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Case report

Combined transcranial and transnasal endoscopic approach in transnasal-penetrating intracranial injury: A rare case report

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ABSTRACT

Introduction: Transnasal-penetrating intracranial injuries are rare traumatic brain injuries that can cause serious and fatal brain damage and a high mortality rate and necessitate immediate multidisciplinary surgical management. We describe an uncommon case whereby a patient who presented with an accidental penetrating injury of the brain was found to have a wooden transnasal-penetrating intracranial object.

Case presentation: A 28-year-old man consulted an ear, nose, and throat (ENT) surgeon after complaints of headache for two days, a history of epistaxis, and vomitus. The right side of the nose had been punctured by wood as a result of falling from a motorcycle. A computed tomography (CT) scan led to diagnosis of a transnasal penetrating intracranial injury. Removal of the transcranial foreign body was carried out jointly by a neurosurgeon and ENT surgeon. Postoperatively, antibiotics were given for 14 days, and the patient was discharged without neurological deficit.

Clinical discussion: Early diagnostic procedures, such as CT scan of the skull to assess trajectory and extent of vascular and brain tissue injury, are required for appropriate surgical planning and post-operative treatment of such patients. Surgery was performed by combined transcranial and transnasal endoscopy to identify the skull base, dura mater defect, and brain tissue damage. Removal of the corpus alienum by transnasal endoscopy yielded a good outcome.

Conclusion: Combined transcranial and transnasal endoscopic approach showed better result than transcranial approach only. The wooden foreign body can be completely eliminated transnasally without active bleeding using this approach. The patient was discharged with good outcome.

1. Introduction

Penetrating intracranial injuries include any damage to the head due to penetration by an object [1]. They can be divided into two groups based on the speed of penetration: high-velocity penetration (including gunshot injuries) [2] and low-velocity penetration (including injuries produced by a knife or other sharp items) [3]. Penetrating intracranial injury is a rather uncommon event, with the exception of gunshot wounds [4], and affects all ages [5]. Clinical presentation varies depending on the mechanism of the injury [4].

Non-missile injuries are a significant subset of penetrating head injuries, creating a localized injury along the trajectory of the projectile without the thermal and kinetic components of high-velocity penetrating injuries such as gunshot wounds. The processes of neuronal and vascular impairment resulting from non-missile injuries such as cranial stab wounds may differ from those resulting from other types of head trauma [6,7]. Even though the mortality rate of low-velocity penetration is not high, post-trauma complications such as cerebrospinal fluid (CSF) leakage, infection (abscess, empyema, meningitis, and ventriculitis), intra-ventricular bleeding, sinus thrombosis, and traumatic aneurysm are serious problems [1,3,7].

