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Transorbital craniocerebral penetrating injury with iron cutting metal blade

Hanmant Kamble MS, **Batuk Diyora** DNB, **Sanjay Kukreja** MBBS,
Naren Nayak M Ch, **Alok Sharma** M Ch
Department of Neurosurgery, LTMG Hospital, Sion (W), Mumbai-400022.

Abstract : A 36-year-male presented with foreign body in the right orbital region. He had sustained a transorbital craniocerebral penetrating injury by a broken piece of rotating iron cutting metal blade while working in an industrial unit. CT scan brain revealed a metallic foreign body entering through the right orbit traversing through the anterior skull base and reaching up to the frontal horn of the lateral ventricles. Emergency surgical exploration was performed and foreign body was removed along with the intraparenchymal hematoma.

Keywords: craniocerebral injury; metallic foreign body; orbital injury; penetrating injury

INTRODUCTION

Transorbital craniocerebral penetrating injury in civilian practice is rare[1-3]. They are usually low velocity injuries and associated with a good prognosis[4-8]. Unusually, they can be of a high velocity resulting massive tissue destruction and associated with a poor clinical outcome. Clinical diagnosis remains straightforward in the presence of foreign body within the wound. Radiological imaging is essential to know the presence and type of foreign body, path traversed by it and its final location. Fracture of the orbital wall and the skull, injury to the eyeball, pneumocephalus, subarachnoid hemorrhage (SAH), contusions, intracerebral hematoma and the intraventricular hemorrhage are the usual radiological findings. Initial neurological condition of the patient, which is a reflection of the extent of underlying brain injury, is the key factor in the clinical outcome of the patient even after successful surgical removal of the foreign body.

CASE REPORT

A 36-year- man was brought to a level I trauma centre following accidental injury to his eyes and head while working in the industrial estate. A piece of a rotating metal blade broke while cutting an iron plate and entered his right orbit. Primary survey at a nearby medical center revealed a metal blade penetrating through the orbit in to the cranium. On arrival, his vital parameters were normal. His Glasgow coma scale (GCS) score was 6/15. Local examination revealed a wound over right orbital region with obliquely placed metal foreign body through the right eye along with the contused brain matter pouting on either side (Fig 1). His right eye was completely damaged. Left pupil was 3 mm in size and reacting to light. There was no evidence of any systemic injury.

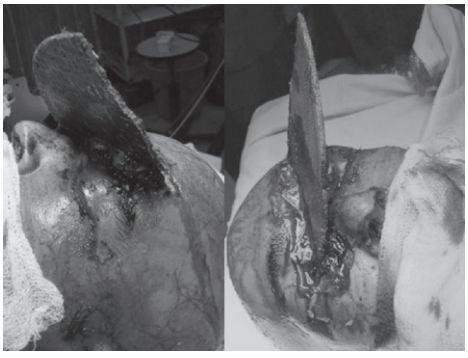
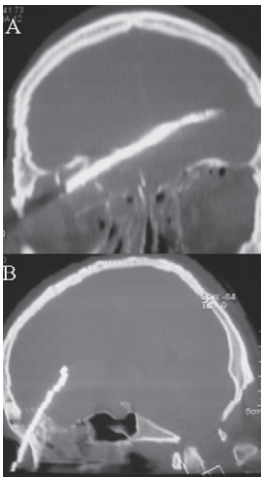


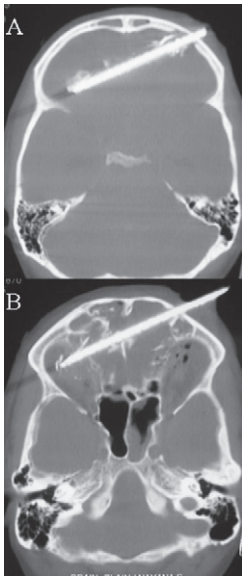
Fig 1: Clinical picture showing an obliquely placed metallic foreign body across the right orbit.

Computed tomography (CT) scan of brain and orbit revealed a metallic foreign body in the anterior cranial fossa, entering through the right orbit, orbital roof and left supra orbital ridge in to the anterior cranial fossa crossing the midline to involve both frontal lobes(left more than right (Figs 2a, 2b, 3a, 3b). There was contusion and intracerebral hematoma present around the foreign body (Figs 4a, 4b). Intraventricular bleed and comminuted depressed fracture of both superior orbital walls and frontal bones were noted.

Address for correspondence:
Dr. Batuk Diyora
Department of Neurosurgery,
2nd Floor, L.T.M.G. Hospital, Sion (W), Mumbai - 400022
Phone : 022 24024713, Mobile : 09820986061
E-mail: bddiyora@hotmail.com



Figs 2a & b: CT scan brain showing foreign body across the right orbital roof and anterior cranial fossa. (coronal & sagittal views)



Figs 3a & 3b: CT scan brain showing foreign body across the right orbit and the anterior cranial fossa floor.

