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Case report

Transorbital penetrating cerebellar injury in a 10-year-old girl ☆

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ABSTRACT

Impalement injuries are infrequent yet tend to be life-threatening. Transorbital penetration by foreign bodies represents a peculiar form of traumatic brain injury. However, much is at stake with the high risk of neurological and ophthalmic impairment. We narrate an unusual case of a riding crop penetrating the eye of a 10-year-old girl who presented to our hospital after a fall and an episode of syncope while at a riding stable. Magnetic resonance imaging detected an extended passage-like signal in the right-sided part of the pons and the cerebral peduncles extending to the right cerebellar hemisphere. The patient exhibited marginal clinical symptoms. This case was unsurpassed, as despite the horizontal course of the riding crop perforating the osseous structures and penetrating the brain, it resulted in manageable symptoms, which resolved in a matter of weeks.

Introduction

Falls are the most common cause of traumatic brain injury (TBI); they are mainly prevalent in the elderly and children and affect both low- and high-income countries [1]. The human skull acts as a resilient barrier when facing foreign body impacts and in cases of accidents. Nevertheless, the temporal and orbital regions are thin areas of the skull and are more susceptible to damage during trauma [2]. We herein report a case of a 10-year-old girl who presented to our hospital after a fall and an episode of syncope while at a riding stable. We narrate the performed investigations, imaging evaluation findings, course of treatment, and follow-up of this extraordinary case of transorbital penetrating brain injury.

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Fig 1 – Post-traumatic hyposphagma and eyelid hematoma of the right eye on admission to the emergency room.

Case report

A 10-year-old girl presented to the emergency room after experiencing syncope and an impalement injury acquired while at a riding stable. The trauma occurred as the girl tried to reach something on the ground and fell off the horse. Her face landed on a riding crop with a sharp pointed end. The exact mechanics of the fall are unclear. After the fall, she lost consciousness for a few seconds and jerked her right hand and foot. No one in her surroundings saw her fall to the ground. However, a family friend who happened to be nearby has observed the seizure. During the interview to reconstruct her accident, she stated that she pulled a small object of about 3 to 4 cm in length out of her right eye after she regained consciousness.

After regaining consciousness, she presented with slurred speech and hyperventilation. She stated that she was feeling nauseous and admitted not having a sufficient breakfast. The patient also expressed extreme pain in her right eye. The patient's mother denied any previous trauma to the head, regular use of medications, or allergies. The patient is vaccinated according to StIKo (The German Standing Committee on Vaccination) recommendations and has no history of any seizure or syncope episodes.

Initial physical examination showed a 10-year-old female, awake and oriented with an injury to the inner right eye accompanied with double vision and vision impairment exclusive to the affected eye. Neurological examination was normal, with the exception of a slightly slurred speech. The patient did not display any meningeal signs caused by meningeal irritation after the impalement injury. Glasgow Coma Scale of 15/15. On the day of admission, the girl developed increasing headaches, nausea and vomiting as well as a fever reaching 38.8°C. Upon Ophthalmological examination, the physical injury was limited to subconjunctival hemorrhage and lower right eyelid hematoma (Fig. 1).

The MRI examination was performed on a 1.5-T scanner (Achieva XR-Philips Healthcare). We administered 14 ml of Gadoteridol (ProHance- Singen, Germany) intravenously as a contrast agent. An elongated canal-shaped signal disruption (Fig. 2A) was detected in all sequences in the right cerebellum (ventrodorsal orientation) with an approximate length of 45 mm and a diameter of 4 mm. The canal-shaped elongation was detectable in the right-sided part of the pons and the cerebral peduncles extending to the right cerebellar hemisphere, as shown in Figure 2B, along with hemosiderin deposits. An SWI sequence revealed a moderate intracranial hemorrhage and a suspicious foreign body in the cerebellum measuring 15 mm × 3 mm (Fig. 2C).

The treatment, as advised by the infectious disease specialist as prophylaxis because of the possible contamination of the wound, consisted of a 14-day course of Cefotaxime and Metronidazole, in addition to Vancomycin for the first 7 days. Neurosurgeons found no indication for surgery.

Two weeks after admission, the patient was discharged in good general condition with planned further outpatient care. Before discharge, the final MRI examination revealed an unchanged puncture canal with regressive perifocal edema; the latter became apparent only after the 2nd day of hospitalization. The aforementioned ophthalmological symptoms subsided during the course of treatment, and diplopia only occurred when the patient fully abducted the affected eye. Another ophthalmological consultation before discharge confirmed an improved ophthalmologic condition. The patient also experienced mild dysdiadochokinesis and a disorder of the fine motor skills of the right hand with atactic writing. Both improved during the inpatient stay under intensive physio and ergotherapy. The patient was advised to return to the Hospital upon any clinical deterioration.

Discussion

Impalement injuries are few and far between. In a meta-analysis performed by Peeters et al., they looked at 28 epidemiological studies on TBI from 16 European countries; an overall incidence of 262 per 100,000 for admitted TBI was derived [1].