Here, we report an extremely uncommon case of transnasal

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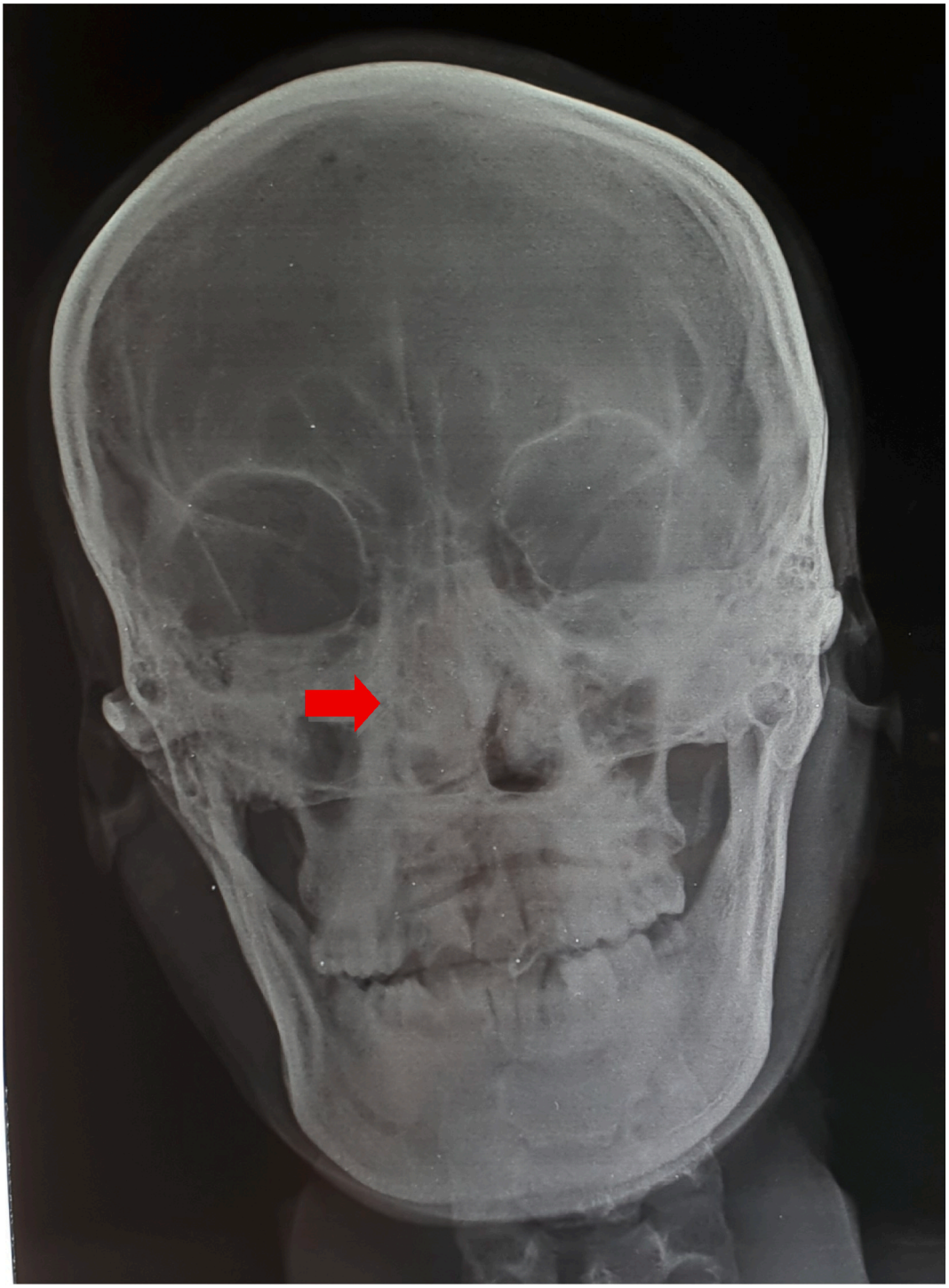

Fig. 1. An anteroposterior X-ray of the skull, showing a blood clot with a radiopaque appearance in the right nostril (red arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

intracranial penetration by a wooden foreign body with a rather favorable outcome and no fatal complications. This case was report according to the Surgical Case Report Guidelines 2020 [8].

2. Case presentation

A 28-year-old Asian male arrived in emergency room (ER) at Wahidin Sudirohusodo Hospital Makassar, Indonesia, with a headache and an impacted wooden stick in the right nostril that had been present for two days before his admission to the hospital. He was seen by an ear, nose, and throat (ENT) surgeon in the ER. The patient had slipped while getting off a motorcycle, and his right nostril had been punctured by a wooden stick as he fell. There had been a history of vomitus and epistaxis on the first day of the incident. The patient had been referred from a regional hospital where he had undergone a previous head X-ray examination (Fig. 1) and the wooden stick had been cut off.

Upon review, he was hemodynamically stable, conscious, and alert. Additional injuries were not found in primary or secondary surveys, and no significant medical histories or instances of drug, tobacco, or alcohol abuse were noted. Anterior rhinoscopy showed part of the wooden stick

