

Case Report

Stephanion to cranial base penetrating stab wound with outstanding recovery: A case report

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ABSTRACT

Background: Mortality due to head trauma is common in developed countries in all age groups. Nonmissile penetrating skull base injuries (PSBIs) due to foreign bodies are quite rare, accounting for about 0.4%. PSBI carries that a poor prognosis brainstem involvement usually is often fatal. We are reporting the first case of PSBI with a foreign body insertion site through the stephanion with a remarkable outcome.

Case Description: The 38-year-old male patient was referred with a penetrating stab wound to the head through the stephanion caused by a knife after a conflict in the street. He had no focal neurological deficit or cerebrospinal fluid leak, and Glasgow coma scale (GCS) was 15/15 on admission. A preoperative computed tomography scan showed the path of the stab beginning at the stephanion, which is the point where the coronal suture crosses the superior temporal line, heading toward the cranial base. Postoperatively, GCS was 15/15 without any deficit apart from the left wrist drop, possibly due to a left arm stab.

Conclusion: Careful investigations and diagnoses must be made to ensure convenient knowledge of the case due to the variety of injury mechanisms, foreign body characteristics, and individual patients' characteristics. Reported cases of PSBIs in adults have not reported a stephanion skull base injury. Although brain stem involvement is usually fatal, our patient had a remarkable outcome.

Keywords: Cranial base, Knife stab, Nonmissile, Penetrating traumatic brain injury, Stephanion

INTRODUCTION

Traumatic brain injury is one of the most frequent causes of death in developed countries in all age groups. Approximately 5 million people die annually due to physical head traumas, in which most cases are preventable. Penetrating skull base injuries (PSBIs) due to foreign bodies (FBs) are not common, representing about 0.4% of all head traumas. Although PSBIs are less prevalent than closed-head traumas, they carry a worse prognosis.^[2] Patients may be asymptomatic firstly but they can develop serious events later.

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PSBIs are caused mainly by high-velocity tools that lead to dangerous damage with high mortality rates. Others made by nonmissile low-velocity objects are scarce among civilians, with the better outcome due to being more localized primary injuries. Most intracranial FBs can be defined using a cranial computed tomography (CT) scan. Management for PSBIs includes surgical removal of FBs, control of infection, treatment of vascular injuries, and reconstruction of the skull base.

Herein, we report a case of a 38-year-old male with the left stephanion to cranial base penetrating wound injury caused by a knife after a conflict in the street. The patient underwent surgery for knife removal, pre-and postoperative Glasgow coma scale (GCS) was 15/15, and no neurological deficit was observed.

CASE DESCRIPTION

A 38-year-old male patient was referred to the Neurosurgery Teaching hospital with a penetrating stab wound to the head caused by a knife after a conflict in the street [Figure 1]. He had no focal neurological deficit or cerebrospinal fluid leak, and GCS was 15/15 on admission. Other stabs in the left arm and left side of the neck were observed. A preoperative CT scan showed the path of the stab beginning at the stephanion, which is the point where the coronal suture crosses the superior temporal line, heading toward the cranial base [Figure 2]. The patient underwent surgery to remove the knife by gentle traction with direct visualization of the FB path inside the head. Postoperatively, GCS was 15/15 without any deficit apart from the left wrist drop, which could be due to left arm stab.

DISCUSSION

Mortality due to head trauma is very common among developed countries in all age groups.^[15] Nonmissile PSBIs



Figure 1: Preoperative picture of the patient in supine position under general anesthesia by endotracheal intubation, showing the knife stab insertion point to the left side of his head.

due to FBs are quite rare, accounting for about 0.4%. PSBI carries a very poor prognosis, although patients may be asymptomatic initially deteriorate later. Classification of PSBI into missile and nonmissile is based on the velocity at which the foreign object made the penetration. The injury is considered nonmissile if the velocity is <100 m/s.^[1] High-velocity objects commonly cause PSBIs, but in our case, it is a nonmissile PSBI. Penetration depends on the shape, material, energy, angle, and insertion site.^[1,13] Our case was a PSBI caused by a stab using a cold weapon after a street conflict. Usually, these kinds of injuries are associated with multiple trunk stabs. However, in our case, the patient was presented with neck and arm stabs as he was trying to preserve his head with his arms.

