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Case report

PARTIAL AVULSION OF THE OPTIC NERVE HEAD: A CASE REPORT

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Abstract

Avulsion of the optic nerve is a rare but quite serious injury characterized by severe and permanent visual impairment. It is mainly encountered in the working-age population, with a male predominance.

In this paper, we describe the case of a 15-year-old patient who presented for an ophthalmological examination due to pain and sudden loss of vision in the left eye after an injury caused by a wooden object. Clinical and imaging examinations revealed a tissue defect at the level of the optic disc with surrounding intraretinal and preretinal hemorrhages and partial hemophthalmus in the central parts of the vitreous. A diagnosis of partial avulsion of the optic nerve papilla was made. The patient was evaluated over six months, during which there was a gradual resolution of the hemorrhages and a modest improvement in visual acuity.

This case indicates the seriousness of the problem and the need for appropriate prevention as the most effective strategy in its management.

Keywords: optic nerve, trauma, avulsion, traumatic optic neuropathy

Introduction

Optic nerve avulsion is the traumatic separation of the optic nerve fibers from the eyeball at the level of the lamina cribrosa. It is a rare but devastating form of traumatic optic neuropathy. This entity was first mentioned by His in a pathohistological specimen in the mid-nineteenth century. Thirty years later, Aschmann described a case of complete, and Lang a case of partial avulsion of the optic nerve. However, the first detailed description of this entity was given by Salzmann in 1903, and he called this condition "Evulsio nervi optici"[1].

Avulsion of the optic nerve is most often due to trauma in the head and eye area with or without concomitant fracture of the bones of the orbit. The word avulsion comes from Latin (the verb *vellere* meaning "to pull" and the prefix "a" meaning "out"). If the avulsion is complete, the optic nerve is pulled back, and an oval hole is observed at the level of the papilla, while in partial avulsions, the optic nerve remains partially attached to the eyeball[2].

This diagnosis can sometimes be challenging, due to retinal hemorrhage and the appearance of hemophthalmus, which clog the space at the level of the optic disc[3]. Medical history, the mechanism of injury, supplemented by clinical ophthalmological examination and additional diagnostic procedures, are usually sufficient to clarify diagnostic dilemmas.

Case report

A 15-year-old patient presented for an ophthalmologic examination due to pain and loss of vision in the left eye following an injury by a wooden log to the left side of his face, several hours prior to the examination. Best-corrected visual acuity was 6/6 in the right eye and only light perception in the superior nasal quadrant of the left eye. Intraocular pressure and bulbar motility were normal.

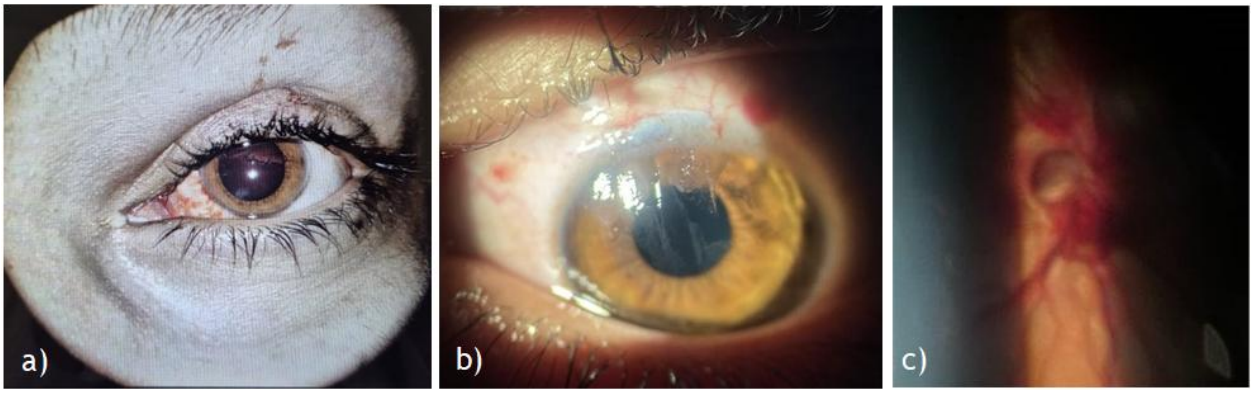

Fig. 1. Initial presentation of the patient. a) Excoriation of the upper eyelid, punctiform subconjunctival hemorrhages in the nasal sector, linear corneal erosions, mydriatic pupil. b) Laceration of the conjunctiva in the upper sector, corneal lacerations with flaps of 11-1h. c) Fundoscopic examination, peripapillary hemorrhage and oval defect at the level of the optic disc-avulsion

