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Case Report

Non-fatal impalement of the brain: A case report

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ABSTRACT

We present a rare case of a non-fatal impalement injury of the brain. A 13-year-old boy was found in his classroom unconsciously lying on floor. His classmates reported that they had been playing, and throwing building bricks, when suddenly the boy collapsed. The emergency physician did not find significant injuries. Upon admission to a hospital, CT imaging revealed a “blood path” through the brain. After clinical forensic examination, an impalement injury was diagnosed, with the entry wound just below the left eyebrow. Eventually, the police presented a variety of pointers that were suspected to have caused the injury. Forensic trace analysis revealed human blood on one of the pointers, and subsequent STR analysis linked the blood to the injured boy. Confronted with the results of the forensic examination, the classmates admitted that they had been playing “sword fights” using the pointers, and that the boy had been hit during the game.

The case illustrates the difficulties of diagnosing impalement injuries, and identifying the exact cause of the injury.

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1. Introduction

An impalement injury is a penetrating injury caused by a mostly elongated object that enters the body and causes a canal-shaped wound track [1,2]. Impalement injuries are most frequently accidental [1], but may also be caused with homicidal [3,4] or suicidal [5] intention. In some instances, a differentiation between accident and third party fault can be challenging [6].

Depending on whether the object remains in the wound canal or not, the diagnosis of an impalement injury may be difficult, since in many cases no or only minimal externally visible lesions may exist [7]. The full extent of the injury might then remain unseen [8–10]—frequently with serious, sometimes even fatal, consequences like meningitis, vascular lesions, and bleeding [11,12]. Radiological imaging methods may aid the diagnosis [2,13,14], however, in some cases, even CT imaging stays inconclusive [15]. Identification of the object having caused the injury may also be difficult.

Impalement injuries of the head and brain are rare [16], and mainly accidental. They may be caused e.g., by traffic accidents

[17,18], accidents at the working place [16,19], or during recreational activities [20]. Children are especially at risk for such injuries, because of their increased craniofacial ratio, lower facial bone density, and underdeveloped paranasal sinuses [21] as well as their playful, experimental and sometimes careless behavior. We present the case of a 13-year-old boy with an impalement injury of the brain that was diagnosed after clinical forensic and molecular genetic examination.

2. Case report

2.1. History

A 13-year-old, previously healthy boy was found by his teacher unconsciously lying on the floor of his classroom. According to his classmates, they had been playing and throwing building bricks, when the boy was hit by a brick. He slumped, fell on the floor, and, when trying to get up again, collapsed again and hit his head on a desk and the wall. The child was intubated at the scene by an emergency physician, and transported to a hospital for further diagnosis and treatment.

Upon admission to the hospital, a cranial CT (CCT) was performed (Fig. 1), and showed an accumulation of blood (“blood path”) extending in sagittal direction from the orbital roof to the occipital region of the left cerebral hemisphere over a distance of