Nonmissile penetrating brain injuries are relatively rare.^[15] However, penetrating brain injuries have significantly increased in the past decade. In addition, the mortality has reached about 35,000 in civilians.^[9] Usually, such cases have high morbidity and mortality.^[10] Common insertion routes are through thin bony areas, specifically temporal squama, orbit, and skull foramina. According to the literature, a vast list of FB causes penetrating brain injuries.^[15]

Insertion through the orbital roof is the most common site, followed by temporal squama due to their relative thinness.^[13] In our case, penetration was through the stephanion. The stephanion is a craniometric point, where the coronal suture meets the superior temporal line. It can be felt superficially and is an important site for burr holes.^[4,11] It is the area overlaying the region of the inferior frontal sulcus and precentral sulcus.^[4] To the best of our knowledge, there are no reported cases of PSBI describing FB insertion through the stephanion, and our case represents the first one with outstanding recovery.

The stephanion provides an important topographic anatomical key point. It can approximate the junction between the inferior frontal sulcus and precentral sulcus.^[4] Thus, the stephanion is an important burr hole site for many procedures, such as some chronic subdural hematoma evacuation and many endoscopically assisted craniectomies.^[7,11] A 2 cm incision can be made at the stephanion level just behind the hairline with a burr hole at the incision site. This burr hole provides an access point for the anterior fontanelle and pterion with the assistance of an endoscope. Such access is essential for craniectomies to correct craniosynostosis and has been well-established.^[7] Despite its clinical significance, the stephanion has not been described before as an FB insertion site in PSBIs.

We conducted a PubMed Medline database search by the following keywords: (((nonmissile [Title/Abstract]) OR (penetrating injury [Title/Abstract])) AND ((skull base [Title/Abstract]) OR (stephanion))). A total of 33 reported cases of PSBI in adults have been reported. A literature

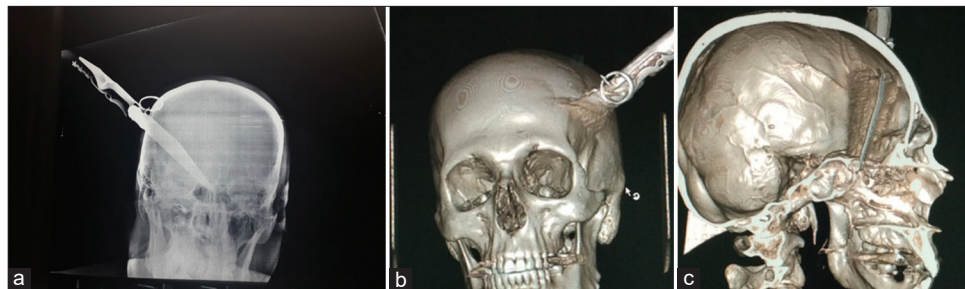


Figure 2: (a) Preoperative CT scan, sagittal section, bone window, (b) preoperative CT scan, sagittal section, 3D reconstructed, shows the knife stab penetrating the left Stephanion heading toward the cranial base, (c) preoperative CT scan, coronal section, 3D reconstructed shows the extension of the knife tip to the skull base (posterior ethmoidal sinus). CT: Computed tomography.

review published in 2017 identified 37 PSBI cases, 29 of which are adult injuries. Other four cases of adult PSBIs were identified after 2017, none describing FB insertion sites through the stephanion.^[3,8,12-14] Furthermore, a management plan is required to gain the best results in PSBI cases.

CT scans and 3D construction are recommended for PSBI diagnosis to provide a clear image of the case due to the complexity of such cases. CT scan was used to assess anatomical structures surrounding the object and to rule out any slight brain damage since many important structures lie within the skull base. In addition, a 3D-constructed CT scan was obtained, which provided further details to facilitate diagnosis and presurgical planning.^[13] Preoperative sagittal CT scan showed the trajectory of the stab penetrating the left stephanion and heading toward the cranial base [Figure 2a]. In our case, due to resources limitation in the hospital, imaging assessing vascular structures angiography was not obtained.