Biomicroscopic examination of the left eye revealed excoriations of the upper eyelid and periocular edema. A small conjunctival laceration was present on the upper bulbar conjunctiva, close to the limbus. Corneal lacerations with a flap were present from 11 to 1 o'clock, close to the limbus. In the remaining parts, the cornea was transparent. In the anterior chamber, the presence of cells 3+ was observed, and the presence of a hyphema measuring 1 mm in height. Evaluation of the pupil indicated a relative afferent pupillary defect of grade IV in the left eye. The lens was transparent and in place. Fundoscopic examination revealed the presence of partial hemophthalmus in the central parts of the vitreous space as well as peripapillary intraretinal and preretinal hemorrhages. A circumferential defect was visible in the optic disc area, which occupied more than 2/3 of its surface. A clinical diagnosis of partial optic nerve avulsion was made. The severity of the condition and the visual outcome were explained to the patient's parents.

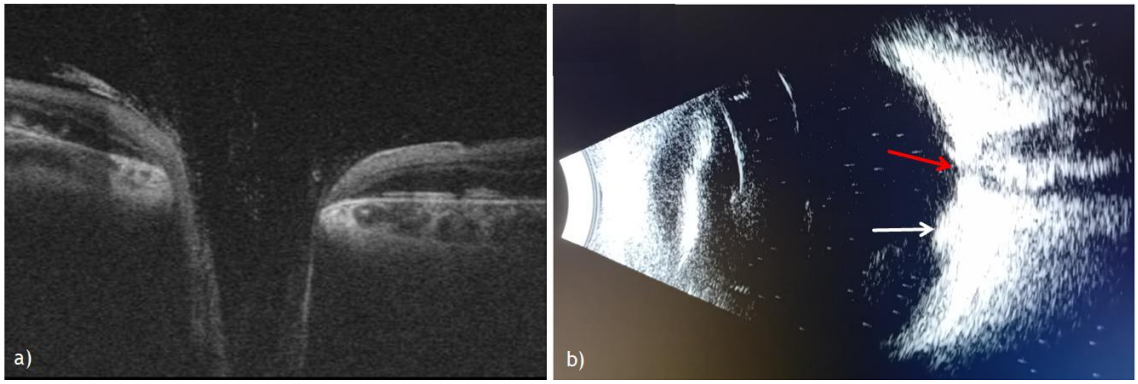

Fig. 2. a) Optical coherence tomography of the optic disc, avulsion with absence of the lamina cribrosa. b) Echography of the eyeball immediately after the injury. Hyperechoic preretinal content-hemorrhage (white arrow), discontinuity and deepened excavation of the papilla-site of avulsion (red arrow).

Additionally, ophthalmological imaging techniques, such as fundus photography, posterior segment optical coherence tomography and eye echography, were performed to further evaluate the condition. Visual evoked potentials showed a large disturbance in the amplitude and latency in the conduction of the left eye. The perimetry of the right eye was without the presence of focal or diffuse scotomas in the visual field. A computed tomography of the head and orbits was performed in order to exclude concomitant fractures.

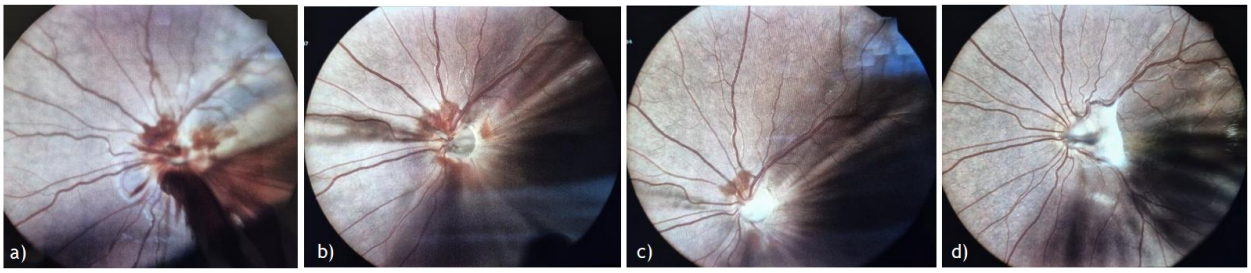

Fig. 3. Monitoring the evolution of the injury through fundus photographs. a) Immediately after the injury, peripapillary intraretinal and preretinal hemorrhages are present, partial hemophthalmus, oval defect in the papilla area, ischemic zone of the retina in the temporal sector. b) One month after the injury, significantly reduced hemorrhage, well-defined zone of tissue defect, residual peripapillary hemorrhages, nasal sector of the papilla vital. c) Two months after the injury, gliosis of the optic disc injury has begun, residual peripapillary hemorrhage. d) Six months after the injury, glial membrane covers the papillary region and causes tortuosity of the surrounding blood vessels, completely resorbed hemorrhage

