Case Report

Penetrating brain injury with machete, stuck to calvarium: Hurdles in imaging and solutions

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ABSTRACT

Penetrating brain injury is a less common form of traumatic brain injury in civilian set up, with a higher mortality and morbidity. A detailed preoperative imaging is warranted to ascertain the extent of injury and involvement of neurovascular structures. We present a rare case of penetrating brain injury with a long machete, who underwent emergency craniotomy, removal of the weapon, debridement and evacuation of the brain contusion and dural repair. Due to the sheer size of the weapon stuck to the calvarium, only X-rays could be performed preoperatively. The difficulties posed by the case, requiring modifications in standard imaging, possible solutions to address the problem and individualized management techniques are discussed in this report.

Key words: Computed tomography scan, imaging, management, penetrating brain injury

Introduction

Penetrating brain injury (PBI) is a type of traumatic brain injury caused by either low velocity sharp objects like knife or high velocity projectiles like bullets. It is defined as trauma to brain in which a projectile breaches the cranium but does not exit it. The morbidity and mortality following PBI remains high due to severe brain injury and associated vascular injury. A detailed imaging evaluation is essential to assess the trajectory, structures injured before the surgical management. We report an unusual case of PBI with a machete which had to operated only with an X-ray skull imaging due to technical limitations posed by the size of the object.

Case Report

A 27-year-old gentleman presented with an alleged history of assault to head with a long sharp iron machete.

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At presentation in hospital 6 h after the trauma, he was conscious, obeying requests, disoriented and had left hemiplegia. The long weapon, approximately four feet long, was stuck to the skull wound and was hanging from the right side of cranium [Figure 1a and b]. The patient was planned for imaging followed by surgical exploration and debridement. However, CT scan head was not possible, as the patient could not be positioned supine or lateral in CT scan gantry due to the long projecting machete obstructing the movement of head into gantry. The weapon was firmly jammed to the calvarium and could not be retrieved. Hence, only skull radiographs could be performed to assess the depth of injury. Skull antero-posterior and lateral radiographs revealed the weapon lodged in the right posterior frontal bone with a depth of approximately 9 to 10 cm [Figure 1c and d]. The patient was taken for emergency surgery, a right fronto-temporo-parietal skin flap was raised around the weapon. A craniotomy was done around the weapon and bone flap was raised along with the weapon. The dura was irregularly torn with underlying 7 cm deep laceration of frontal and parietal cortex [Figure 1e and f]. The brain contusion was evacuated and duroplasty was performed. Bone flap was not replaced due to severe brain bulge.

A post-operative CT brain demonstrated the injury track involving right caudate and internal capsule, with specks

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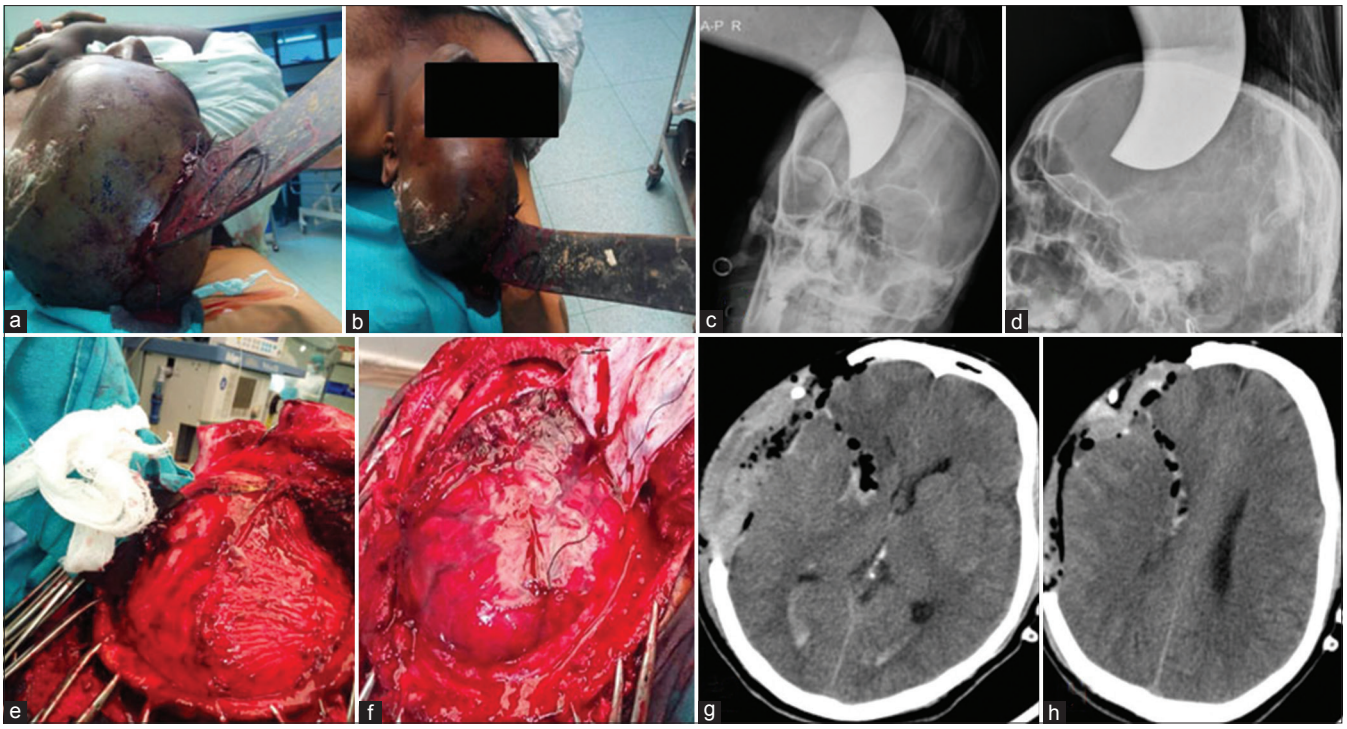

