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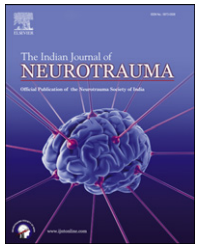

Case report

Severe craniocerebral injury with impacted axe in situ: A fatal outcome

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ABSTRACT

Penetrating head injury [PHI] with impacted axe in situ is extremely uncommon. Management of these injuries requires anticipation of difficulties faced in the CT room as well as in the operating room and a sound knowledge of technique required for a safe delivery of the impacted weapon. We present an extremely uncommon case of penetrating head injury with impacted weapon (axe) in situ on admission. Management of the case discussed & literature reviewed.

1. Case history

A twenty six years old female presented in the emergency room with alleged h/o assault from husband with axe 6 h back. The axe was seen lying impacted in the left fronto temporal region of the skull [Fig. 1]. She was unconscious with GCS of E1V1M5. Patient had spontaneous left upper limb movements & had an extensor response from the right side. Pulse 104/min, B.P. 96/60 mmHg, with right pupil 3 mm sluggishly reacting and left pupil 5 mm nonreacting to light. The patient was immediately intubated. CT Scan [Fig. 2A and B] of the patient could be done in this case as the wooden handle was lying loose and could easily be detached without disturbing the impacted part of the axe. Although there was too much of metal artifacts in the CT Scan, but it was good enough to demonstrate the absence of any territorial infarct and thus almost ruled out the possibility of major vascular injury. CT Scan showed blood in the occipital horns of the bilateral lateral ventricles and brainstem contusions. After initial resuscitation the patient was shifted to the operating room. C-Arm was used for X-ray of the skull [Fig. 3] in the operating room, showed the impacted axe in the left fronto temporal region flush to the roof of the orbit & reaching upto about 2 cm short of the midline. A scalp incision perpendicular to the long axis of the impacted axe given. A 'D' shaped craniotomy made with the vertical limb of the 'D' formed by the bone defect caused by the axe. Dura opened in 'T' shaped manner. A soft brain spatula is then made to slide against the body of the axe till its medial most limit. Slight brain retraction & gentle delivery of the axe without zigzag movements achieved. There was no breakthrough bleeding, cavity inspected & cleared of gross contaminants, hairs etc.

Abbreviations: h/o, History of; GCS, Glasgow Coma Score; min, Minute; mmHg, Millimeter of mercury; mm, Millimeter; CT Scan, Computed tomography scan; PHI, Penetrating head injury; SAH, Subarachnoid hemorrhage.

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Fig. 1 – Impacted axe in situ in the left fronto temporal region.

Contused brain sucked away. Little oozing from the brain controlled with oxidized cellulose. Dura closed using a pericranial patch. After thorough cleaning and irrigation of the wound with saline, the bone flap was replaced & wound closed in layers. Patient didn't show improvement in the neurological status after surgery. A post operative CT head [Fig. 4] showed brainstem hypodensities with contusions in the brainstem and some extraaxial blood around the brainstem. Unfortunately the patient died of brainstem dysfunction on the 2nd post operative day.

2. Discussion

Penetrating head injury is potentially dangerous. Experimental model demonstrated by Cobb Pilcher[1] confirms without doubt the severity & mortality associated with penetrating head injury. Penetrating head injuries [PHI] can be divided into high & low velocity PHI's, depending upon the mode of injury. High velocity PHI's comprise of mainly gunshot & missile injuries. Low velocity PHI's include assault, suicide & occupational accidents such as injuries by hunting arrow, fan blade injuries, stab injuries, axe injuries etc. Incidence of low velocity penetrating head injury is more in the

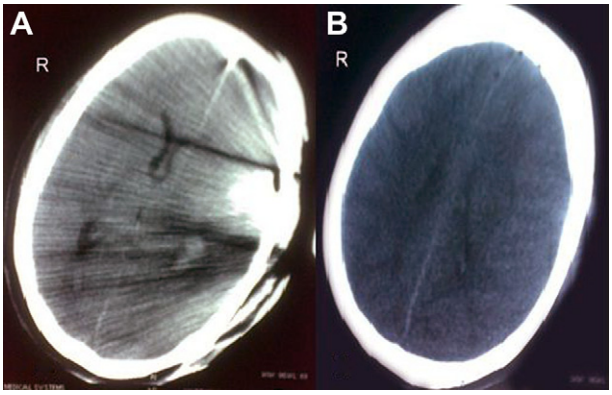

Fig. 2 – Preoperative CT scan showing (A) metal artifacts, brainstem contusions. However no obvious territorial infarct is seen in the higher cuts (B).