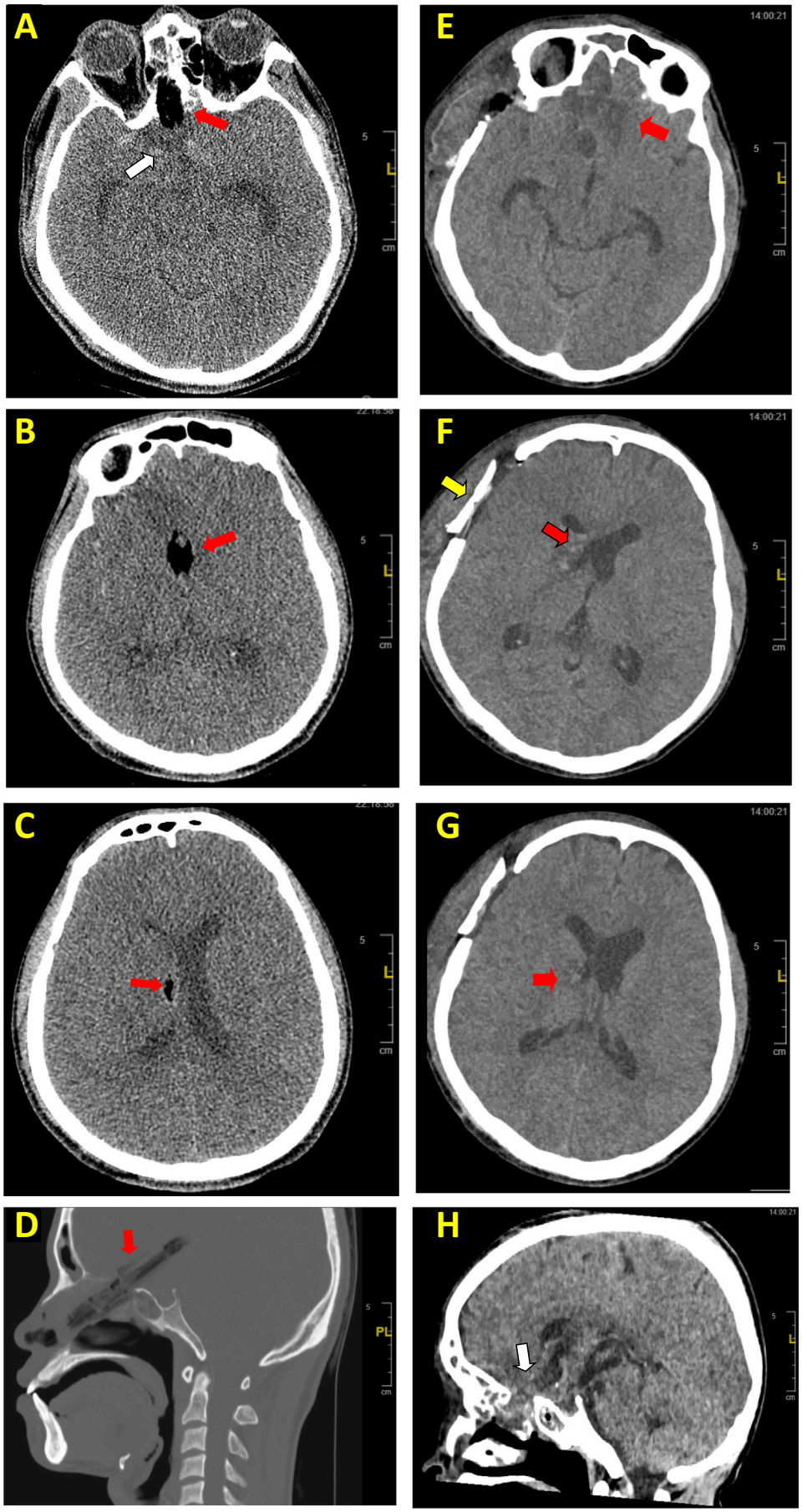

Fig. 2. A non-enhancement head CT scan (axial plane) showing a hypodense lesion extending from the right nasal cavity to the cerebral parenchyma of the right frontotemporal lobe, corresponding with the pneumocephalus apparent after extraction of the wood (A, B, C). The white arrow indicates a hyperdense lesion corresponding to contusion of the frontal lobe region (A). The sagittal plane shows fractures in the ethmoidal bone and right sphenoidal bone (D). A non-enhancement post-surgery head CT scan, axial plane (E, F, G). Arrows indicate the bilateral frontal lobe and right periventricular contusion cerebri (red arrow) and the right frontotemporal bone defect post craniectomy (yellow arrow). Sagittal plane, (H): the ethmoid bone was closed by a musculus temporalis graft (white arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

