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Case Report

Four intracranial injury cases with peripapillary scleral hemorrhage—Reconsidering the mechanism of hemorrhage

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1. Introduction

Ocular findings are present in approximately 70% of deaths due to child abuse [1]. Peripapillary scleral hemorrhage was first mentioned in 1990 as a scleral hemorrhage surrounding the optic nerves in abusive head trauma cases [1]. Peripapillary scleral hemorrhage is believed to be an important finding suggesting shaken baby syndrome [2–4]. However, it was recently reported that peripapillary scleral hemorrhage was found in accidental head trauma cases [5,6]. Herein, we report four intracranial injury cases in which peripapillary scleral hemorrhage was found, and discuss the potential mechanisms involved.

2. Case reports

2.1. Case 1

A man aged in his 80s was found unconscious in his garden, with vomit around him. He seemed to have fallen from a 3-m high tree while pruning it. He was transported to a hospital and pronounced dead on arrival. A complete autopsy was performed 9 h after death. We detected pre-retinal hemorrhage in his right eye via indirect ophthalmoscopy prior to autopsy. External examination revealed bruises over the occipital region (Fig. 1a). Internal examination revealed skull fracture at the occipital region, subdural hematoma and subarachnoid hemorrhage with frontal cerebral contusions (Fig. 1b), subcutaneous hemorrhage on the upper back, and multiple rib fractures. We detected peripapillary scleral hemorrhages in both eyes (Fig. 1c). Microscopic examination showed hemorrhages associated with vessels at the Zinn-Haller arterial ring (Fig. 1d). We determined the cause of death to be intracranial injuries.

2.2. Case 2

A man aged in his 50s was in prison for the abuse of methamphetamine. One day, he intentionally hit his head against a wall then fell down many times in an effort to harm himself, while in solitary confinement. His condition gradually worsened. Two days after inflicting the self-harm, he was found in a state of cardiopulmonary arrest. He was transported to a hospital and pronounced dead on arrival. A complete autopsy was performed 12 h after death. Bruises were found, mainly over the occipital region (Fig. 2a). Subdural hematoma, subarachnoid hemorrhage, and cerebral hemorrhage with cerebral contusion were found (Fig. 2b), as were dens fracture and cervical spinal contusion (C2, C3). Microscopic examination revealed peripapillary scleral hemorrhages in both eyes (Fig. 2c). Other internal findings included cardiac hypertrophy, cirrhosis of the liver, and chronic pancreatitis. We determined the cause of death to be intracranial and cervical injuries.

2.3. Case 3

A female pedestrian aged in her 60s was hit by a car at a road crossing. She was immediately transported to a hospital and diagnosed with skull fracture and subdural hematoma with cerebral contusion. She was pronounced dead 7 days after arriving at the hospital. We performed whole-body postmortem computed tomography (PMCT) prior to autopsy. PMCT showed subdural hematoma and subarachnoid hemorrhage with frontal cerebral contusions (Fig. 3a). A complete autopsy was performed 24 h after death. External examination only revealed healed injuries. Internal examination revealed brain fragility, skull fracture at the occipital region (Fig. 3b), subdural hematoma, and subarachnoid hemorrhage with frontal cerebral contusion as a contrecoup injury. We detected pre-retinal hemorrhages in her right eye, and peripapillary scleral hemorrhage in both eyes (Fig. 3c, d). Other internal findings included muscle hemorrhage in her left lower leg, and pneumonia. We determined the cause of death to be intracranial injuries. It was suspected that she had been hit by a car on her left side, then the back of her head had hit the ground.

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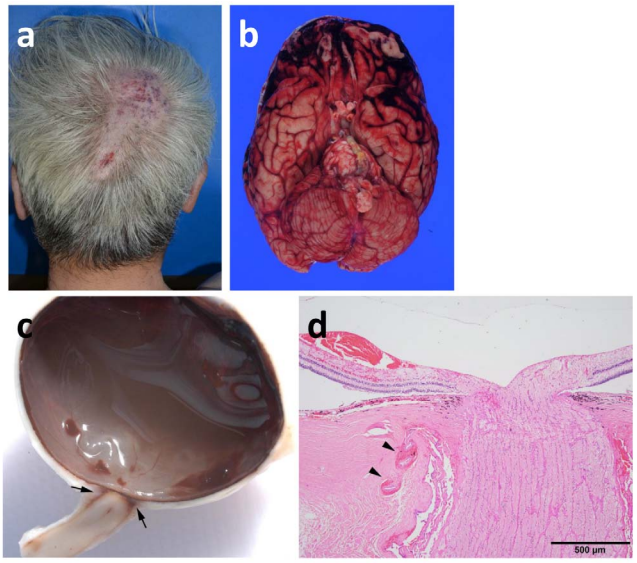

Fig. 1. Pictures of case 1. (a) Bruises in the occipital region (after cutting off the hair). (b) Base of the brain. (c) Macroscopic findings in the right eye. Pre-retinal hemorrhage and peripapillary scleral hemorrhage (arrows) were detected. (d) Hemorrhage associated with vessels at the Zinn-Haller arterial ring (hematoxylin and eosin stain, arrowheads).