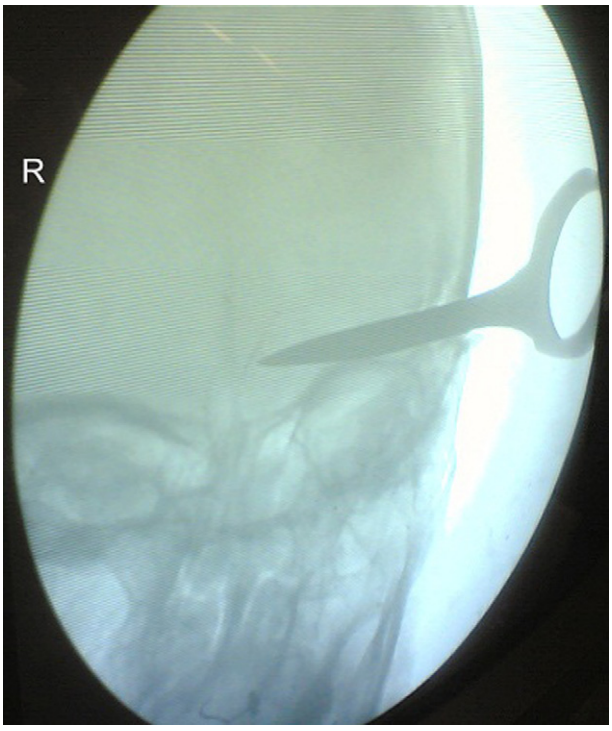

Fig. 3 – C-Arm photo of X-ray skull taken in the operating room showing axe in situ reaching medially just short of midline. Flush to the orbital roof.

countries such as South Africa where there are strict gun laws.[2] In India low velocity penetrating injuries are seen in rural set up where there is easy availability of sharp farming equipments such as sickle, axe etc. low velocity PHI's are usually seen in young adult males & are uncommon in children and aged population and in females. Left half of the skull is more commonly involved than the right and can be explained by the right handedness of the assailant in a face to face assault.[3]

CT Scan is mandatory to know intracranial injuries, associated contusion, hematoma, major vascular injury or brainstem injury and essential in decision making of surgical strategy.[4] However large impacted object(weapon) in situ pose difficulties in getting a CT Head done because of the limited space in the CT scan Gantry. With metallic objects, too much of the metal artifacts renders the CT scan difficult to infer.[5] Although by adjusting the "window", these metal artifacts can be minimized to some extent.[6]

In the presented case the weapon was with large wooden handle lying loose and could be easily detached from the impacted metallic part without disturbing it. Penetrating intracranial head injuries located near the normal course of major intracranial vessel or venous sinus warrants a preoperative cerebral angiography to rule out vascular injury. In the presented case angiography was not done as there was no evidence of infarct on the initial CT Scan [Fig. 2A and B].

The importance of cerebral Angiography is stressed in the literature to rule out vascular injury. In cases where suspicion of vascular injury is high, it is advisable that the patient should be followed up with repeat cerebral angiograms to rule

Fig. 4 – Post operative CT scan shows brainstem contusions and hypodensities with extraaxial blood in the left brainstem cisterns.

out post traumatic aneurysms which if remains unnoticed & untreated can present as SAH, Intra cerebral bleed at a later date ranging from first week to several months after the initial trauma.[7,8]

The technique of removal of impacted weapon used in the presented case was given by Van Dallen and Lipschitz[3] for the removal of impacted knife blade. They recommended that there should not be any rocking, zigzag movement of the weapon while it is in situ or during its removal in the operating room.[9] No attempt should be made to remove the impacted object in the emergency room as it can lead to breakthrough bleeding as well as further trauma. One assistant should be made to hold the impacted object throughout the procedure thus preventing any undue movement. The weapon should always be withdrawn in a straight reverse path of its entry. Van Dallen J. R advised skin incision extended vertically along the length of the wound produced by knife, to enable skin & soft tissue reflection where possible. It may be necessary to make T-shaped incision and the safest method of bone removal is to make D-shaped craniectomy. The knife blade is allowed to rest against the flat vertical segment of the D providing stability. Such an exposure provide sufficient access to control hemorrhage. A brain retractor is then gently slid along side of the knife blade to expose tip of knife. The blade is then withdrawn. This provides a method of removal with least amount of additional trauma and access to deeper structure. Water tight dural closure to prevent CSF leak is recommended.

Low velocity penetrating head injuries with impacted weapon in situ are uncommon and may be once in a life time experience for many neurosurgeons. A basic knowledge of the technique of removal as well as other factors unique to this particular entity can be of utmost importance especially to young neurosurgeons who otherwise could be in a fix when such a situation arises.

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