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Case Report

Infantile acute subdural hemorrhage probably caused by injury to the diploic channels ☆,☆☆,★

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ABSTRACT

A 6-month-old, previously healthy boy hit the right frontal region of his head against the corner of a plastic toy box. At presentation, a small area with scalp discoloration was noted in the right frontal region. Head computed tomography at the level of discoloration revealed an intracranial hematoma, 5 mm in maximal thickness, below the coronal suture. In addition, there were bony bridges connecting the frontal and parietal bones. Furthermore, a linear crack was found in the diploe of the frontal bone in contact with the coronal suture. Cerebral MRI confirmed linear hyperintensity between the inner tables. We assumed that a kind of ping-pong ball fracture was caused by the head blow, centering on the coronal suture, resulting in rupture of contacting diploic channels and tear of the dura mater, and forming a subdural hematoma. Acute subdural hemorrhage may be caused by an insignificant blow to the coronal suture in infantile patients with underdeveloped cranial bones and sutures, accompanied by subtle external findings.

Introduction

Infantile traumatic acute subdural hemorrhage (ASDH) is a distinct entity that can be caused by abusive and accidental head trauma resulting from the rupture of the bridging veins connecting to the superior sagittal sinus. It can develop even after minor head injury and might be missed on initial computed tomography (CT) [1,2]. Depressed fractures are a common type of fracture found in the pediatric population. They are most frequently caused by falls and are radiologically classified into true, flat, or ping-pong ball types [3]. Fractures affecting the cranial sutures have been documented as a rare type of skull fracture associated with abusive and accidental pediatric head trauma [4,5]. To date, traumatic ASDH caused by injury to diploic channels has rarely been reported [6]. To our knowledge, such ASDH has not been documented in the pediatric population.

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★ Ethical Standards and Patient Consent: We declare that the present study has been approved by the institution's guidelines for human research and performed following the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. We declare that the patient described in this study provided informed consent before inclusion in this study.

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Fig. 1 – A photo of the patient showing a small area of the scalp appearing slightly bluish discoloration in the right frontal region without findings of swelling, depression, or bruise (*Within the dotted circle*). *Arrow:* eczema.

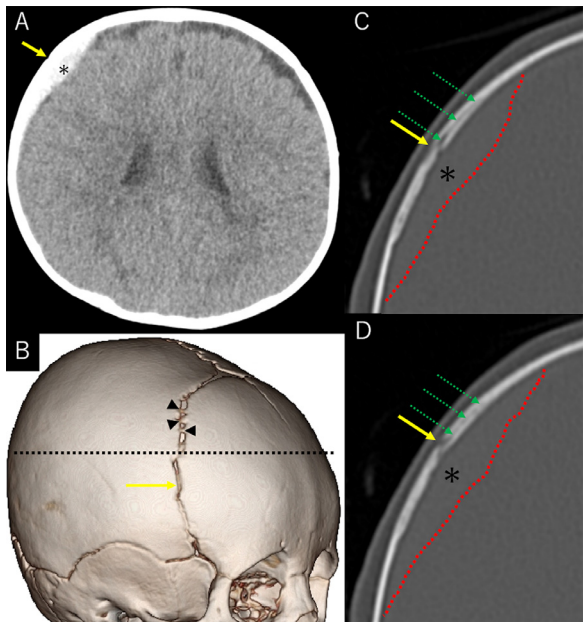

Fig. 3 – (A) Axial computed tomography (CT) at the level of scalp discoloration showing an intracranial hematoma below the coronal suture (*arrow*), slightly compressing the right frontal lobe (*asterisk*). (*B*) Three-dimensional CT shows many bony bridges in the coronal suture connecting the frontal and parietal bone (*arrowheads*). (C, D) Contiguous magnified images of bone-target axial CT at the level of scalp discoloration, showing a linear crack formed in the diploe of the frontal bone (*dotted arrows*) contacting the coronal suture (*arrow*). Note that the intracranial hematoma (*asterisk*) has maximal thickness just below the scalp discoloration. *The dotted line in B:* scanned level of *A*, *C*, and *D*; *Dotted line in C and D:* lower margin of the hematoma.

Herein, we present a unique case of ASDH, probably caused by injury to the diploic channels, from a blow to the coronal suture.

Case report

A 6-month-old, previously healthy boy hit the right frontal region of his head against the corner of a plastic toy kitchen, when he was hugged by his mother, who unexpectedly slipped and fell on the floor. The boy vomited several times 1 h later and was immediately transported to our hospital. At presentation, the patient was irritable, but did not show any focal neurological deficits. Superficial and fundoscopic examinations did not indicate an abusive injury. Meanwhile, an area