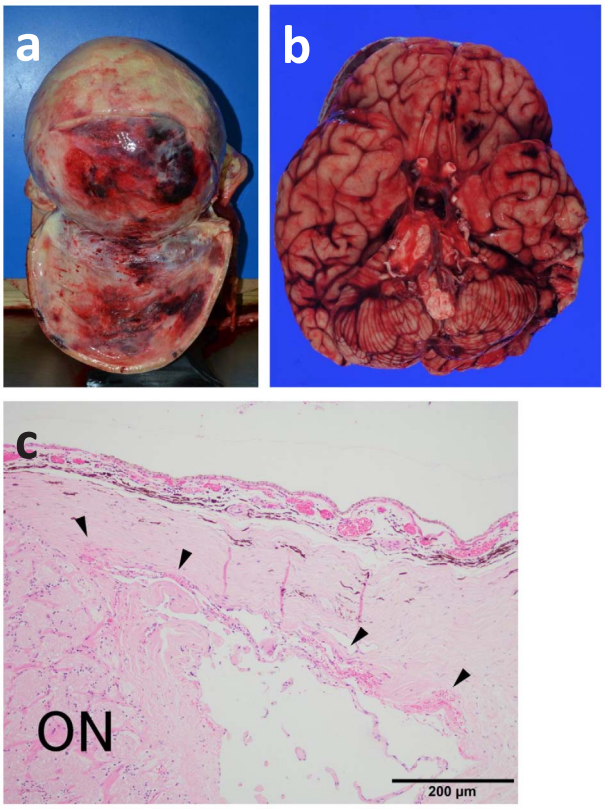

Fig. 2. Pictures of case 2. (a) Subcutaneous hemorrhage over the occipital region. (b) Base of the brain. (c) Peripapillary scleral hemorrhage (hematoxylin and eosin stain, arrowheads). ON; optic nerve.

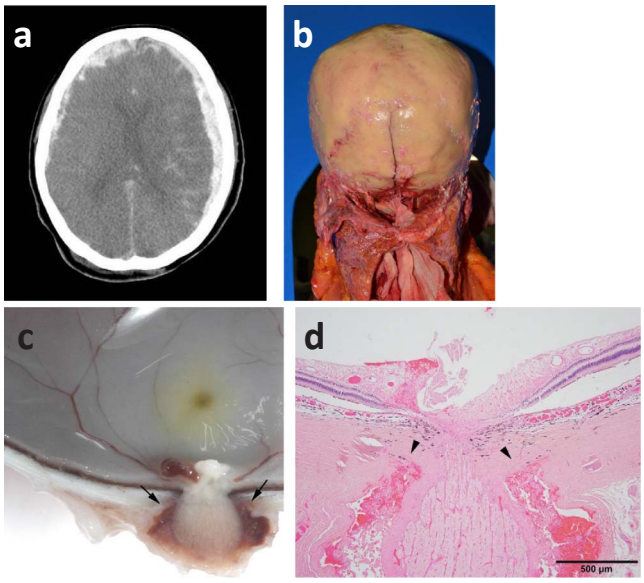

Fig. 3. Pictures of case 3. (a) Postmortem computed tomography image. (b) Skull fracture at the occipital region. (c) Macroscopic findings in the right eye. Pre-retinal hemorrhage and peripapillary scleral hemorrhage (arrows) were found. (d) Peripapillary scleral hemorrhage (hematoxylin and eosin stain, arrowheads).

2.4. Case 4

A 1-month-old boy was found in a state of dyspnea by his father and transported to a hospital. He was in a state of cardiopulmonary arrest on arrival, and was diagnosed with skull fracture, and acute interhemispheric subdural hematoma (Fig. 4a). Abusive head trauma was suspected and he was referred to an ophthalmologist. Multiple retinal hemorrhages were found in his right eye (Fig. 4b). He was pronounced dead 1 month after arriving at the hospital. A complete autopsy was performed 18 h after death. Internal examination revealed skull fracture in the posterior right parietal bone (Fig. 4c), subdural hematoma with chronic histological changes, and brain fragility. The retinal hemorrhages had resolved. Microscopic examination revealed remnant evidence of peripapillary scleral hemorrhages in both eyes, and retinal hemorrhages in the right eye as hemosiderin depositions (Fig. 4d, e). We determined the cause of death to be intracranial injuries. It was suspected that he had been shaken vigorously by his mother, and hit his head against something.

3. Discussion

Peripapillary scleral hemorrhage has been reported in abusive head trauma cases [7,8]. The proposed mechanism of peripapillary scleral hemorrhage is acceleration-deceleration forces derived from violent shaking, causing rotation stress at the optic nerve-globe junction in an infant [3,4].