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Case Report

Acute enlargement of subdural hygroma due to subdural hemorrhage in a victim of child abuse

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ABSTRACT

An 11-month-old female baby was found dead by her mother. Cranial postmortem CT prior to the forensic autopsy showed dilatation of bilateral extra-axial spaces and ventricles. The autopsy revealed a new linear fracture of the left parietal bone and occipital bone, and a healed linear fracture of the right parietal bone and occipital bone like a mirror image of the left one as well. Intracranially, 230 ml of subdural fluid were collected, which was mixed with blood. There was a fresh hemorrhage around a bridging vein of the left parietal lobe and the dura mater. Moreover, the outer side of the cerebrum and the inner side of the dura mater were covered by a thin membrane, which mater might have been previously formed because of being positive for Fe-staining and anti-CD68 antibody. A subdural hematoma might have been developed when the right side of the skull was previously fractured, which was transformed into a subdural hygroma. Subsequently, it is likely that, after the left side fracture of the skull occurred, the subdural hygroma rapidly enlarged due to hemorrhaging from the bridging vein, which resulted in intracranial hypertension, because microbleeding was detected in the brain stem. Accordingly, we diagnosed the cause and manner of death as intracranial hypertension due to subdural hemorrhage in subdural hygroma, and homicide, including child abuse, respectively.

1. Introduction

Subdural hygroma (SDH) is characterized by subdural fluid collection whose CT value is between 10 HU and 16 HU, or less than 20 HU [1–3]. The ages of patients with SDH are diphasic; children aged less than 10 years, particularly less than 2 years, or men aged above 60 years, which may be attributed to the broad subdural space of children and elderly people [4,5]. Whereas SDH is a common complication of blunt head injuries in adults, the etiology of SDH in infants and children has been reported as surgical procedure, complications of leptomeningeal infections or unexplained, in addition to post-traumatic [1,4]. Although the subdural fluid would be considered cerebrospinal fluid (CSF) and leak from the subarachnoid space through a damaged arachnoid membrane, expanding into the subdural space, it can sometimes appear xanthochromic, yellow or slightly hemorrhagic [2,5]. Moreover, subdural fluid collection might be related to the impairment of CSF absorption by arachnoid granulations [2,3]. In other words, SDH occurs traumatically, spontaneously or post-surgically, and its pathogenesis is still unclear [1–6].

Herein we present an autopsy case of SDH induced by head injury inflicted by an assault several months before death, which suddenly enlarged by subdural hemorrhage due to head injury from an assault a few days before death, resulting in death. Also, we investigated the mechanism of the development of SDH, on the basis of the findings of postmortem cranial CT imaging, as well as those of macroscopic and microscopic examinations.

2. Case report

2.1. Case history

An 11-month-old female baby was found in cardiopulmonary arrest by her mother, in prone position with vomited yellow fluid, in late morning. She was carried to an emergency hospital and cardiopulmonary resuscitation was vigorously performed, but she died without recovering her heartbeat and breathing. Although cranial postmortem CT was performed immediately after the death had been certified in the hospital, using CT for living individuals, an attending pediatrician could not diagnose a cause of death, and then reported it to the police as an unnatural death.

According to police investigation, her mother testified that, although the baby was alive 9 h before the discovery of the

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cadaver, the mother checked the baby because there was no sound of crying, and then found the cadaver. Although there were just a few slight abrasions and subcutaneous hemorrhages on the extremities found by the external examination by a police inspector, child abuse was suspected because of the duration between final confirmation of being alive and discovery of the cadaver. Thus, in order to investigate the cause of death, medico-legal autopsy was performed one and a half days after the estimated time of death.

2.2. Autopsy findings

Upon an external examination, the deceased was 71 cm tall and weighed 11 kg. There was a subcutaneous hemorrhage, approximately 3 cm across, on the left side of the parietal region, which was brown or yellow-colored. Moreover, there were two subcutaneous hemorrhages, approximately 3 cm across, on the upper edge and the left side of the occipital region as well. In addition, slight subcutaneous hemorrhages and abrasions were observed on extremities. Corresponding to the subcutaneous hemorrhages in the left side of the occipital region, the left edge of the occipital bone had a new fracture similar to a depressed fracture macroscopically, from which a linear fracture was derived in the left parietal bone, and these fractures accompanied subperiosteal hemorrhages (Fig. 1a). On the other hand, there were cross-shaped old fractures, which had been already fused and healed macroscopically, in the posterior edge of the right parietal bone and the fracture continued into the right side of the occipital bone (Fig. 1b), which was almost a mirror image of the left one.

