-slice orbito-cerebral computed tomography is the examination of choice for documenting the trajectory, orbital and skull base fractures, associated intracranial lesions, and the presence of foreign bodies. Depending on the trajectory

and the hemorrhagic context, CT angiography can detect vascular injury involving the internal carotid artery, cavernous sinus, or ophthalmic branches and can help guide neurosurgical management. MRI may further assess the integrity of the optic nerve and soft tissues, but it must be considered with caution in the presence of metallic debris. In our case, CT directly visualized bilateral pre-chiasmatic interruption of the optic nerves and ruled out globe rupture, which was subsequently confirmed by surgical exploration. [7-13]

From a pathophysiological standpoint, the right-to-left transcranial trajectory likely transmitted sufficient kinetic energy across the orbital apexes and pre-chiasmatic optic nerve segments to produce bilateral interruption without direct globe penetration. This mechanism explains the dissociation between catastrophic visual loss and the absence of scleral rupture on surgical exploration. The secondary posterior segment assessment also showed asymmetric intraocular damage, with total retinal detachment and vitreous hemorrhage in the left eye, whereas the right eye retained a flat retina with only a small inferior vitreous hemorrhage. These findings suggest associated ocular contusion, particularly on the left side, but they do not account for the immediate bilateral absence of light perception, which remained most consistent with the bilateral pre-chiasmatic optic nerve transection demonstrated on computed tomography. Similar cases remain exceptional in the literature, which underlines the educational value of documenting such an injury pattern.

From a therapeutic standpoint, management of traumatic optic neuropathy remains debated for indirect forms, but the available data do not support a reproducible benefit of high-dose corticosteroids or optic canal decompression and emphasize a potential risk in the context of head trauma. In cases of complete transection, visual recovery is exceptionally reported, and the objective becomes optimization of overall management, prevention of infection, and repair of associated craniofacial injuries. Because the injury was self-inflicted, early psychiatric assessment was essential both to prevent recurrent suicidal behavior and to address the major functional and psychological consequences of sudden acquired bilateral blindness. [4-6,15]

Limitations

This report has several limitations. Detailed ballistic data, including caliber and projectile characteristics, were unavailable. Posterior segment assessment was initially limited by severe anterior segment trauma, and ultrasonography was obtained only secondarily. In addition, follow-up remained limited to the early postoperative period.

CONCLUSION

Bilateral optic nerve transection following transcranial ballistic trauma is exceptional and carries a disastrous visual prognosis. This case underscores the value of a rapid diagnostic approach based on imaging and exclusion of associated ocular lesions, as well as the need for multidisciplinary management integrating intensive care, psychiatry, craniofacial surveillance, and ophthalmologic follow-up.

Declarations

Consent and anonymization. The clinical images and data presented were anonymized. Publication of this case report should comply with local institutional requirements regarding consent and ethics.

Conflicts of interest: The authors declare that they have no conflicts of interest.

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