Intracerebellar Penetrating Injury and Abscess Due to a Wooden Foreign Body

—Case Report—

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Abstract

A 4-year-old boy presented with chopstick penetration into the cerebellum via the temporal squamosa and tentorium cerebelli, which resulted in a cerebellar abscess 1.5 years after the injury. The neuroimaging appearance of the wooden chopstick were unusual, hyperdense on computed tomography, and isointense on T₁-weighted and hypointense on T₂-weighted magnetic resonance imaging. Abscess aspiration and continuous drainage was performed with real-time intraoperative ultrasound guidance. The chopstick fragment was surgically removed and the patient discharged with minor neurological deficits. Wooden foreign body may show changes in properties after a long period of intraparenchymal retention. Extra care is required to remove wooden foreign bodies because of the high risk of infection.

Key words: abscess, cerebellum, chopstick, penetrating injury, trauma

Introduction

Penetrating injuries of the skull and brain are relatively uncommon, representing about 0.4% of head injuries.³⁾ Injury by a wooden body usually involve penetration of a relatively thin bone such as the orbit,⁵⁻¹³⁾ as the thin wall offers little resistance. Penetration into the posterior fossa, which is encircled by thick bone, is extremely rare.¹⁰⁾ Brain abscess initiates when microorganisms are introduced into cerebral tissues as a result of head injury, contiguous infection, or hematogenous dissemination. Penetrating craniocerebral trauma is a well-recognized cause of brain abscess. However, a cerebellar abscess due to a penetrating injury has been reported only once.¹⁾ We describe a case of intracerebellar penetrating injury by a chopstick which was misdiagnosed at the time of injury, and cerebellar abscess occurred 1.5 years after the injury. In-

traparenchymal wooden foreign bodies are usually strikingly hypodense on computed tomography (CT), but the intracerebellar chopstick fragment appeared as hyperdense in this case after a long period of intraparenchymal retention.

Case Report

A 4-year-old boy was admitted to a regional hospital with a scalp injury in the left preauricular area that occurred when he fell down the stairs while carrying a chopstick. There were small wounds on his forehead and in the preauricular area. He had no disturbance of consciousness, his vital signs were normal, and skull radiography found no abnormalities. Although part of the broken chopstick was not found, no further investigations were performed.

The patient was admitted to our hospital with a 5-day history of low-grade fever and a 4-day history

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Fig. 1 Computed tomography (CT) scans showing the cerebellar abscess, a stick-like mass in the posterior fossa, and ventricular dilation. The stick-like mass appears hyperdense without enhancement (left). Postcontrast CT scan showing ring-like enhancement of the abscess capsule (right).

Fig. 2 Magnetic resonance images showing the intracerebellar stick-like mass as isointense on the T_1 -weighted image (left; repetition/echo time [TR/TE] = 430/15 msec) and hypointense on the T_2 -weighted image (right; TR/TE = 4000/110 msec).

of headache 1.5 years after the accident. On admission, the patient had a stiff neck and was drowsy. Initial physical examination failed to detect a scar on his scalp. Laboratory studies revealed a white blood cell count of 16,400/ml with a left shift in the granulocytic series. The cerebrospinal fluid contained 17 cells/ml with polymorphonuclear cell dominance. Cerebrospinal fluid, obtained by a closed spinal tapping technique, contained 17 cells/ml with polymorphonuclear cell dominance. Skull radiography found no abnormality. CT showed a hyperdense stick-like mass measuring 60 mm in length and 3 mm in width in the cerebellum, a cerebellar abscess, and obstructive hydrocephalus (Fig. 1). The stick-like mass appeared isointense on

Fig. 3 Three-dimensional computed tomography scan, superior-anterior view, of the posterior fossa showing the spatial relationship between the chopstick fragment (arrow) and the surrounding structures such as the drainage tube (arrowhead). A metal ball, marking the preauricular scar, and the chopstick fragment are on the same straight line.

T_1 -weighted magnetic resonance (MR) imaging and hypointense on T_2 -weighted MR imaging (Fig. 2).