Intracranially, 230 mL of slightly bloody fluid were collected from both sides of the subdural space, and the inner side of the dura mater and the outer side of the arachnoid mater of the cerebrum were widely covered by a thin membrane (Fig. 1c). Moreover, there was hemorrhaging around a bridging vein on the left parietal lobe and the dura mater from the rupture of the bridging vein (white arrow in Fig. 1c). In addition, the inner side of the dura mater was wholly yellow-stained (Fig. 1d). Corresponding to the old fracture of the right parietal bone, there was a linear scar on the right outer side of the dura mater. Cerebrum with brain stem and cerebellum weighed 1013 g, and there was neither contusion nor hemorrhage, except for a slight subarachnoid hemorrhage in the suprasellar region. Bilateral lungs (lung weights: left, 48 g; right, 52 g) were congested and edematous without pneumonia. The thymus weighed 8 g, and was extremely atrophic. The other organs showed no significant findings.

Alcohol was not detected in either blood or urine. The urine drug-screening test by Triage® identified no positive substances.

2.3. Postmortem cranial CT

The hospital had given us the data of the postmortem cranial CT formatted by DICOM. In order to interpret the postmortem cranial CT taken in the hospital again, we restructured the data using image workstation (SYNAPSE VINCENT V3.3.0003, FUJIFILM, Tokyo, Japan) before the autopsy, and dilatation of bilateral extra-axial spaces was observed (Fig. 2). Whereas the average CT value of the right extra-axial space was determined at 24 HU, the CT value of the left one was 32 HU, which had been imaged using CT for living individuals [7], and suggested that extra-axial fluid would be serous fluid rather than blood [8]. Moreover, all ventricles were dilated, indicating hydrocephalus. However, both new and old skull fractures could not be detected because the wide slice thickness, which was 5 mm, caused a partial volume effect. In addition, no high-density areas were observed in bilateral ocular globes.

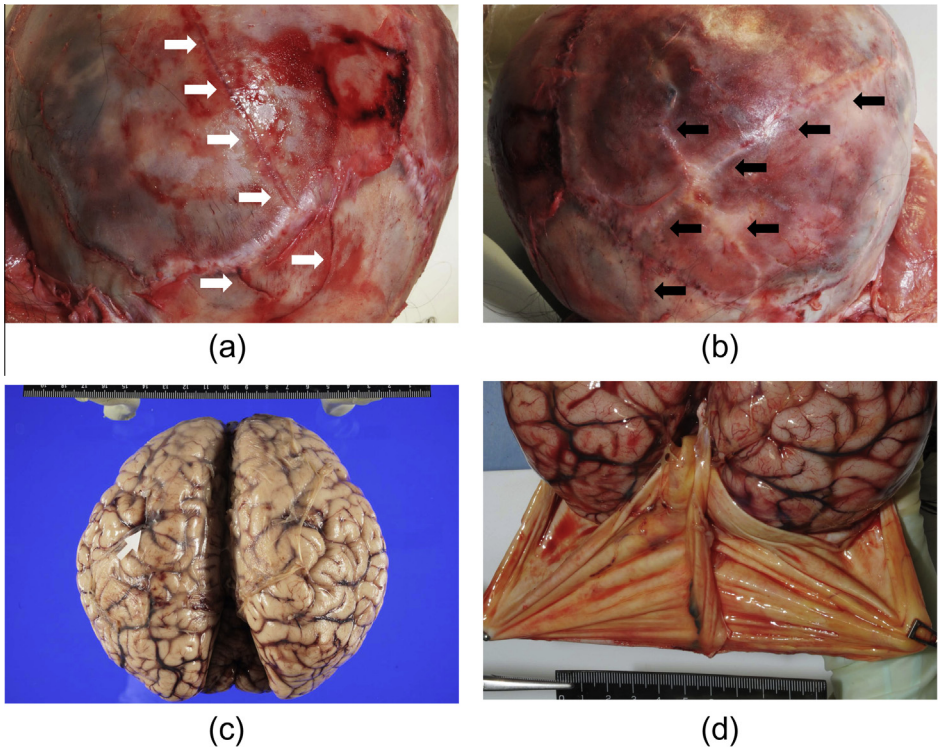

Fig. 1. External examination. The left parietal bone and the occipital bone are freshly fractured ((a) white arrows) while the right parietal bone and the occipital bone were previously fractured ((b) black arrows). A thin membrane widely covers the outer side of the arachnoid mater of the cerebrum ((c) fixed by 4% formalin). In addition, a bridging vein on the left parietal lobe and the thin membrane are ruptured with subarachnoid hemorrhage ((c) white arrow). The inner side of the dura mater is wholly yellow-stained (d).