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Penetrating Head Injury by a Key: A Case Report

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Abstract: Penetrating head injury is defined as head trauma caused by an object that penetrates the skull and the underlying duramater. We reported a 22-year-old man who came to the hospital with a motorcycle key stuck into the back of his head after a fight with his friend approximately one hour before admission. The patient was fully conscious. History of projectile vomiting, and seizures were denied, and there were no other neurological deficits. Blindly removing the key can damage the neural tissue and can cause secondary injury to the brain and surrounding blood vessels. The primary goal of treatment for patients with suspected traumatic brain injury is to prevent secondary brain injury and infection. The removal of the object safely, debridement of the damaged parenchyma, removal of the hematoma, and closure of the injured dura and skin are the main goals of surgical treatment for penetrating head injuries. In this case, motor key evacuation was performed followed by craniotomy and debridement. The prognosis was good, and there was no neurological deficit. In conclusion, complete and adequate care is essential for patients with penetrating brain injuries. The strategy for treating these injuries is primarily surgery with the aim of preventing secondary brain injury and infection. According to existing research, antibiotics should be given for an indefinite period after surgery.
Keywords: penetrating head injury; traumatic brain injury

INTRODUCTION

Penetrating head injury due to motorcycle key are very rare case. Penetrating head injury is defined as head trauma caused by an object that crosses the skull bone and the underlying duramater. It may be retained in the skull or exit from another point. Penetrating head injury is usually caused by violence, accidents, or even suicide attempts. Incidence of penetrating and perforating injuries to the head in the civilian population is unknown, but current estimations indicate that bullets account for 4.6% and puncture wounds, stab, nails, etc., cause 0.4% of this kind of brain injuries.[1]

Disturbing or removing penetration objects prematurely can lead to fatal vascular injury or intracranial hemorrhage. The overall treatment for penetrating head injuries is to prevent secondary brain injury, and prevent infection.[1,2] Several factors can influence prognosis and should be carefully evaluated before determining the treatment plan. These include the patient's neurological condition, hemodynamic and respiratory status upon admission, the type of penetrating object, pupil size and reactivity, as well as CT findings. The most common complications that may arise are intracranial infections, cerebrospinal fluid (CSF) leaks, and recurrent seizures.[2]

In this case, we discuss a rare case of penetrating head injuries and its proper management to prevent secondary brain injury and infection.

CASE REPORT

A 22-year-old man came to the hospital with a motorcycle key stuck in the back of his head after a fight with his friend approximately 1 hour before admission. The patient was fully conscious. History of projectile vomiting, and seizures were denied, and there were no other neurological deficits.

Physical examination revealed that both the primary and secondary surveys were stable. On local status examination, the entrance wound on the occipital region was obtained, and there were still pieces of keys that stuck in the patient's head. (Figure 1). Neurological examination showed the Glasgow coma scale (GCS) E4M5V6 was obtained, isochor OD 3 mm OS 3 mm, light reflex right eye (+) left eye (+), meningeal sign (-), other neurological status within normal limits.

The laboratory analysis revealed no anomalies. The foreign body in the occipital region was observed to extend intracranially upon analysis of the AP/Lateral scalp x-ray. Recon 3D and a head CT scan without contrast showed. There was a shadow of metal density in the left occipital area that seemed to extend about 2.4 cm to the intracranial cavity (Figures 2, 3, and 4). Patients was diagnosed with penetrating head injury due to foreign body in the occipital region.

Management of this patient was done by removing the foreign object, followed by craniectomy, closing the injured duramater, and debridement with control of the source of bleeding. The patient was placed in a prone position, then the scalp was disinfected using povidone iodine. The surgical field was then narrowed with sterile cloth. The incision was made until it touched the bone, about three cm proximal and three cm distal to the motor key. Then the foreign object was carefully removed, followed by widening the hole with a burr hole. The evaluation was continued and a tear was found in the duramater, measuring about 1 cm. The surgical field was then washed with normal saline and hydrogen peroxide several times. The injured duramater was closed and bleeding control was continued. Finally, the surgical wound was sutured. The patient was hospitalized for five days. During treatment, the patient was given empirical antibiotics (ceftriaxone 1 g/12 hours/iv and metronidazole 500 mg/8 hours/iv) for five days, analgesics (tramadol 100 mg/8 hours/iv) for five days, and antifibrinolytics (tranexamine acid 500 mg/8 hours/iv) for three days.

After surgery, the patient only experienced pain in the area of the surgical incision and spent five days in the hospital. The patient had stable vital signs, a GCS of 15, without any neurological deficits. The patient showed no symptoms of sensory or motor issues during routine monitoring at the neurosurgery clinic.

