

# Penetrating brain injury with a bike key: a case report

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## ABSTRACT

Penetrating brain injury (PBI) may be caused by low-velocity or high-velocity objects. Several objects are known to cause such injury ranging from knives to rooster pecks. However, an assault with the key of a bike causing PBI has not been reported in the literature. The objective of this study was to report the case of a 21-year-old male patient, who presented after an assault with a bike key. The key was impacted in the left parietal region. Left parietal craniotomy was done and the key was removed. There was an underlying parenchymal contusion, which was excised. On post-operative day two, the patient developed motor aphasia, which subsided in subsequent days with antiedema measures. At the first month follow-up, the patient was having normal speech and consciousness. Prompt treatment of penetrating brain injury is important and angiography is not always necessary for PBI.

**Key words:** Bike key; left frontal contusion; penetrating brain injury; post-traumatic seizure.

## INTRODUCTION

Penetrating brain injury (PBI) is a relatively rare cause of traumatic head injury. PBI in civilian population is commonly low-velocity, high-energy type and can be caused by almost all sharp and blunt objects under the sun. The weapons range from knives and chopsticks to scissors and door keys.<sup>[1]</sup> To date, there have only been two case reports of PBI caused with a key.<sup>[2,3]</sup> Bike key used as a weapon is being reported for the first time in the literature. This study aimed to discuss the clinical presentation and successful management of such injury.

## CASE REPORT

A 21-year-old male, with no addictions or comorbidities, presented to our emergency service with history of assault with the key of a bike on his head. He was hit by an unknown person at night while he was reaching the bike stand to take his

bike. He presented four hours after the incident and had no history of loss of consciousness, vomiting or seizures. At presentation, his Glasgow Coma Scale (GCS) was 15/15 without any neurological deficit and pupils were bilaterally equal and reacting. A key was seen partially penetrating his left parietal scalp (2 cm posterior to coronal suture and 5 cm away from midline) through a lacerated horizontal wound measuring 10 mm × 5 mm (Fig. 1). There was no evidence of any other injury.

X-ray image of the skull showed the key in the left parietal region with a portion of it intracranially (Figs. 2a, b). Computed tomography (CT) of the brain showed a metallic foreign body penetrating the left parietal bone and 1 cm of adjacent parenchyma. (Figs 3a, b). CT cerebral angiography was deferred as we did not expect a major vessel injury at such a location.

The patient underwent left parietal craniotomy and removal of foreign body, six hours post-trauma. A horse-shoe flap was made, centering the key, based temporally. Craniotomy was done along the line of skin incision and osteo-cutaneous flap was raised, during which the key came along. The key was removed (Fig. 4) and dura hitched at the edges of craniotomy. There was a dural breach measuring 8 mm × 3 mm. Dura was opened in a U-shaped fashion, based superiorly, which revealed an underlying 10 mm × 5 mm sized contusion. Contusectomy was done and hemostasis was achieved with bipolar forceps and oxidized regenerated cellulose. Brain surface was washed with saline. The dural defect edges were freshened, and the dural opening was closed in a water-tight manner with pericranial flap. The bone edges through which

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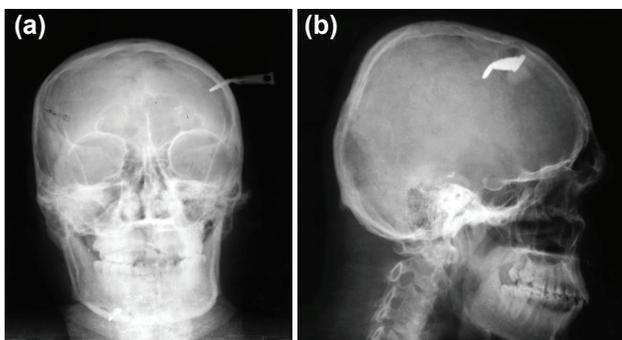
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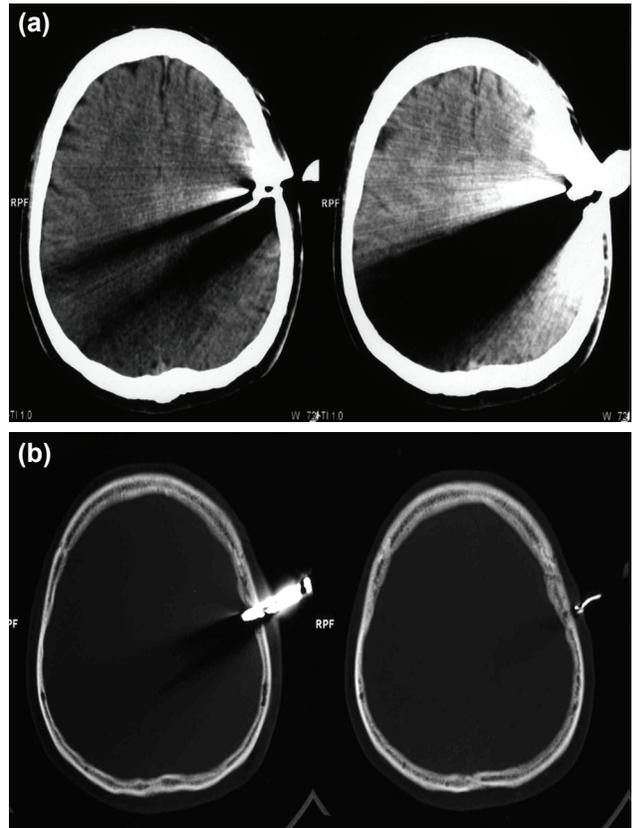
**Figure 1.** Clinical picture showing a key penetrating the left parietal region.

the key came were punched out till clean. The bone flap was replaced, and the wound was closed in layers after freshening the edges. A drain was kept in the subgaleal plane.

