An Unusual Presentation of Pediatric Orbital Trauma: Complete Optic Nerve Avulsion

Avulsão Completa do Nervo Ótico Após Traumatismo Orbitário Contuso num Doente Pediátrico

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ABSTRACT

Our aim is to describe a rare case of complete optic nerve avulsion in a pediatric patient following orbital blunt trauma and its follow-up with multimodal retinal imaging.

An 8-year-old boy was admitted after sustaining blunt injury to his right orbital region with a door knob. Upon admission, he had periorbital hematoma, anisocoria, impaired eye movement and absence of light perception in the right eye. Fundus exam revealed sub-hyaloid and peripapillary haemorrhages with an absent optic disc, with a papillary "lacuna" in its place. Computed tomography imaging revealed several orbital fractures with entrapment and stretching of medial and inferior rectus muscles. The patient was managed conservatively and later submitted to reconstructive orbital surgery. There was no improvement in visual acuity six weeks after the trauma.

Optic nerve avulsion is a rare complication of orbital trauma that leads to irreversible loss of visual function. In some cases, the diagnosis can be difficult initially due to media opacities.

KEYWORDS: Child; Eye Injuries; Optic Nerve; Optic Nerve Injuries/diagnostic imaging; Optic Nerve Injuries/surgery.

RESUMO

O nosso objetivo foi descrever um caso raro de avulsão completa do nervo ótico num doente pediátrico após traumatismo orbitário contuso e o seu *follow-up*.

Um rapaz de 8 anos de idade foi admitido no serviço de urgência após traumatismo contuso na região orbitária direita com a maçaneta de uma porta. À admissão, apresentava um hematoma periorbitário, anisocoria, restrição nos movimentos oculares e ausência de perceção luminosa no olho direito. A fundoscopia revelou uma hemorragia sub-hialoideia macular e hemorragias peripapilares com a ausência do disco ótico, com uma "lacuna" papilar. A tomografia computorizada orbitária revelou diversas fraturas orbitárias com aprisionamento e estiramento dos músculos retos medial e inferior. O doente foi tratado de forma conservadora e mais tarde foi submetido a cirurgia maxilo-facial. Não houve recuperação da acuidade visual durante o *follow-up*.

A avulsão do nervo ótico é uma complicação rara de traumatismos orbitários que leva a perda

irreversível da função visual. Em alguns casos, o diagnóstico pode ser dificultado inicialmente por opacidades dos meios óticos.

PALAVRAS-CHAVE: Criança; Lesões do Olho; Lesões do Nervo Óptico/cirurgia; Lesões do Nervo Óptico/diagnóstico por imagem; Nervo Óptico.

INTRODUCTION

Optic nerve avulsion is a rare complication of head trauma with or without orbital fracture. If the avulsion is complete, the optic nerve and lamina cribrosa will be pulled backwards within the dural covering. In some cases, the avulsion may be incomplete, with the nerve only partially pulled away from its dural covering.

The optic nerve is comprised by the axons from the retinal ganglion cells. It undergoes myelination as it travels through the lamina cribrosa sclerae and is then enclosed in three layers of meninges (dura mater, arachnoid, and pia mater) as it extends from the eyeball to the orbit. The optic nerve exits the bony orbit through the optic canal and then reaches the optic chiasma. It can be broken down into extracranial and intracranial components, with the extracranial component further divided into intraocular and intraorbital sections. The intraorbital portion of the optic nerve is connected to the dura at the optic foramen and is often the site of injury in blunt trauma to the eye.

The aim of the present case report is to describe a rare and unfortunate case of complete optic nerve avulsion after orbital trauma in a paediatric patient.