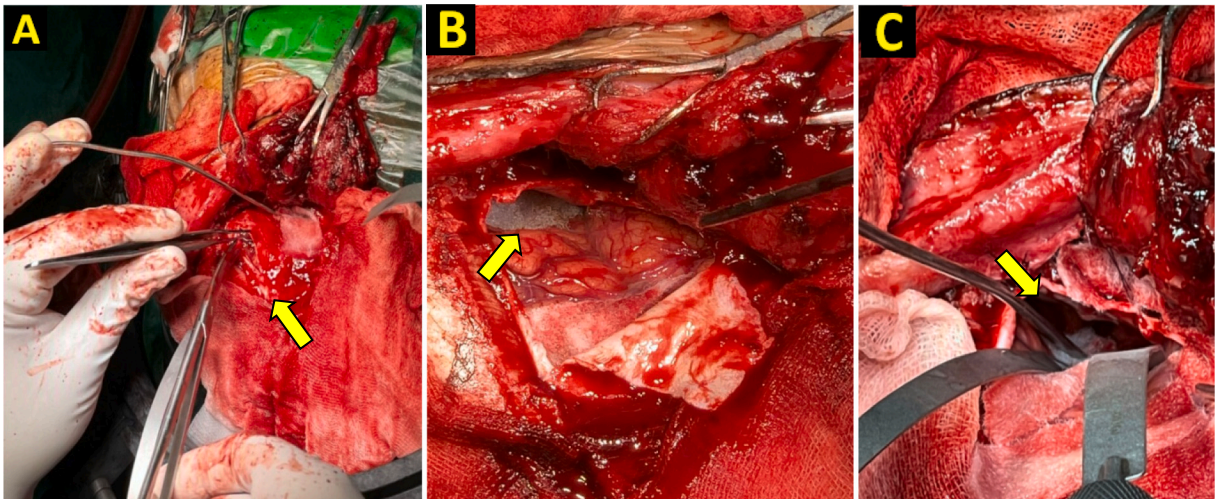

Fig. 3. After durotomy, exploration and irrigation of the wood fragments were carried out (A and B). Evaluate the bleeding and bleeding control (C).

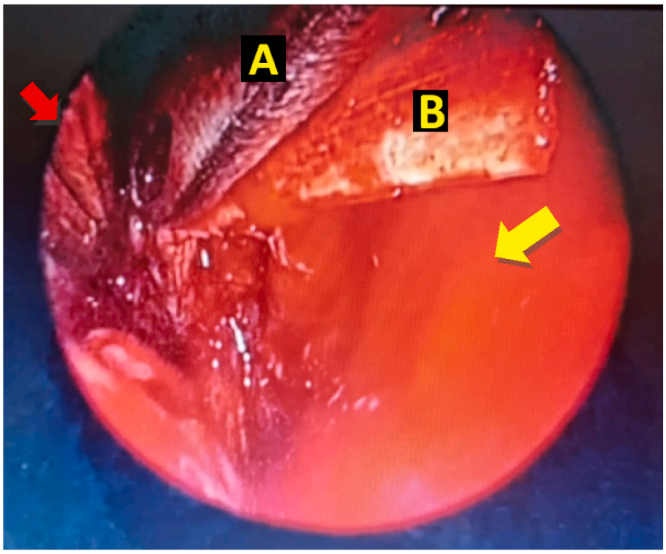

Fig. 4. Transnasal endoscopy. The wooden foreign body (A) was extracted by up-ten forceps (B). Concha inferior (red arrow), septum nasi (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

embedded in the right nasal cavity. There were no external wounds or deformities over the craniofacial region, and the results of neurological examinations were normal.

The patient underwent a head computed tomography (CT) scan and was diagnosed with a transnasal penetrating intracranial injury (Fig. 2A-D). It was decided that the transcranial operation to remove the foreign body would be performed jointly by a neurosurgeon and an ENT surgeon.

The patient was brought into the operating theater 6 h later, where he underwent a pterional approach craniotomy by a neurosurgeon. The patient was in the supine position with a headpin. Intraoperatively, the skull base, dura mater, and cerebral parenchyma were evaluated. There was fracturing of the ethmoid bone, frontobasal laceration, and bone fragments in the cerebral parenchyma, but the tip of the foreign body was not visible. Subsequently, exploration and irrigation of the wood particles were carried out cautiously, with bleeding control (Fig. 3). The ENT surgeon then identified the wooden foreign body in the nose using transnasal endoscopy. The object was impacted firmly in the right nostril and was extracted by transnasal endoscopy performed by the ENT surgeon (Fig. 4). The embedded wooden stick was measured 7.0 × 2.0 cm after its extraction, there was leakage of CSF, and a dural flap was performed. The ethmoid bone defect was then closed by musculus temporalis graft, and fibrin glue and Spongostan (absorbable hemostatic gelatin sponge) were applied.