Figure 1: (a and b) Photograph showing penetrating injury by machete to right frontal region, with the weapon firmly stuck to calvarium. (c and d): X-ray skull AP and lateral oblique views showed the metal weapon penetrating the calvarial bone. (e and f): Operative photographs showing the machete stuck to frontal bone (e). After craniotomy and dural opening, underlying laceration of frontal lobe was noted (f). (g and h): CT head plain images axial sections showed air and specks of blood along the trajectory of the weapon in the right frontal lobe and caudate region, with blood in both occipital horns

of hematoma [Figure 1g and h]. The patient improved in sensorium post-operatively, was conscious, oriented with persistent hemiplegia. He was managed with anti edema measures and antibiotics and was discharged on 7th post-operative day.

Discussion

PBIs can result from a variety of objects, namely missiles, bullets, sharp instruments and low-velocity objects which may cause significant damage to the brain resulting in severe neurological deficits. While PBIs are commonly seen in war front, there is an increasing trend of such injuries among the civilians. In the United States, gunshot wounds to the head have become the leading or second leading cause of head injury in many.[1,2]

Unusual cranio-cerebral perforating injuries have been reported to be caused by nails, metal poles, ice picks, keys, pencils, chopsticks, and power drills.[3-5] The management of PBI needs to be individualized based on the extent of injury and structures involved. It has been reported earlier that increased vascular complications and mortality were noted in cases which had retained objects (knife blades) compared to those which did not. Possible reasons for these findings are that retained knife blades tend to be deeply penetrating with a potential for more cerebral and vascular injury.[6] The injury in our patient was on the convexity close to motor cortex, therefore resulting in significant motor weakness.

Recent studies have demonstrated the utility of CT scan with 3D reconstruction to ascertain the trajectory of the penetrating object.[7,8] In addition, CT angiography/4 vessel angiography may be required if a vascular injury is suspected.[9] We were unable to perform CT brain in the present case due to the obstructive size of the object preventing positioning of the patient inside the 70 cm gantry of our CT scanner (Brilliance 16 slice CT, Philips, Netherlands). We attempted positioning the patient supine and reducing the table height to minimum to enable entry of the patient into the gantry without disturbing the long weapon, but could not obtain a CT imaging. However, in hindsight, we believe that a foot first positioning with gantry tilt could have allowed CT imaging of this patient, which was not perceived as an option by the imaging staff on emergency duty. Imaging would have yielded the desired knowledge of details of brain injury before taking up for surgery. The utility of intra-operative CT scan of brain in head injury has been reported earlier.[10,11] In our patient, an intra operative CT scan of brain could have been performed after removal of the foreign body, providing necessary information

about brain injury and any need for additional surgical procedures. However, this modality may not be available in all centers, more so in emergency settings.

Management for PBI consists of exploration of wound, craniotomy/craniectomy, debridement of devitalized brain, evacuation of hematoma, debridement of retained fragments if possible and water tight dural closure and repair of skull base if injured. In the present case, considering the extent of contamination and severe brain bulge, the bone flap was not replaced.

Conclusion

Penetrating brain injury is rare, can pose unique difficulties and require individualized treatment. Modifications in standard imaging and management techniques may be essential based on the circumstances.

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