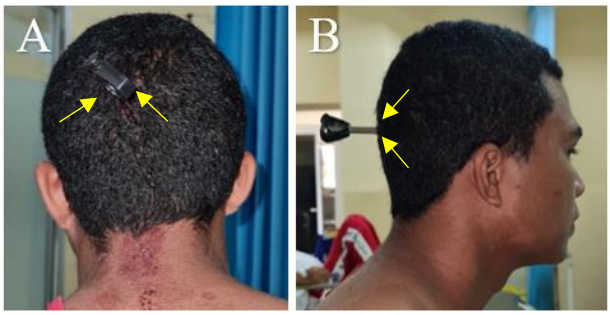

Figure 1. A, B. A 22-year-old male with a motorcycle key stucked in the occipital region

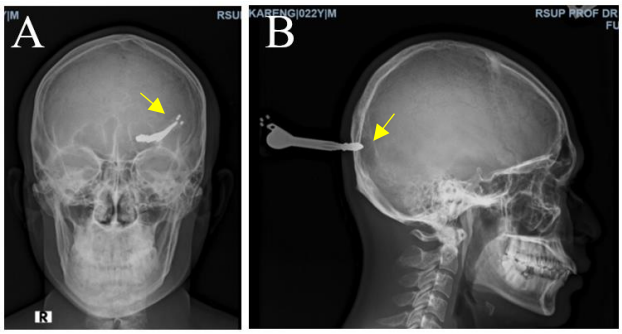

Figure 2. Skull X-ray A) Antero-posterior view; B) Lateral view, there was a radiopaque shadow with metal density in the left occipital region that was seen reaching intracranially

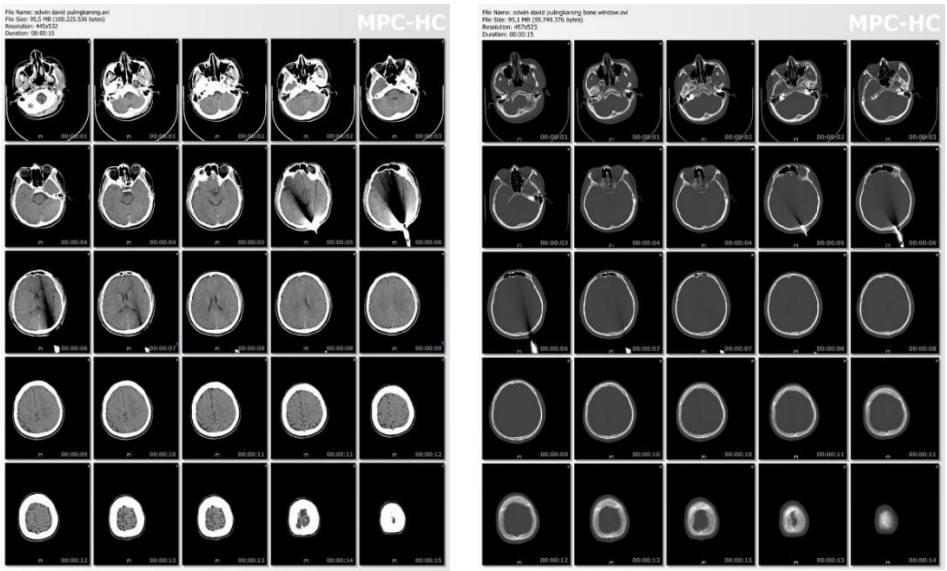

Figure 3. Head CT-Scan. A) parenchym window; B) bone window. There was a metal density shadow in the left occipital region which appeared to reach the intracranial cavity with a penetration distance of +/- 2.4 cm

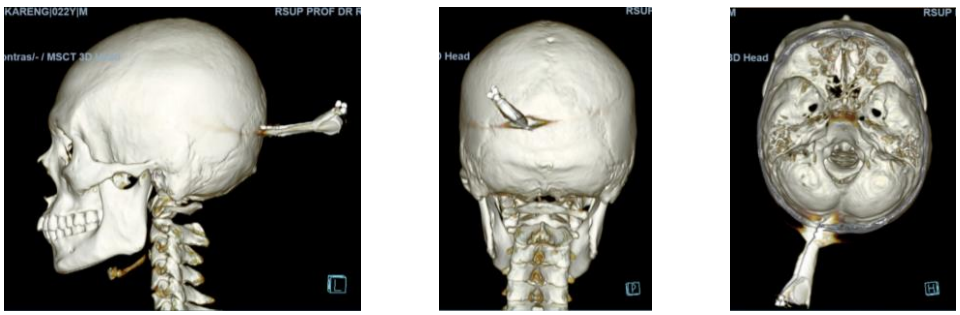

Figure 4. Recon 3D A) Lateral view; B) Dorsal view; C) Basis cranii view. There was bone discontinuity. There was a foreign body in the left occipital region passing through the intracranial cavity

