Transorbital-transpetrosal Penetrating Cerebellar Injury
—Case Report—

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Abstract

A 4-year-old boy presented with a transorbital-transpetrosal penetrating head injury after a butter knife had penetrated the left orbit. The knife tip reached the posterior fossa after penetrating the petrous bone. Wide craniotomy and the pterional, subtemporal, and lateral suboccipital approaches were performed for safe removal of the object. The patient was discharged with left-sided blindness, complete left ophthalmoplegia, and hypesthesia of the left face. Early angiography is recommended to identify vascular injury which could result in fatal intracranial hemorrhage.

Key words: penetrating injury, orbit, petrous bone, cerebellar hematoma, cerebral angiography, microneurosurgery

Introduction

Penetrating injury of the skull and brain is relatively uncommon, representing about 0.4% of head injuries.3) Transorbital injuries represent 24% of penetrating head trauma in adults and 45% in children.4,7) Penetrating transorbital injuries of the brain by foreign bodies are uncommon. There are three possible paths for penetrating the cranium: via the orbital roof, the superior orbital fissure, or the optic canal and lateral wall of the orbit.4,6) We report a patient with transorbital penetrating injury caused by a butter knife which reached the cerebellar hemisphere by passing through the petrous bone.

Case Report

A 4-year-old boy was admitted to a regional hospital after knife penetration of the left orbit occurring when he fell down the stairs with a butter knife in his hand. There was no reported disturbance of consciousness, and his vital signs were normal. He was sedated and transported to our institution.

On admission, the patient appeared sedated and stuporous. General physical examination revealed the left orbit was penetrated by the butter knife. The knife had pierced the lower eyelid near the medial canthus, with only the handle visible outside the wound. No bruit or pulsatile proptosis was evident. Ocular examination revealed the pupil was dilated and fixed. The optic fundus was pale and opaque indicating central retinal artery occlusion. The patient had no other neurological deficits.

Skull and orbital radiographs showed the knife had passed through the left orbit and superior orbital fissure and the petrous bone to reach the posterior fossa (Fig. 1). Computed tomography (CT) demonstrated a transorbital-transpetrosal knife tract and a hematoma in the left temporal lobe. CT with bone windows demonstrated that the knife had passed medial to the left eye ball, through the medial wall of the orbit just lateral to the sella turcica, and through the petrous bone (Fig. 2). Emergency cerebral angiography showed no vascular abnormality other than slight elevation of the left middle cerebral artery from the temporal hematoma and nonvisualization of the portion of the ophthalmic artery external to the superior orbital fissure (Fig. 3).

Antibiotics were administered from admission to prevent intracranial infection. The patient underwent operation in the supine position. The head was placed vertex down and turned 90° to the right. A skin incision was made for a pterional, subtemporal, and lateral suboccipital combined approach. The
sphenoid ridge was radically resected and the petrous bone was flattened until the flat floor of the temporal fossa was gained by use of the high-speed drill and rongeur. Posterior fossa craniectomy exposed the transverse sinus superiorly and sigmoid sinus laterally. The left internal carotid artery was intact. The lower half of the optic nerve had been transected by the blade near the superior orbital fissure. The knife had penetrated the superior orbital fissure to the extradural space and then entered the subdural space, lacerating the base of the temporal lobe. The petrous bone was penetrated at Meckel’s cave. The knife had entered the posterior fossa between the trigeminal nerve and the acoustic nerves and pierced the cerebellar hemisphere. As the blade of the knife was fixed at the superior orbital fissure, the orbital roof near the superior orbital fissure and anterior clinoid process was removed using the high-speed drill. When the knife became mobile it was retracted slightly until absence of bleeding was confirmed. Then the knife was extracted gradually through the petrous bone and orbit. Bleeding from the cavernous sinus was observed and stopped with oxycel. The hematoma was

Fig. 1 Lateral skull radiograph demonstrating the knife in situ penetrating the petrous bone.

Fig. 2 Computed tomography scans demonstrating a hematoma in left temporal lobe (left), and the knife tract reaching the posterior fossa (right, bone window).

Fig. 3 Left carotid and vertebral angiograms, lateral view, demonstrating the knife passing near the intact internal carotid and superior cerebellar arteries, with no vascular abnormality except for nonvisualization of the peripheral portion of the ophthalmic artery.

Fig. 4 Postoperative computed tomography scan demonstrating hematomas in the left temporal lobe and left cerebellar hemisphere, without brain swelling.
evacuated from the left cerebellar hemisphere. The lacrimal gland was injured extensively and it was not reconstructed.

Postoperative CT showed intracerebral hematomas in the left cerebellar hemisphere and left temporal lobe, but no brain swelling was observed (Fig. 4). The patient was alert by the 4th postoperative day, with no sign of intracranial infection. Auditory function was normal. He was discharged with left-sided blindness, complete left ophthalmoplegia, and hypesthesia of the left upper face.

Discussion

Intracranial penetration may follow one of three pathways: the optic canal, the superior orbital fissure, or the orbital roof. The orbital roof is the most frequent route, as the thin wall offers little resistance to penetrating objects. The prognosis of this type of injury is fairly good, although penetration tends to occur near the internal carotid artery, which may be injured after the object passes through the optic canal or superior orbital fissure. This route may also be associated with injury to the optic nerve and other orbital structures. A major complication of injury to the internal carotid artery is formation of a carotid-cavernous fistula. Diffuse brain injury does not occur in penetrating head injury, with damage being restricted to the directly affected areas. The prognosis is good in the absence of direct injury to the brain stem or laceration of a major intradural vessel. In our patient, no lesion of major cerebral vessels had occurred except for mild bleeding from the cavernous sinus at extraction of the knife. Brain injury was restricted to the temporal lobe and cerebellar hemisphere. Therefore, the outcome was good.

Review of 250 patients with cranial stab wounds, from whom the penetrating object had already been removed, found 12% had traumatic aneurysms. Also 10% of patients with cranial stab wound requiring urgent evacuation of intracerebral hematomas had traumatic aneurysms that could be managed simultaneously. Therefore, cerebral angiography should be performed soon after admission. We performed angiography immediately because of the high likelihood of injury to the internal carotid artery or posterior fossa vessels in this case and the generally high risk of mortality due to intracranial hemorrhage from lesions of major vessels.

The general principle guiding surgical treatment of such patients is considered to be "open and see." Since the object had penetrated multiple regions including the orbit, temporal fossa, and posterior fossa, three approaches were necessary to see the object and surrounding structures adequately. Specifically, the pterional, subtemporal, and lateral suboccipital approaches were employed. The petrous bone was drilled sufficiently to minimize brain retraction.

References


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