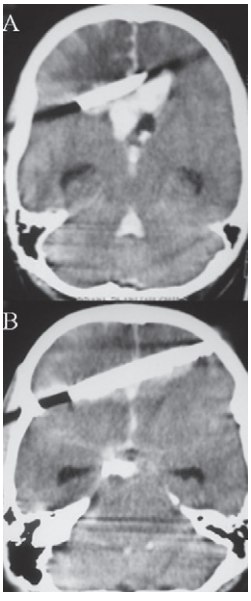


Fig 4a: CT scan brain showing foreign body with the extensive parenchymal injury with contusion, and intraventricular bleed.
Fig 4b: CT brain showing foreign body with subarachnoid haemorrhage.

Patient underwent emergency exploration via a bicoronal skin incision. Scalp flap was raised and a bifrontal craniotomy was performed. On removal of the bone flap, the metal plate became loose which was gently delivered out under vision after opening the dura. Contused brain parenchyma was excised and intracerebral hematoma was evacuated. Lax duraplasty was carried out using fascia lata graft. Both the frontal sinuses were exteriorized and anterior cranial base was repaired. Right eyeball evisceration was done by ophthalmic surgeon. Post operatively, patient was kept on ventilator support. He received broad spectrum intravenous antibiotics along with the anticonvulsants and antiedema drugs. However, after an initial period of neurological recovery, he succumbed to his injuries.

DISCUSSION

Various cases of transorbital craniocerebral injury have been reported in the literature involving door key, nail, pencil, spectacle arm, metal bar, ear pick, bicycle brake handle, plastic chop stick, wooden foreign body, ceramic stone and toilet brush handle[4-13]. These injuries are usually of a low velocity, localized, traverse a straight course and usually associated with a good clinical outcome. In these cases, the magnitude of injury depends on the injury to the bony and neurovascular structure coming in the path of the traversing foreign body. High velocity penetrating injuries are comparatively more dangerous as they occur not only from initial *laceration* and crushing of brain tissue by the *projectile* but also from the subsequent *cavitation.* High-velocity objects create rotational forces and results in a *shock wave* that causes stretch injuries. A pulsating temporary cavity is thus formed by a high-speed object. Though this cavity is reduced in size once the force is over, the tissue that was compressed during cavitation remains significantly injured. In our case, an electrically rotating metal blade suddenly broken into pieces which acted like shrapnels and entered through the unprotected orbit in to the cranium with a high velocity resulting in massive orbital as well as craniocerebral injury.

Computed tomographic scan (CT) of the head is the investigation of choice. It reveals the presence of foreign bodies, their location in the brain and presence of associated intracranial lesions which may include depressed bone fragments, pneumocephalus, subarachnoid hemorrhage, intracerebral hematoma, contusion, intraventricular hemorrhage and infarct. Presence and severity of such lesions adversely affects

the clinical outcome. Three dimensional CT scan of orbit and brain helps in better delineation of location of the foreign body and its relation to the surrounding bony and parenchymal structures in an emergency situation. In the postoperative period it is helpful in identifying residual bone fragments or foreign body, abscess formation as well as new or recurrent haematoma and areas of tissue injury not evident at the time of initial imaging[14]. During the follow up period, one should keep the possibility of pseudoaneurysms and post traumatic arteriovenous fistula mind, especially when track of foreign body was close to the major vessels or dural sinuses[15].

The goals of modern treatment include removal of the foreign body under a controlled environment in the neurosurgical operation theater. Surgical principles include removal of bony fragments, intracerebral hematoma, control of hemorrhage and prevention of further loss of neural tissue. Patient should receive broad spectrum intravenous antibiotic therapy along with tetanus prophylaxis. Monitoring and control of elevated intracranial pressure with maintenance of cerebral perfusion pressure plays a significant role in patient's survival and outcome. The follow up of such patients is essential considering known complications like cerebrospinal fluid fistula in the early postoperative period and brain abscess and seizures which may occur years after injury.

Outcome after a penetrating head injury is directly related to the Glasgow coma scale at the time of presentation which is the reflection of extent of brain tissue damage caused directly by the primary impact intensive postoperative monitoring of intracranial pressure, cardio respiratory function and metabolic status are required for optimizing the outcome of victims of penetrating craniocerebral injuries[16]. Penetrating head injuries have a higher mortality and morbidity than blunt trauma even in a civilian set up. Even after timely removal of the penetrating objects and intensive medical management, outcome may remain gloomy. Adequate use of protective gear by the workers helps to prevent such a life threatening injury.

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