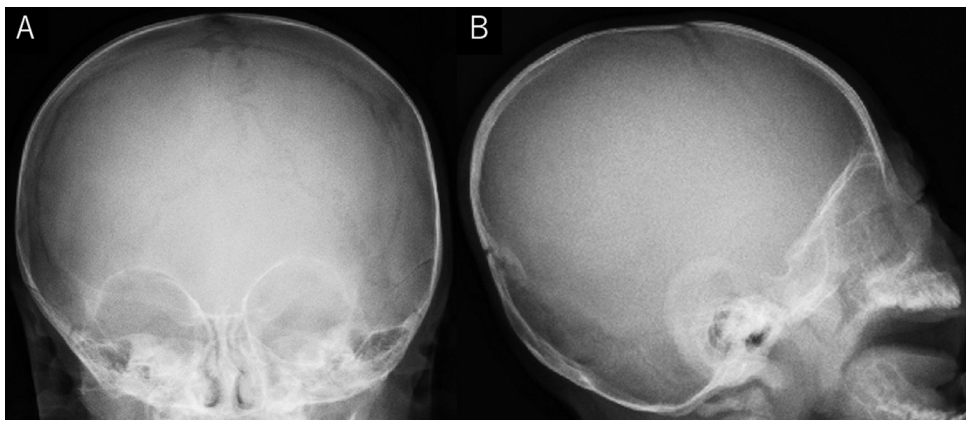

Fig. 2 – Cranial radiography, anteroposterior (A), and left-right lateral (B) views, showing an intact skull without fracture or deformation.

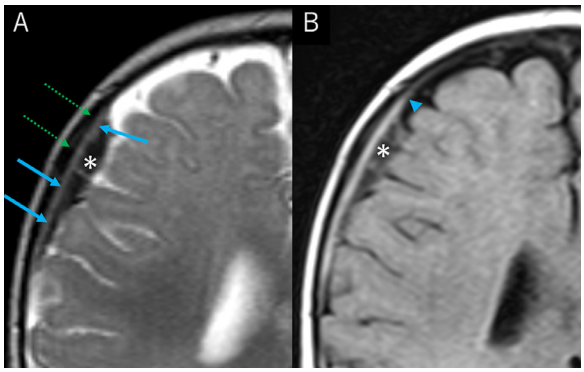

Fig. 4 – (*A*) Axial T2-weighted magnetic resonance imaging performed on post-hospitalization day 4, showing linear hyperintensity (*arrows*) between the inner table and hematoma (*asterisk*) with remarkable regression of the hematoma. (*B*) Fluid attenuated inversion recovery sequence performed at the same level, showing that the dura mater (arrowhead) is not displaced by the hematoma (*asterisk*). *Dotted arrows in A:* crack in the diploe.

with slightly bluish discoloration of the scalp, 2 cm in dimension, was noted in the right frontal region, not accompanied by swelling, depression, or bruising (Fig. 1). Cranial radiography did not identify fractures or deformations of the skull (Fig. 2). Head CT at the level of the scalp discoloration revealed a slightly compressive intracranial hematoma, with a maximal thickness of 5 mm below the coronal suture. Three-dimensional CT revealed many bony bridges in the coronal suture connecting the frontal and parietal bones. Bone-target CT images showed a linear crack formed in the diploe of the frontal bone, contacting the coronal suture. The intracranial hematoma had maximal thickness just below the scalp discoloration (Fig. 3). Cerebral magnetic resonance imaging (MRI) performed on post-hospitalization day (PHD) 4 confirmed linear hyperintensity between the inner table and the hematoma, suggesting subdurally migrated cerebrospinal fluid, with remarkable regression of the hematoma. Displacement of the dura mater was not observed (Fig. 4). Cerebral contusions or other intracranial hemorrhages were not observed. The patient was discharged on PHD 5, without neurological deficits.

Discussion

In this case, an area with scalp discoloration, presumed to be the site of the head blow, was located just above the coronal suture that contacted the crack formed in the diploe. Many bony bridges were connecting the frontal and parietal bones. The maximal dimension of the intracranial hemorrhage was just below the bruise site. Furthermore, the findings of the hematoma on cerebral MRI were highly suggestive of subdural location. Therefore, we assumed that a spontaneously reduced, reversible ping-pong ball fracture was caused by the head blow, centered on the coronal suture, resulting in rupture of contacting diploic channels and tear of the dura mater underneath, culmination in the formation of ASDH. ASDH caused by injury to diploic channels has not been documented in the pediatric population. The main reason for this seems to be the underdevelopment of the calvarial diploic system [7]. Bony bridges found in the coronal suture might have functioned as hinges for helping the plasticity of the skull at the fracture. A previous study exploring the microscopic fiber alignment of the pediatric coronal suture and its mechanical properties did not mention the role of the coronal suture in pediatric skull fracture [8]. In addition, the crack formed in the diploe was thought to result from the incomplete reduction of the ping-pong ball fracture in the inner part, compared to the outer part of the skull. Pediatric depressed skull fractures are radiologically classified as either true, flat, or ping-pong ball types [3]. In addition to these three types, a skull fracture-forming crack in the diploe may present in infantile patients with head trauma near the cranial sutures. In general, traumatic ASDH in infants is estimated to result in a poor prognosis [2]. In the present case, in addition to a lack of extracranial injury, bleeding from the diploic channels, instead of profuse hemorrhage from the bridging veins that connect to the superior sagittal sinus, might have contributed to the good outcome.

ASDH may be caused in infantile patients with underdeveloped cranial bones and sutures by an insignificant blow against the coronal suture, accompanied by subtle external findings.

Author Contributions

All authors contributed equally to the study.

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