Intravenous antibiotic therapy was initiated, and abscess aspiration and continuous drainage was performed via a small suboccipital craniectomy under real-time intraoperative ultrasound guidance. However, ultrasonography failed to detect the stick-like mass during the procedure and so the foreign body could not be removed. After the operation we carefully examined the boy's head, and found a small scar in the preauricular area. To confirm the relationship between the scar and the intracerebellar stick-like mass, three-dimensional CT was performed with a small metal ball placed on the preauricular scar as a marker. Three-dimensional CT clearly demonstrated that the metal ball and the stick-like mass were on the same straight line (Fig. 3). Therefore, the intracerebellar stick-like mass was thought to be the missing chopstick fragment which had penetrated into the cerebellum via the temporal bone. A second operation was performed to remove the chopstick fragment via an infratentorial supracerebellar approach with a larger suboccipital craniectomy. The previous craniectomy was extended laterally and superiorly to expose the upper surface of the cerebellum. The chopstick fragment was easily found at the upper surface of the left cerebellar cortex, and was completely removed (Fig. 4). The chopstick fragment was wet with no calcification on its surface.

Fig. 4 Photographs showing a small scar in the left preauricular area (arrow) (left) and the extracted chopstick fragment (right).

The postoperative course was uneventful. The patient was discharged with minimal ataxia and dysmetria after a 3-week course of antibiotics.

Discussion

Only six cases of penetrating injury into the posterior fossa by wooden bodies have been reported,^{1,9,10,13-15)} and only one case of cerebellar abscess due to a penetrating injury.¹⁾ These cases including ours are summarized in Table 1. Wooden body penetration into the posterior fossa occurred mainly in boys and resulted from falls with penetration of thin bony areas such as the orbit, nostril, auditory canal, or temporal squamosa. The symptoms, including fever and consciousness disturbance, appeared shortly after the injury in most cases, but our patient remained asymptomatic for more than a year after the accident. Therefore, wooden objects can penetrate the cranium and extend into the posterior fossa even if the patient has a small wound and shows no neurological deficit after the injury.

Radiography of the skull is helpful in demonstrating the intracranial course of metallic materials, but the radiodensity of wood is very nearly the same as that of soft tissue and the brain, so is difficult to detect.⁴⁾ CT is valuable for detecting wooden foreign bodies as a hypodense mass.^{6,9,13,15)} However, the wooden foreign body in our case appeared hyperdense on CT *in vivo*. Wood is an extremely porous

substance, composed primarily of cellulose, which probably accounts for the hypodense appearance in the acute stage.⁴⁾ In an experimental study, certain woods tended to show change in CT density over time as they absorbed water *in vitro*.⁶⁾ Therefore, wooden bodies may appear various densities after long periods of intraparenchymal retention, so it is not surprising that the chopstick fragment appeared hyperdense on CT in our case. Wooden bodies appear hypointense on T₁- and T₂-weighted MR imaging.^{5,7,11)} However, the MR imaging was performed immediately after the penetrating injury, and the wooden bodies were most likely dry. In contrast, the chopstick fragment in our case appeared isointense on T₁-weighted MR imaging and hypointense on T₂-weighted MR imaging, suggesting that the fragment contained a lot of water. MR imaging in our case was performed in the chronic stage and the retained wooden foreign body was wet. The observed differences in both CT and MR imaging findings may reflect the content of water within the wooden bodies. This case indicates that the CT and MR imaging properties of a wooden foreign body can change *in vivo* after a long period of intraparenchymal retention.

Wood is a potent source of infection, and the removal of a retained wooden foreign body is essential. Our patient was misdiagnosed at the time of injury, and the retained wooden body caused a cerebellar abscess. Our policy is to treat abscess following penetrating trauma, with open surgical debridement to remove foreign matter and devitalized tissue, and not by simple aspiration as with other abscesses. Therefore, we tried to remove the stick-like mass at the first operation. We previously reported the use of real-time ultrasound guidance to localize lesions that are hyperdense on CT during intracranial procedures.²⁾ We expected that ultrasonography would detect the stick-like mass because the mass was hyperdense on CT. However, it failed to detect the hyperdense mass. Three-dimensional CT clearly demonstrated that the metal ball marker on the scalp and the stick-like mass were on the same straight line, suggesting that the intracerebellar stick-like mass was the missing chopstick fragment which had penetrated into the cerebellum via the temporal bone. Therefore, three-dimensional CT was quite helpful in determining the spatial relationship between the chopstick fragment and other structures in this case. However, this method may not be helpful in the acute stage because wooden bodies appear hypodense on CT. Extensive radiologic examinations, including three-dimensional CT, are particularly important to determine the exact location of wooden foreign bodies

Table 1 Summary of cases of penetrating injuries into the posterior fossa by wooden bodies

