

Patient Survival after a Very Deep Penetrating Orbitocranial Injury

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Sir,

A seven-year-old girl was referred to the emergency ward at the Khatamolania Hospital, Zahedan, Iran, in March 2012 after she fell face-first onto a pencil she was holding. The blunt end of the pencil had entered the orbit beneath the medial *canthus*. Upon ophthalmological examination, the ocular globe was intact but laterally displaced and vision in the left eye had diminished to only light perception. Moreover, the examination revealed a positive relative afferent pupillary defect in the left eye. Further fundoscopic examinations were not performed due to the patient's condition. Her vital signs were normal and she was conscious without any neurological deficits. Computed tomography (CT) scans of the brain without contrast revealed a foreign body in the medial left orbit which had passed through the superior orbital fissure into the cranium near the temporal lobe and was positioned laterally to the cavernous sinus [Figure 1]. The foreign body had passed next to the petrous *apex*, tangentially to the brainstem and had entered the cerebellum to a depth of 4 cm. A four-vessel angiography produced a normal angiogram [Figure 2].

The pencil was removed slowly along the route of entry while the patient was under general anaesthesia. The pencil measured 18 cm, of which 14 cm had entered into the orbit. A surgical team remained on standby to perform an emergency craniotomy in case of sudden intracranial haemorrhage. Fortunately, a postoperative CT scan showed no evidence of haematomas or vascular leaks. The wound was irrigated and sutured. The patient was prescribed prophylactic antibiotics and high-dose corticosteroids for the ophthalmic nerve injury. She recovered well with no signs of postoperative infection. At follow-up ophthalmological and neurological examinations 10 months later, she showed normal eye movements with 10/20 visual acuity and no neurological deficits.

Impalement through the eye orbit accompanied by transorbital penetration of the *calvarium* is rare. Most cases are reported in children.^{1,2} Stab injuries of

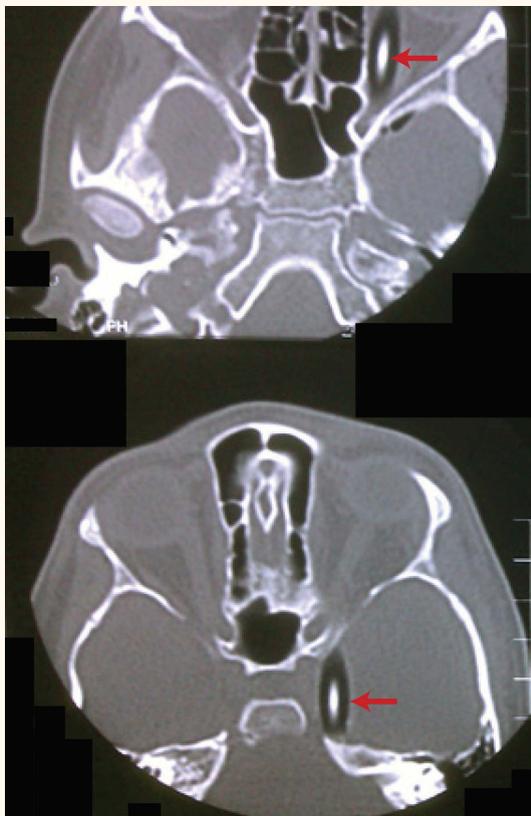


Figure 1: Plain cranial computed tomography scans showing the path of the foreign object (arrows) in a seven-year-old girl with a very deep penetrating orbitocranial injury due to a pencil.