CASE REPORT

An 8-year-old boy was admitted in the emergency department after sustaining blunt injury to his right orbital region with a door knob. Upon admission, he had periorbital hematoma, anisocoria with a larger and non-reactive right pupil and absence of light perception in his right eye. He also had limitation of infraversion in the right eye. Slit lamp exam revealed subconjunctival haemorrhage, red blood cells in the anterior chamber and non-reactive mid-mydriatic pupil. The lens was clear and in its place. Fundus exam revealed a sub-hyaloid boat-shaped haemorrhage in the macula, peripapillary flame haemorrhages, a pale retina and absent optic disc with a papillary "lacuna" in its place with appreciable stereoscopic depth with binocular indirect ophthalmoscopy (Fig. 1). The fellow eye exam was unremarkable.

Orbits and cranioencephalic computed tomography imaging was performed and revealed: several fractures and sinking of the medial and inferior walls of the orbit with orbital fat herniation into the ipsilateral maxillary sinus; entrapment and stretching of the inferior and medial rectus muscles; peribulbar edema with outwards and inferior rotation of the right eye; significant enlargement and deviation in inferior and anterior direction of the optic nerve insertion (Fig. 2). The patient was managed conservatively with antibiotics and oral corticosteroids in the early post-trauma period and was later submitted to reconstructive orbital surgery.

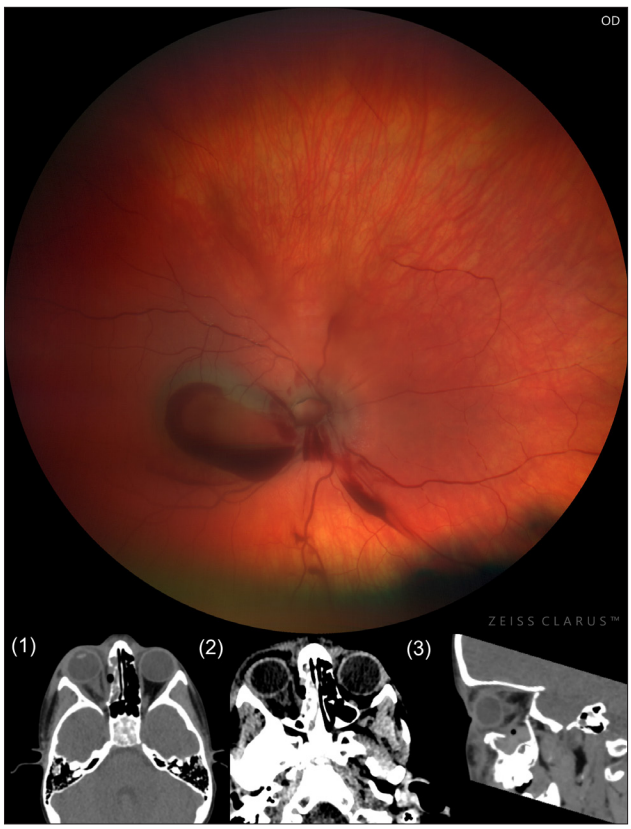

Figure 1. Status at the day of the trauma. Above, wide field fundus photography (Zeiss Clarus®) showing an absence of the optic disc with exposed sclera underneath, sub-hyaloid boat-shaped haemorrhage in the macula and peripapillary flame haemorrhages radiating from the disc. Also note the pale retina in the macula and peripapillary region, as a result of central retinal artery compromise. Down, computed tomography (CT) scan with several fractures of the medial and inferior wall of the right orbit (1 and 2), as well as inferior rectus entrapment and herniation of the orbital fat into the maxillary sinus (3). Also visible is a significant enlargement and inferior and anterior deviation of the optic nerve insertion (1).

At 6 weeks after the trauma there was no improvement in visual acuity (no light perception). Slit lamp exam was unremarkable apart from a non-reactive mydriatic pupil, with clear lens and cornea. Fundus exam revealed partial reabsorption of the macular and peripapillary haemorrhages with a pigmented membrane overlying the macula that undulated with eye movements and the optic "la-

Figure 2. Status at 6 weeks after trauma with wide field fundus photography (Centervue Eidon®) on the left-side and MultiColor fundus photography (Spectralis®) on the right side. There was a partial reabsorption of the subhyaloid macular hemorrhage and of the peripapillary flame hemorrhages and instead of a papillary "lacuna" an atrophic optic disc was now seen.