Most cases in the literature on skull perforating trauma caused by gunshot wounds, knife attacks, or penetrations into the cerebrum with metal stabbing weapons or wooden sticks are accompanied by severe injuries of the cortex and subcortical structures followed by significant damage to these vital structures [3–6]. In particular, transorbital-penetration injuries of the skull and brain are sporadic and often associated with substantial ophthalmic and neurological trauma [7]. Our patient experienced mild ophthalmic and neurologic symptoms despite the riding crop's penetration path being detected in the cerebral peduncles and extending to the right cerebellar hemisphere. We hypothesize that one of the reasons that our patient experienced minimal clinically significant symptoms is the relatively small diameter of the riding crop as well as the unique transorbital pathway which it travelled through. The brain corridor that the riding crop took is somewhat similar to that previously used in the Icepick lobotomy method developed by Dr. Walter Freeman in 1946. The latter used a slender

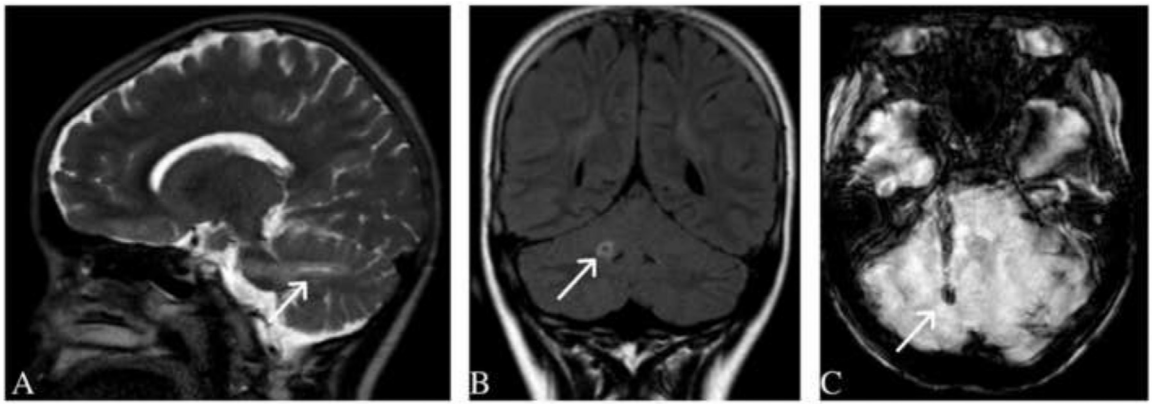

Fig 2 – Post-injury MRI findings of the brain. (A) Sagittal T2-weighted MR image with Turbo-Spin-Echo (TSE) sequence demonstrating an abnormal hyperintense signal (white arrow). (B) Coronal T2-weighted MR image with fluid attenuated inversion recovery (FLAIR) sequence showing a circular hyperintense signal (white arrow). (C) Axial T2-weighted MR image with susceptibility-weighted imaging (SWI) sequence displays a hypointense linear signal secondary to hemosiderin deposition (white arrow).

rod, shaped like an icepick, to perform transorbital lobotomy on patients suffering from bouts of manic depressions and suicidal ideations [8]. Although the procedure is now outdated and banned from use, the transorbital brain access corridor has been adapted and modified for use in a wide range of transorbital endoscopic surgeries due to its temporary side effects in most cases. In our reported case, the patient suffered from transient diplopia in the injured eye which is one of the most common complications of transorbital neuroendoscopic surgeries in the sole transorbital approach [9].

Deriving from the patient's symptoms, our main concern was the prevention of local transorbital infection and meningitis. No cerebrospinal fluid leak was seen on the MRI scan. The latter, along with bleeding and any signs of infection should be the primary investigative interest of the radiologist.

A post-injury MRI showed that the patient experienced moderate intracranial hemorrhage, which has a rate of 8.5% in mild TBI patients [10].

Proceeding with an MRI examination upon the patient's arrival seems to be a quintessential step. We used SWI in our MRI protocol since it is valuable in detecting traumatic cerebral microbleeds and can provide etiologic evidence for specific post-traumatic neurologic deficits [11]. In a study conducted by Lindberg et al., the MRI sequences most likely to identify traumatic brain injuries in children were gradient recall echo and T2 single-shot turbo spin echo, which recognized signs of TBI in 94 and 88 participants out of 111 respectively [12].

The young age of our patient was the first indication to proceed with an MRI rather than a computerized tomography (CT) scan. Improvement of the patient's symptoms and the MRI injury progression control scans indicated no additional need for requesting a CT scan. However, CT would have played a useful role in cases of suspicion of a foreign body with ferromagnetic properties.

As per our case study, falls are the most common cause of traumatic brain injuries, especially in children and the elderly; they also seem to be more frequent in the high-income regions of Europe [1]. The elderly is at a disadvantage when it comes to TBI, as the odds of a poor outcome increase by 40% to 50% per 10 years of age [13].

Perforating skull and brain injuries caused by penetrating stabs or gunshots are reported in most cases to be followed by the immediate or somewhat delayed death of the individual suffering from such traumatic and destructive wounds. Severe TBI has a mortality rate of 72%, according to Okidi et al., who also concluded that the Glasgow coma scale of the patient at presentation had an inordinate impact on the survival rate [14].

Conclusion

Even in the absence of eyewitnesses, and due to the circumstantial evidence, it is accepted that the riding crop penetrated the patient's right eye all the way to the right cerebellar hemisphere briefly before being extracted via the same route without leaving any foreign body intracranially. The front dorsal course of the penetrating trauma is unique, taking into account that no essential structures of the brain were vulnerated in a manner that would cause severe life-threatening intracerebral hemorrhage.

Patient consent

The patient's mother signed a declaration of consent that was provided by the Hospital.

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