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Case Report

A case of transnasal intracranial penetrating injury with skull base fracture caused by a broken golf club shaft



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1. Introduction

Penetrating head injuries are an uncommon subset of head trauma and account for only 0.4% of all head injuries [1-3]. Penetrating head injuries are usually caused by firearms or metallic objects such as bullets or knives. These injuries are most commonly the result of assault, falls, or motor vehicle collisions. In Japan, most penetrating intracranial traumas are caused by pointed objects such as pencils and umbrella tips [4,5]. Most of them pass through the eye orbit, and cases through nasal cavity are rare.

Penetrating intracranial injuries cause a wide variety of complications such as intracerebral hemorrhage, subdural hemorrhage, subarachnoid hemorrhage, major blood vessel damage, spinal fluid leakage, and brain contusion [6,7]. Moreover, late onset complications include infections of the brain such as meningitis and brain abscess, often with serious consequences [8].

Here we report a homicidal case of transnasal penetrating intracranial injury, in which a broken golf club shaft was violently inserted into the nasal cavity of the victim. The victim died of massive bleeding from the arteries distributed in the nasal cavity, such as the branches of sphenopalatine artery and the cavernous sinus.

2. Case history

A 40-year-old male, sitting on the driver's seat in his car, quarreled with the perpetrator who was standing beside the driver's seat. The perpetrator repeatedly hit the victim with a golf club through the open car window. At first, the victim was struck on both hands by the head part of the putter. A few minutes after the beginning of the assault, the shaft of the golf club fractured into two parts, after which the perpetrator began to stab repeatedly toward the victim's heart with the tip of the grip side of broken golf club shaft (Fig. 1). During the assault, sudden massive epistaxis occurred in the victim. The perpetrator continued to hit and stab the victim with the broken golf club shaft with screaming loudly. Approximately fifteen minutes after the start of epistaxis, the victim became unconscious. A witness who was watching

from a little away immediately called an ambulance, however, the victim died during transport to hospital. Postmortem CT revealed pneumocephalus (Fig. 2a), massive fluid collection in the main bronchus, and a crush fracture in distal part of the left radius. Postmortem CT also revealed fracture of the left posterior wall of the sphenoid sinus (Fig. 2b). However, a definitive cause of death was not identified.

3. Autopsy findings

Twenty-four hours after his death, an autopsy was carried out. The body was 177 cm, 61.5 kg; an asian male consistent in appearance with the stated age. There was a 0.6 cm long and 0.05 cm wide incision in the 2 o'clock direction of the right nostril and a lot of blood was pooled in the nasal cavity (Fig. 3). A band-like mucosal abrasion was observed in the right side of the nasal septum. The wound path of the nasal cavity reached the skull base and made a 1.0×1.5 cm bone defect adjacent to the left side of the sella turcica with dural rupture (Fig. 4). The region of cavernous sinus was destroyed by the wound. At the bottom of the wound track, a cerebral contusion $2.0 \times 1.5 \,\mathrm{cm}$ in size on the infra inner side edge of the left temporal lobe was observed (Fig. 5). There was subarachnoid hemorrhage encompassing the base of the cerebrum, the whole cerebellum, the occipital lobe, and ventral surface of the temporal lobe but absence of hemorrhage in epidural and subdural space. The distance from the right nostril to the skull base fracture was measured to 10.4 cm. On the left side of the anterior chest and the epigastrium were nine abrasions ranging in size from 1 to $9 \text{ cm} \times 0.9 \text{ cm}$ situated from upper right to lower left, presumably caused by the apex of the fractured shaft. Subcutaneous bruises 4×4 cm in size were observed on the posterior aspect of the wrists. A star-like-shaped laceration 2×2 cm in size was identified in the central part of the bruise in the left forearm. The trachea contained a large amount of dark red blood with a lot of small foam. The 650 g left lung and 1000 g right lung were highly congestive and edematous. Both lungs revealed blood aspiration. The heart contained no blood and the brain and all abdominal organs were anemic. Histological examination

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https://doi.org/10.1016/j.legalmed.2018.03.001 Received 17 October 2017; Received in revised form 6 February 2018; Accepted 11 March 2018 Available online 12 March 2018

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Fig. 1. The broken golf club shaft, with blood, used as a weapon. a) entire golf club b) enlarged photograph of the top. The shaft was fractured at the one-third distal position. A towel was wrapped around the grip by the perpetrator so as not to slip during striking. The diameter of the broken point of the shaft was 0.9 cm. The top of the broken shaft was sharp.



Fig. 2. Postmortem CT scan of transverse section through the brain. a) Intracranial air was observed in the frontal horn of the left lateral ventricle, the left sylvian fissure, and the subdural space in front of the left frontal lobe. A high intensity area indicating subarachnoid hemorrhage was observed in the inferior horm of the left lateral ventricle. b) The left posterior wall of the sphenoid sinus was fractured (white arrow). The region is located just to the left cavernous sinus.

of the region of the contusion of the brain a showed tissue tear with microscopic bleeding. Based on these findings, death was attributed to hemorrhagic shock due to bleeding from the damaged the branches of sphenopalatine artery as well as the destroyed left cavernous sinus.

4. Discussion

The skull, orbits, nasal cavities, and oral cavities may become penetration paths for foreign objects. In the case of transcranial insertion, a strong external force such as nail gun, nail, reinforcing bar, umbrella, Bowghan, etc. is required. When penetrating the orbit, nasal cavity, or oral cavity, a softer foreign object such as a chopstick or plant can penetrate with even a small external force.

Most cases of penetrating intracranial injuries occur via the transorbital or transoral cavity, and transnasal intracranial penetrating injury is rare. So far, pencil [9,10], ballpoint pen [11], wooden stick [12], cue [13,14], wooden chopstick [15,16], paintbrush [17], garden prop [18], weed [19], wire [20], plastic stick [21], and metallic chopstick [22] have been reported as transnasal intracranial foreign bodies. The comparatively thin and fragile orbital roof, temporal squama, and cribriform plate allow access to the intracranial cavity by objects not usually strong enough to penetrate other regions of the skull.

Depending on the angle of penetration, there are various pathways through the ethmoid sinus, sphenoid sinus, and orbital fissure, and depending on the pathway, the damaged parts of the brain and blood vessels and the severity of the injury will vary. Penetrating injuries with nasal entry may extend into the intracranial cavity through the orbital roof and cribriform plate. Intracranial penetration via the medial superior orbital fissure has a high likelihood of causing carotid artery injury, either with occlusion or aneurysm formation [23,24]. Objects penetrating through the orbital roof put the anterior circle of Willis at risk, especially the anterior cerebral artery complex [21]. In the present case, a golf club shaft was inserted from the right nostril toward the upper left along the nasal cavity. It destroyed the left posterior wall of the sphenoid sinus and impacted the middle fossa, fracturing the wall adjacent to the left side of the sella turcica. The object also made a Download English Version:

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