Author (Year)	Age/ Sex	Mechanism	Penetrating object	Route	Symptoms	Skull film	CT findings	Treatment	Outcome
Amano and Kamano (1982) ¹⁾	7/M	fall	plant?	orbit	fever	n.d.	low density track, abscess	conservative	good
Yamamoto et al. (1985) ¹⁵⁾	53/M	suicide	chopstick	nostril	cons. disturb.	fracture	low density	simple removal	died
Ildan et al. (1994) ⁹⁾	7/M	fall	pencil	orbit	blindness	normal	low density, high density (lead)	simple removal	good
Kuroiwa et al. (1995) ¹⁰⁾	1/F	fall	chopstick	temporal, petrosal bone	cons. disturb.	normal	low density	craniotomy and removal	good
Mori et al. (1996) ¹³⁾	9/M	fall	chopstick	orbit	cranial nerve pareses (II-VI)	intracranial air	low density	craniotomy and removal	good
Shigemori et al. (1996) ¹⁴⁾	3/M	play	chopstick	oral	cons. disturb., tetraparesis	n.d.	n.d.	craniotomy and removal	fair?
Present case	4/M	fall	chopstick	temporal, tentorium	fever	normal	high density, abscess	craniotomy and removal, abscess drainage	good

cons. disturb.: consciousness disturbance, CT: computed tomography, n.d.: not described.

in penetrating injuries.

References

- 1) Amano K, Kamano S: Cerebellar abscess due to penetrating orbital wound. Case report. *J Comput Assist Tomogr* 6: 1163-1166, 1982
- 2) Fujita K, Yanaka K, Meguro K, Narushima K, Iguchi M, Nakai K, Nose T: Image-guided procedures in brain biopsy. *Neurol Med Chir (Tokyo)* 39: 502-509, 1999
- 3) Gennarelli TA, Champion HR, Sacco WJ, Copes WS, Alves WM: Mortality of patients with head injury and extracranial injury treated in trauma centers. *J Trauma* 29: 1193-1201, 1989
- 4) Ginsberg LE, Williams DW III, Mathews VP: CT in penetrating craniocervical injury by wooden foreign bodies: Reminder of a pitfall. *AJNR Am J Neuroradiol* 14: 892-895, 1993
- 5) Green BF, Kraft SP, Carter KD: Intraorbital wood: Detection by magnetic resonance imaging. *Ophthalmology* 97: 608-611, 1990
- 6) Hansen JE, Gudeman SK, Holgate RC, Saunders RA: Penetrating intracranial wood wounds: Clinical limitations of computerized tomography. *J Neurosurg* 68: 752-756, 1988
- 7) Ho VT, McGuckin JF Jr, Smergel EM: Intraorbital wooden foreign body: CT and MR appearance. *AJNR Am J Neuroradiol* 17: 134-136, 1996
- 8) Horner FA, Berry RG, Frantz M: Broken pencil points as a cause of brain abscess. *N Engl J Med* 271: 342-345, 1964
- 9) Ildan F, Bagdatoglu H, Boyar B, Doganay M, Cetinalp E, Karadayi A: The nonsurgical management of a penetrating orbitocranial injury reaching the brain stem: Case report. *J Trauma* 36: 116-118, 1994
- 10) Kuroiwa T, Tanabe H, Ogawa D: Chopstick penetration of the posterior cranial fossa: Case report. *Surg Neurol* 43: 68-69, 1995
- 11) Matsumoto S, Hasuo K, Mizushima A: Intracranial penetrating injuries via the optic canal. *AJNR Am J Neuroradiol* 19: 1163-1165, 1998
- 12) Miller CF II, Bradkey JS, Colombi BJ: The danger of intracranial wood. *Surg Neurol* 7: 95-103, 1977
- 13) Mori Y, Shibata T, Kajita Y: [Penetrating intracranial foreign bodies]. *Nihon Kyukyu Igakukai Zasshi* 7: 191-196, 1996 (Jpn, with Eng abstract)
- 14) Shigemori M, Tokutomi T, Kikuchi Y: [Brain injury], in Shigemori M, Katayama Y, Kobayashi S (eds): [Head Injury of the Children]. Tokyo, Igakushoin, 1996, pp 95-97 (Jpn)
- 15) Yamamoto I, Yamada S, Sato O: Unusual craniocerebral penetrating injury by a chopstick. *Surg Neurol* 23: 296-298, 1985

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