Such cases should be managed as soon as possible, even if they appear asymptomatic, because they usually deteriorate and have a poor prognosis.^[6] Since PSBIs are rare and complicated, and treatment depends on many factors, such as the site of penetration, trajectory, and patient characteristics, there is no standard approach to removing the FB.^[13] However, management usually involves a craniotomy, which provides early visualization, preservation of important vasculature, controlled FB removal, and repair of damaged tissue.^[5] Indications of surgery include retention of FB, CSF leakage, and vascular injury. In general, the surgery aims to remove the FB and reconstruct the skull base.^[6]

Complications are common in nonmissile penetrating head injuries, primarily vascular, and infectious complications. Many patients may develop aneurysms and vessel cutoffs. Infections are also common, and the lack of prophylactic antibiotics administration is associated with infectious complications.^[6] In our case, recovery was rapid, with a postoperative GCS of 15/15 and no deficit except for a wrist drop caused by a left arm stab wound. Such cases with

brainstem involvement usually have a very poor prognosis and are often fatal.^[9]

CONCLUSION

Nonmissile PSBIs constitute an essential type of traumatic brain injury. Careful investigations and diagnoses must be made to ensure convenient knowledge of the case due to the variety of injury mechanisms, FB characteristics, and individual patients' characteristics. Previously reported cases of PSBIs have not reported the stephanion as an FB insertion site. Although brain stem involvement is usually fatal, our patient had a remarkable outcome.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Alafaci C, Caruso G, Caffo M, Adorno AA, Cafarella D, Salpietro FM, *et al.* Penetrating head injury by a stone: Case report and review of the literature. *Clin Neurol Neurosurg* 2010;112:813-6.
- Alao T, Waseem M. Penetrating head trauma. In: StatPearls. Treasure Island, FL. StatPearls Publishing; 2021.
- Aydin S. Intracranial penetrating trauma caused by fishing sinker. *World Neurosurg* 2019;129:237-40.
- Chaddad-Neto F, Joaquim AF, dos Santos MJ, Linhares PW, de Oliveira E. Microsurgical approach of arteriovenous malformations in the central lobule. *Arq Neuropsiquiatr* 2008;66:872-5.

5. de Holanda LF, Pereira BJ, Holanda RR, Neto JT, de Holanda CV, Filho MG, *et al.* Neurosurgical management of nonmissile penetrating cranial lesions. *World Neurosurg* 2016;90:420-9.
6. Harrington BM, Gretschel A, Lombard C, Lonser RR, Vlok AJ. Complications, outcomes, and management strategies of non-missile penetrating head injuries. *J Neurosurg* 2020;134:1658-66.
7. Jimenez DF, Barone CM. Early treatment of coronal synostosis with endoscopy-assisted craniectomy and postoperative cranial orthosis therapy: 16-year experience. *J Neurosurg Pediatr* 2013;12:207-19.
8. Lan ZG, Seidu AR, Li J, Yang C. Nonprojectile penetrating iron rod from the oral cavity to the posterior cranial fossa: A case report and review of literature. *Int Med Case Rep J* 2018;11:41-5.
9. Li XS, Yan J, Liu C, Luo Y, Liao XS, Yu L, *et al.* Nonmissile penetrating head injuries: Surgical management and review of the literature. *World Neurosurg* 2017;98:873.e9-873.e25.
10. Vakil MT, Singh AK. A review of penetrating brain trauma: Epidemiology, pathophysiology, imaging assessment, complications, and treatment. *Emerg Radiol* 2017;24:301-9.
11. Vasella F, Akeret K, Smoll NR, Germans MR, Jehli E, Bozinov O, *et al.* Improving the aesthetic outcome with burr hole cover placement in chronic subdural hematoma evacuation-a retrospective pilot study. *Acta Neurochir (Wien)* 2018;160:2129-35.
12. Yoneoka Y, Aizawa N, Nonomura Y, Ogi M, Seki Y, Akiyama K. Traumatic nonmissile penetrating transnasal anterior skull base fracture and brain injury with cerebrospinal fluid leak: Intraoperative leak detection and an effective reconstruction procedure for a localized skull base defect especially after coronavirus disease 2019 outbreak. *World Neurosurg* 2020;140:166-72.
13. Zhang D, Chen J, Han K, Yu M, Hou L. Management of penetrating skull base injury: A single institutional experience and review of the literature. *Biomed Res Int* 2017;2017:2838167.
14. Zhang M, He Q, Wang Y, Pang S, Wang W, Wang D, *et al.* Combined penetrating trauma of the head, neck, chest, abdomen and scrotum caused by falling from a high altitude: A case report and literature review. *Int Emerg Nurs* 2019;44:1-7.
15. Zyck S, Toshkezi G, Krishnamurthy S, Carter DA, Siddiqui A, Hazama A, *et al.* Treatment of penetrating non-missile traumatic brain injury. Case series and review of the literature. *World Neurosurg* 2016;91:297-307.

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