The patient was hospitalized and treated with systemic corticosteroids (1 mg/Kg TT) and neuroprotective therapy over a period of ten days. The follow-up period, at the control examinations after one week, one month, and two months after the injury showed regression of the hemophthalmus and the hemorrhagic content in the peripapillary region. Ingrowth of glial tissue began to fill the cavity of the defect at the level of the optic disc. Six months after the injury, ingrowth of glial tissue occurred both in the area of the papilla and radially extended towards the vitreous, with complete regression of the hemorrhagic content. Visual acuity during the follow-up period reached 0.05.

Discussion

Optic nerve avulsion is a serious injury that leads to a catastrophic prognosis for vision. The mechanism of occurrence depends on the type of injury. In most cases, it is due to strong rotation of the eyeball and tearing of the optic nerve fibers with forward displacement of the eye [4]. There are also other theories that explain the mechanism of occurrence of this injury. One of them is the sudden, large increase in intraocular pressure in blunt trauma to the eye that leads to disruption of the tissue at the level of the lamina cribrosa, as a potential weak point of the eyeball. The absence of myelin sheath and supporting connective tissue are considered another factor that makes axonal fibers more vulnerable to trauma at the level of the lamina cribrosa [5,6]. It should be noted that optic disc avulsion is sometimes accompanied by trauma to other ocular structures. The first cases of eye avulsion were described following a finger injury during basketball, but similar trauma has also been described after falls from bicycles or motorcycles, or being struck by animals, etc.[7,8]. In our case, the injury occurred when the patient and his friend were trying to move a wooden log, and while the patient was turning back, the edge of the log struck in the area of the left eye.

The diagnosis of this traumatic optic neuropathy is made clinically. The clinical presentation is characterized by a sudden and severe loss of vision, which is permanent. The pupil is mydriatic and not reactive to light. During fundoscopic examination, the presence of a hole in the area of the papilla with a certain amount of peripapillary hemorrhage is noted. The avulsion of the optic nerve may be initially missed due to the presence of vitreous or retinal

hemorrhage that prevents the evaluation of the papilla. In such situations, multimodal imaging and functional techniques are helpful in establishing the diagnosis. Echography can show the site of avulsion, CT can help detect possible fractures of the orbital walls or optic canal, while MRI is of limited use in the initial phase due to the occurrence of surrounding edema and hemorrhage, which mask the site of injury [9, 10]. Depending on the extent of the avulsion, retinal blood vessels may be transected with concomitant ischemia of the entire retinal tissue. In general, blood vessels have greater elasticity than nerves and are more resistant to stretching. Fluorescein angiography can evaluate the vascular network in patients with this injury and show areas of ischemia and nonperfusion[11]. In cases in which complete cessation of circulation has not occurred, it continues to supply blood to unaffected retinal areas.

The evolution of the injury is followed by gradual resorption of the bleeding from the various compartments, supplemented by ingrowth of glial tissue at the level of the injury, which sometimes protrudes towards the vitreous[2,12].

The prognosis is quite poor in terms of the visual function of the affected eye. In complete avulsions, the eye remains without perception of light, amaurotic. In partial avulsions, depending on the degree of avulsion, a modest improvement in visual function occurs. In our case, the patient preserved sectoral vision of the eye, which corresponded to the undamaged zone of nerve fibers.

Up to date, there is no effective treatment for such injuries. Treatment options are quite limited and most often include observation and systemic corticosteroid therapy. *The International Optic Nerve Trauma Study* showed that there is no significant benefit in the final outcome in terms of visual acuity in patients treated with corticosteroid therapy, compared to those in whom observation alone was applied[13]. Surgical intervention, decompression of the optic nerve sheaths, has been attempted, but without significant improvement in vision[2,12]. Due to the severity of the problem, the absence of a therapeutic solution, and the fact that it often affects the young, working population, prevention remains the gold standard for managing this traumatic opticopathy.

Conclusion

Optic nerve avulsion is a rare but very serious injury. It can be a diagnostic challenge in cases associated with inability to evaluate the posterior segment of the eye due to associated media opacities. This diagnosis should be suspected in patients with blunt trauma associated with sudden vision loss and the presence of dense vitreous hemorrhage. The prognosis of this injury is quite poor and is accompanied by permanent vision impairment. To this date, there is no effective treatment. Therefore, prevention of ocular trauma is the most effective solution to this and similar ophthalmological problems.

Conflict of interest statement. None declared.

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