Post-operatively, the patient had an uneventful recovery to his pre-operative neurological status. The drain was removed on post-operative day (POD) 2. Post-operative brain CT was normal except for a small pneumocephalus at the surgical site (Fig. 5). The patient was continued on intravenous antibiotics and oral anticonvulsant. However, on POD 4, the patient developed motor aphasia. Brain CT was repeated, which showed only the same findings as in the previous one. On POD 6, the patient threw right-sided focal seizures, which lasted for 2 minutes; followed by recovery. Anticonvulsant dosage was stepped up. By POD 12, the patient regained his speech and was discharged on POD 14. Oral antibiotic and anticonvulsant were continued for one more week. At POD 45 follow-up, the patient had normal neurological status and had no further seizures.



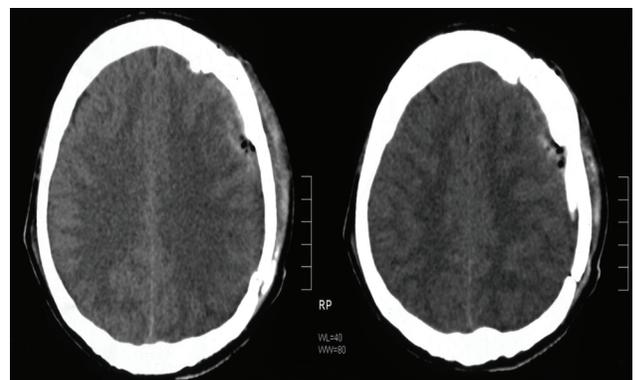
**Figure 2.** (a) Plain X-ray skull AP view showing the inferiorly bent key in the left parietal region. (b) Plain X-ray skull lateral view showing the bent key.



**Figure 3.** (a) Plain computed tomogram (CT) of brain showing the metallic foreign body with metal artefacts. (b) Plain computed tomogram (CT) of head - bone window - showing the foreign body penetrating intracranially.



**Figure 4.** The retrieved key.



**Figure 5.** Plain computed tomogram of brain taken on post-operative day 2, showing mild pneumocephalus at the surgical site.

## DISCUSSION

Medical reports of stab wounds of the brain date from as early as 1806.<sup>[4]</sup> Penetration most commonly occurs through thin bones of the skull - orbital surfaces of frontal bones and squamous part of temporal bone.<sup>[5]</sup>

PBI is associated with high risk of morbidity and mortality due to associated vascular injury, infection, seizures, and cerebrospinal fluid leakage. The best imaging modality for this type of trauma is non-contrast cranial and maxillofacial CT scan. In case of suspicion for vascular injury, an angiography should also be performed to evaluate traumatic aneurysm, which can develop soon after a penetrating injury. Prophylactic antibiotics and antiseizure medications (for the first week) are to be given.<sup>[6]</sup>

The goals of surgical intervention in patients with these injuries are to:-

- 1) Remove the penetrating item from the brain parenchyma.
- 2) Remove necrotic tissue, debris and other potential contaminants.
- 3) Evacuation of any haematomas occurring from the injury and secure hemostasis.
- 4) Ensure watertight closure of the dura to prevent CSF leakage.<sup>[7]</sup>

The key of a vehicle (bike or car) is a weapon which is handy and always within reach, especially among youngsters. High incidences of stab on the left side of skull are probably due to right-handedness of the assailant except when the victim is hit from the back.<sup>[8]</sup> An easily accessible area in the scalp with a short object like a key is the parietal region. The problem with computed tomography of the brain in this case is that the region of interest will be overlapped with metal artefacts, and a separate bone window might be needed. We had to elevate the scalp along with the skull in this case so as to avoid early removal of the foreign body and prevent expansion of underlying hematoma, if any. Motor aphasia which the patient developed during the post-operative period might have been due to edema extending to inferior frontal gyrus.

An era has arisen in which people need to wear helmet, not only while riding a bike, but also before going to the bike stand; as no one knows when, where or with what, you might get attacked on the head!

Protection of the brain within a strong bony enclosure is an extremely conserved feature of vertebrate evolution.<sup>[9]</sup> This report adds to a novel man-made weapon, which can be used to penetrate the nature-made protective covering of the delicate brain. This is the third case report of cranial penetration with a key.

### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Conflict of interest: None declared.

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## OLGU SUNUMU - ÖZET

### Bisiklet anahtarıyla penetran beyin yaralanması: Bir olgu sunumu

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Penetran beyin yaralanmasına (PBY) düşük veya hızlı ivmeli nesnelere neden olabilmektedir. Bıçaklar ve horoz gagası gibi birkaç nesnenin bu çeşit yaralanmalara neden olduğu bilinmektedir. Ancak literatürde bisiklet anahtarıyla saldırı sonucu oluşan PBY bildirilmemiştir. Bu çalışmanın amacı bir bisiklet anahtarıyla saldırı sonrası gelen 21 yaşındaki bir erkek hastayı raporlamaktır. Anahtar sol pariyetal bölgeye takılı kalmış ve sol pariyetal kraniyotomiyle çıkarılmıştır. Altta yatan parankimal kontüzyon eksize edilmiştir. Ameliyat sonrası ikinci gün hastada motor afazi gelişmiş ve daha sonraki günlerde ödem çözücü önlemlerle geçmiştir. Birinci aylık izlemde hasta normal konuşma ve bilincine kavuşmuştu. Penetran beyin yaralanmalarının hemen tedavi edilmesi önemli olup PBY için her zaman anjiyografi gerekmemektedir.

Anahtar sözcükler: Bisiklet anahtarı; penetran beyin yaralanması; posttravmatik nöbet; sol frontal kontüzyon.

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