Figure 5. The penetrating motorcycle key

DISCUSSION

Penetrating head injury is defined as head trauma caused by an object that crosses the skull bone and the underlying dura. It may be retained in the skull or exit from another point.[1,2] Based on the penetration speed, it can be classified into two categories, high-velocity penetration that includes injuries caused by bullets and low-velocity penetration including injuries caused by a knife or other sharp objects, such as nail and scissors. In this case, a 22-year-old man came to the hospital with a motorcycle key stuck into the back of his head by someone. Based on the penetration speed, it can be classified as low-velocity penetration. Low-velocity brain injury has a better prognosis because the primary injury caused is more localized. Even though the mortality rate of trauma of the brain penetrating at a low velocity is not high but the problems are the complications of post trauma such as infection, leakage of the cerebrospinal fluid, traumatic aneurysm, intra-ventricular bleeding, sinus thrombosis are serious that also need to be anticipated.[3,4]

In this case, a CT scan of the head with 3D reconstruction was performed, which showed a metallic density shadow in the left occipital region that appeared to reach the intracranial cavity. The neuroradiology technique that is more recommended for detecting brain damage is computed tomography scanning. In patients with penetrating brain injury and with suspicion of vascular injury, cerebral angiography is recommended.[5]

Rapid transport to a major trauma center is needed for patients with penetrating brain injury to prevent neurological deficit and post traumatic tissue damage. Optimum management of penetrating brain injury needs sufficient understanding of the mechanism and also the pathophysiology of injury. Management of penetrating brain injury focusing solely on head injury should be avoided. Instead, a thorough review of the primary and secondary survey of advance trauma life support (ATLS) is highly recommended.[6]

In this case, we followed ATLS guidelines and thoroughly assessed the primary and secondary surveys prior to surgery. Next, we proceeded with the surgical procedure, which in this instance involved the following actions: A burr hole craniotomy was performed after the corpus alienum/ motorcycle key was evacuated in order to determine whether any brain tissue had been damaged. In this instance, there was a 1 cm tear in the dura mater along with bleeding. Following that, we closed the injured dura, halted the bleeding, cleaned the surgical wound, and then closed it. The management strategy for these injuries is primarily surgical. The step-wise evaluation of the patient, as addressed by de Holanda et al,[7] includes resuscitation, close evaluation of the scalp by looking for the site, number, and shape of penetration, followed by thorough neurological examination.[7]

The primary goal of treatment for patients with suspected traumatic brain injury is to prevent secondary brain injury. Blind removal of the key can damage the neural tissue and may cause problems such as secondary injury to the brain and the adjacent vessels. Things that enter the intracranial cavity or infratemporal fossa and remain partially exteriorized (e.g., arrows, knives, screwdrivers) must be left in place until possible vascular injury has been evaluated and definitive neurosurgical management established. Disturbing or removing penetration objects prematurely can lead to fatal vascular injury or intracranial haemorrhage. The removal of the object safely, debridement of the damaged parenchyma, removal of the hematoma, and closure of the injured

dura and skin are the main goals of surgical treatment for penetrating head injuries. A craniotomy was used to surgically treat the majority of cases in the literature. The craniotomy should be sufficiently wide to allow the removal of the knife with little to no pivotal movement and to help control any potentially sudden bleeding.[8-10]

The patient received metronidazole 500 mg/8 hours/IV and ceftriaxone 1 mg/12 hours/IV as empirical antibiotics for five days. Due to the contaminated nature of penetrating objects, the majority of authors advise to use prophylactic antibiotics as the cornerstone of treatment. Both Gram-positive and Gram-negative bacteria as well as anaerobic bacteria should be covered by the preventative antibiotics. However, the duration of antibiotic therapy is still controversial. There is a clear consensus that the antimicrobial prophylactic therapy should be continued for at least 72 h after surgery if any foreign objects remain in the scalp, skull, orbit, or central nervous system.[11,12]

CONCLUSION

This patient was managed in a comprehensive manner. According to ATLS guidelines, a primary and secondary survey were conducted as soon as the patient arrived at the emergency room. After confirming the patient's suitability for surgery, we proceed with the procedure. In this case, after the motorcycle key was removed, a craniotomy was continued for better exposure, and a tear was found in the duramater of about 1 cm, accompanied by bleeding around it. The duramater was closed, the bleeding was controlled, and then debridement and closure of the surgical wound were performed. Postoperative antibiotics were given. After being treated for approximately five days after surgery the patient's condition was good; there was no neurological deficit. Complete and adequate care is very important for patients with penetrating brain injuries.

Conflict of Interest

The authors affirm no conflict of interest in this study.

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