Postoperatively, the patient remained on a ventilator and was closely monitored in the intensive care unit for one day; therapeutic antibiotics were given for 14 days. There was no ongoing bleeding as visualized by CT scan one day after surgery (Fig. 2E-H). The patient was discharged after 10 days without any sign of infection, neurological deficit, or CSF leakage.

3. Discussion

Transnasal intracranial penetrating injury is uncommon [9–11]. When such injuries occur, they require immediate medical attention and interdisciplinary management to avoid both acute and delayed complications [9]. Following a thorough physical examination, the patient's condition necessitates a proper radiological assessment. Although previous studies have underlined the need for a head CT scan when treating transnasal cerebral-penetrating injury, there are a few things to consider: (a) the density of foreign entities on a CT scan varies depending on their nature—for example, wood and polymers have isodensity or hypodensity and are difficult to distinguish, but metal has hyperdensity; and (b) the density of some foreign bodies may vary over time, leading to frequent misdiagnosis [12].

Surgery is the main strategy for the treatment of penetrating skull base injuries [13–16]. The following are surgical indications: fracture displacement, CSF leakage, retained objects, vascular injury, and intracranial hemorrhage [13–15]. During surgery, foreign bodies are removed, brain tissue is decompressed, and the skull base is reconstructed. In most cases, surgery is recommended within 12 h of the injury. However, premature surgery, on the other hand, could be lethal. Therefore, full physical and radiological examinations must be performed before surgery. Arterial injury would be disastrous for an emergency operation and is one of the most prevalent concomitant disorders that should be recognized before surgery [13,14].

There was a dilemma on how much can be done to overcome the injury and whether a combined transcranial and transnasal endoscopic approach like in our case or rather a craniotomy approach would be more advantageous. Despite the neurosurgeon's ability to remove the remaining impacted tip of the foreign body, is it less recommended to perform a surgery just to remove the retained fragments. The patient was given the option of conservative, periodic follow-up due to the device's asymptomatic long-term retention, stainless steel composition,

intraosseous location, and small size of the foreign body [17].

In this case report, the neurosurgeon chose a combined transcranial and transnasal endoscopic approach to avoid intraoperative hemorrhage, obtain proximal vascular control, as well as a direct view of the foreign body intracranially before it is removed. We chose the pterional approach because it provided the most direct route to the location of the foreign body as well as a clear view of the foreign body through the intracranial cavity, and also enabled the wood fragments that had entered the cavity to be cleared. To uncover foreign objects, it is sometimes necessary to drill the base of the skull [13–15,18].

Thorough debridement along the exposed route, as well as careful reconstruction of the skull base, is critical for preventing postoperative infection and CSF leakage. Aggressive debridement for deep-seated debris, on the other hand, should be avoided as it has been linked to increased disability and mortality [13–15,18].

Infection is the primary sequel of penetrating skull base injuries, with overall incidence of 64 to70 percent and mortality rate of 14 to 57 % [13,19]. Wood is an organic foreign body that serves as both a carrier and a medium for infections such as cerebritis meningitis as well as brain abscesses [13].

4. Conclusion

Combined transcranial and transnasal endoscopic approach showed better result than transcranial approach only. The wooden foreign body can be completely eliminated transnasally without active bleeding using this approach. The patient was discharged with good outcome.

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No funding or sponsorship.

Ethical approval

The study is exempt from ethical approval in our institution.

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 on request.

Author contribution

Djoko Widodo and Fadjar Perkasa: study concept and surgical therapy for this patient. Rais Al-'Abqary, Kevin Jonathan Sjukur, and Muhammad Faruk: Data collection and Writing-Original draft preparation. Djoko Widodo: senior author and the manuscript reviewer. Muhammad Faruk: Editing and Writing. All authors read and approved the final manuscript.

Registration of research studies

Not applicable – single case report.

Guarantor

Djoko Widodo

Provenance and peer review

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Declaration of competing interest

Nothing to declare.

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