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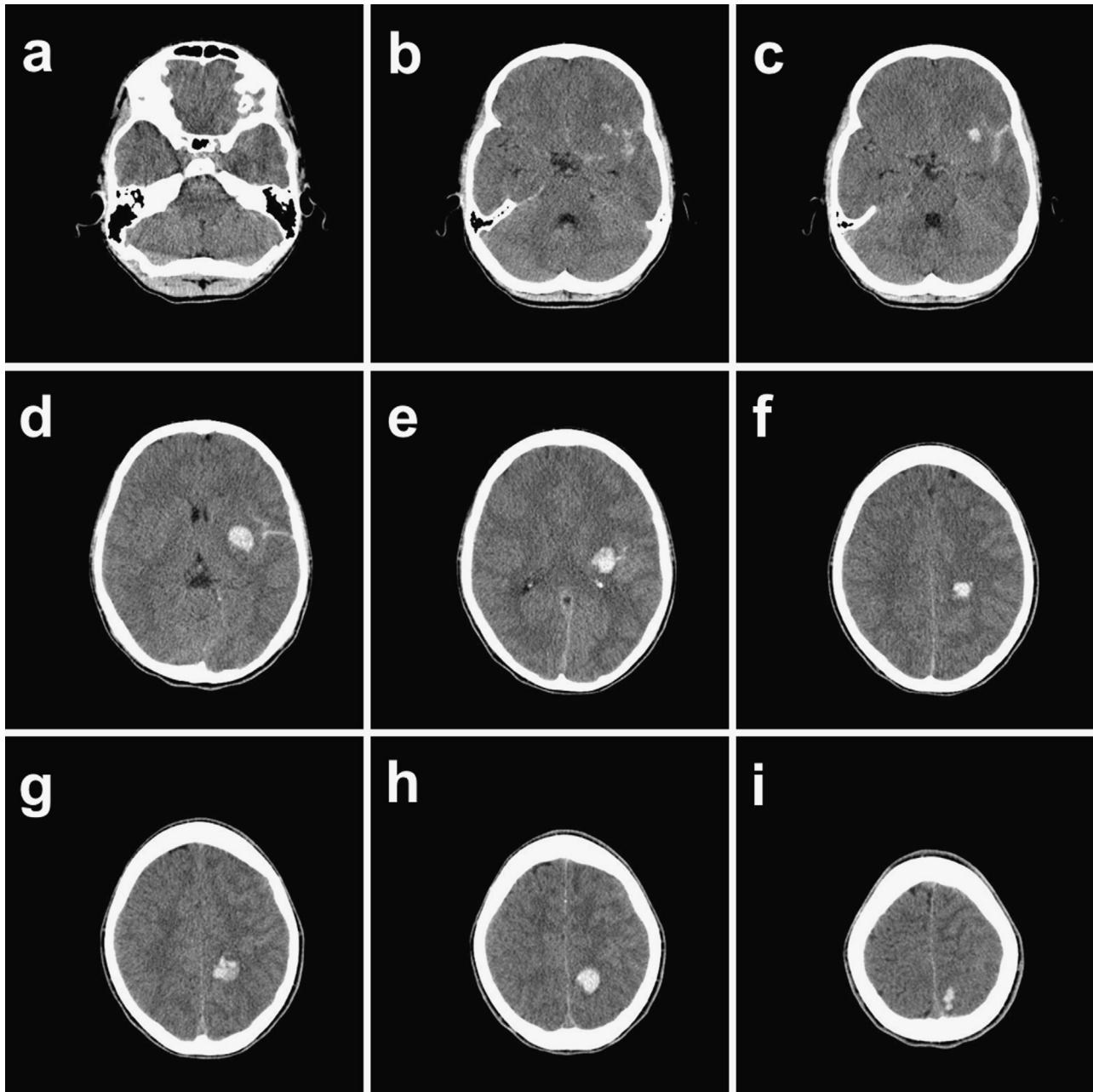


Fig. 1. CT scan. Note the bleeding extending from the orbital roof (a) to the occipital region of the left hemisphere (i).

approximately 12.5 cm (5 in.), similar to a bullet path. Foreign objects were not detectable. A skull fracture was not seen by the radiologist initially. Neurologically, a hemiparesis was diagnosed. The boy was admitted to the ICU for continuing (conservative) therapy.

2.2. Results of the clinical forensic examination

A clinical forensic examination of the child ordered by the police yielded a 10 mm (0.4 in.) long horizontal skin wound just below the outer portion of the left eyebrow (Fig. 2). The wound margins appeared smooth, the skin around the wound exhibited a discrete, 4 mm × 5 mm (0.16 in. × 0.2 in.) large epidermal defect. The left eyelid presented swelling and a hematoma. Further injuries were not seen. Re-evaluation of the CCT showed an 8.5 mm × 6.5 mm (0.33 in. × 0.26 in.) large defect of the orbital roof (Fig. 3). Based on these findings, an impalement injury caused by an elongated object

with a diameter between 4 mm (0.16 in.) to 7 mm (0.28 in.) was diagnosed. Building bricks or blunt force due to a contact with a desk or the wall could be excluded as cause for the injury.

2.3. Further investigations and molecular genetic analysis

Searching the classroom, the police identified three semi-flexible plastic pointers as objects potentially suitable for having caused the impalement injury (Fig. 4). Each of the pointers had a length of 100 cm (39.4 in.), and a diameter (at the flat tip) of 5 mm (0.2 in.). One of the pointers showed discrete brownish discoloration at the tip and 12 cm (4.7 in.) below the tip; an unspecific pre-test for blood (Peroxtesmo, Macherey-Nagel, Düren, Germany) gave a positive result.

Swabs of the pointer tip and the shaft were analyzed using a self-designed assay for degraded DNA and minimal traces [22], and applying two commercially available STR kits (AmpFISTR

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