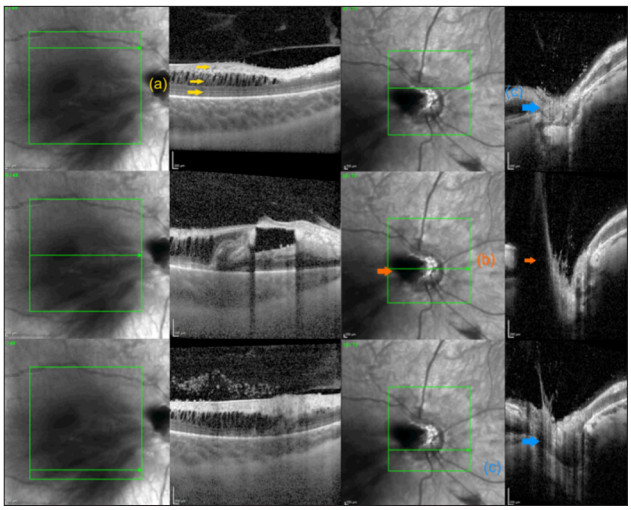

Figure 3. Status at 6 weeks after trauma. On the left side 3 slides of macular optical coherence tomography (OCT) are seen and on the left side 3 slides of optic nerve OCT. There was loss of retinal architecture overall, with an atrophic outer retina, retinoschisis in the middle layers and hyperreflectivity of the internal retina ((a), yellow arrows) . On the right-side optic nerve OCT is seen with a papillary haemorrhage with shadow effect ((b), orange arrows), disruption of normal optic disc architecture and filling of the optic "lacuna" with hyperreflective tissue ((c), blue arrows).

cuna" was now replaced by what resembled an atrophic optic disc (Fig. 3).

DISCUSSION

There are various proposed traumatic mechanisms of damage to the optic nerve that can lead to loss of function, including[1] sudden increase in intraocular pressure pushing the nerve off the lamina cribrosa with decompression,[2] forced rotation of the globe causing shearing of fibre[3] sudden increase in intraorbital pressure causing hyperextension of the nerve or[4] direct injury by projectiles, sharp objects or orbital foreign bodies. Buchwald reported from a retrospective analysis of several case reports that the main causes of serious optic nerve avulsion injuries are hits with sticks, fingers, or hands (especially in indoor sports) and traffic accidents.[1] The severity of the injury can range from contusion to complete avulsion with complete visual loss.[2,3]

The diagnosis of optic nerve avulsion might not be as straightforward as in this case since anterior segment and vitreous haemorrhage can make the direct observation of the optic disc impossible. In late stages, after scarring has occurred, it may be misdiagnosed as a developmental anomaly if there is no knowledge of the previous injury.[4,5] Ultrasound imaging can detect optic nerve damage by an increase in diameter, but it may appear normal.[6-8] CT scans can exclude fractures in the optic canal and visualize direct optic nerve injury, even in incomplete cases.[9]

After head injury, secondary mechanisms may cause further damage to the optic nerve which could potentially be targeted by treatment options. Whereas in cases of complete avulsion there is no medical or surgical treatment available, in cases of optic nerve dysfunction after trauma without evidence of direct optic nerve injury on CT scan (traumatic optic neuropathy), there have been reports of using of corticosteroids and optic canal decompression. However, the International Optic Nerve Trauma Study showed no significant benefit of steroid and/or surgical decompression compared to observation.[10]

Optic nerve avulsion is a rare occurrence in orbital or ocular trauma. Nevertheless, in cases where there is unexplained visual loss after traumatic orbital/ocular injury, consideration should be given to the possibility of traumatic optic neuropathy, even in cases of seemingly minor blunt impact.

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VM: Wrote the paper.
CPA, JAA, JCP, MR and JC: Revision and approval

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