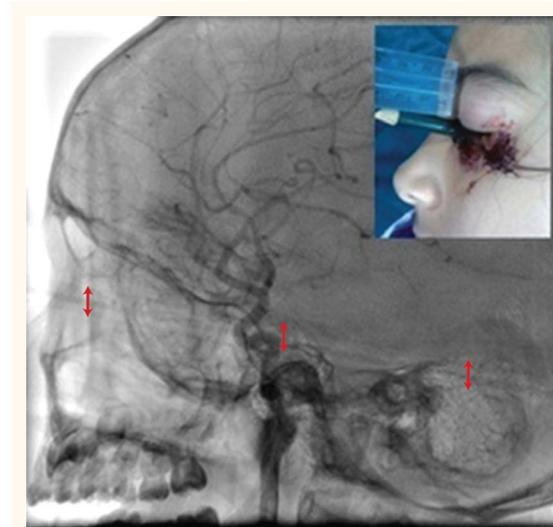


Figure 2: Normal four-vessel angiography scan in a seven-year-old girl with a very deep penetrating orbitocranial injury due to a pencil. The red arrows indicate the path of the foreign body. **Inset:** Photograph showing the foreign body entering the left orbit beneath the medial *canthus*.

the orbit more frequently occur among young male children;¹ this may be due to an increased participation in riskier forms of play. The majority of reported cases of transorbital injury in children are accidental.² There have been some reports of intracranial complications due to transorbital brain injuries.^{1,2} Most accidental transorbital penetrating injuries are reported to be caused by pens.³ In such cases, because of the pyramid shape and weak structure of the orbital *apex*, the treating physician must be aware of potential brain injuries.¹ Since these injuries are classified as low-velocity, the trajectory of the foreign object and the injured anatomical elements in the path determine the extent of the neurological damage.^{3,4}

Sections of the frontal, ethmoid, lacrimal, maxillary, zygomatic and greater wing of the sphenoid bones are joined together and form the pyramidal shape of the orbital cavity. The opening of the optic nerve, superior and inferior orbital fissures are positioned at the *apex* of this cavity. The ocular globe is adjacent to the lateral in comparison to the medial orbital wall; because of its mobile property, a penetrating object is usually directed next to the medial wall, reaching the cranial cavity through the orbital plate or superior orbital fissure.^{1,4} The optic nerve, cavernous sinus, suprasellar cistern, internal carotid artery, temporal lobe, *pons* and brainstem are all vulnerable to injury during transorbital penetration.^{1,2,4} Depending on the site of the injury, intracranial penetration can be immediately fatal or present asymptotically for some time.^{1,2,4} Penetration through the orbital roof and superior orbital fissure are the most common events in transorbital penetrating injuries, resulting in a trajectory into the frontal lobe passing near the optic nerve or internal carotid artery, respectively, to the brainstem.³

Turbin *et al.* concluded that penetrating injuries involving the superior orbital fissure may result in temporal lobe, cavernous sinus and brainstem or cerebellar injuries.¹ In the case of low-velocity penetrating brain injuries, immediate complications are associated with anatomical damage and could include cranial nerve or cerebral vascular injuries and haemorrhagic complications.⁴ Di Roio *et al.* reported two cases of craniocerebral injury with transorbital penetration.² The first was a four-year-old boy who fell onto a metal rod; his mother subsequently pulled the metal rod out of the entry site near the left internal *canthus*. On examination, the child was in a coma and developed meningeal syndrome with a cerebral abscess. In the second case, a six-year-old boy had poked a chopstick in his left eye. The child remained asymptomatic for some time before developing a cerebral abscess.² Al-Otaibi *et al.* reported a case of transorbital brain injury without serious neurological deficits in which the bulk of the pencil was removed under general anaesthesia.⁵ However, this approach carries some risks as the foreign object may shred the vasculature and cranial nerves within its path.

The most common cause of delayed death due to a penetrating brain injury is intracranial infection. Al-Otaibi *et al.* proposed that prophylactic antibiotics be prescribed as soon as possible after the removal of wooden foreign object fragments prone to microbial contamination.⁵ This recommendation is congruent with that of Di Roio *et al.*; both of the reported patients were treated with wide-spectrum antibiotics with no subsequent sign of post-surgical infection.² The authors of this letter advocate non-invasive surgical management for transorbital penetrating brain injuries due to smooth objects, particularly for patients with normal angiograms and without haemorrhage. In the present patient, a craniotomy was not deemed necessary as the only complication was an ophthalmic nerve injury with light perception. Nevertheless, surgical teams should be ready to perform an emergency craniotomy in the event of unexpected complications.

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