

Case Report



Abusive Head Traumas in 4 Infants

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Conflict of Interest

The authors have no financial conflicts of interest.

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ABSTRACT

Pediatric abusive head trauma (AHT) is a serious, repeated child abuse that causes grave brain damage. In Korea, AHT cases have been reported rarely, especially infants. We present 4 cases of AHT in infants diagnosed in our institution during last 2 years. We collected the demographic data, ophthalmologic examination, imaging study, and outcomes. The mean age was 7.2 months, and 2 infants were girls and the others were boys. All four were admitted with no history of head trauma, and among them 2 patients presented with an episode of seizure and respiratory arrest with no history of head trauma. The initial mental status was semi-coma in 3 cases, and stupor in 1 case. There were multiple retinal hemorrhages in both eyes in 2 cases; one had multiple old fractures on the extremities and another child showed multiple skull fractures. All patients underwent emergent surgery for acute bilateral subdural hemorrhages; 3 had craniotomy and another had burr-hole drainage. Two children expired and the other 2 are in vegetative status. The AHT has recently become more frequent in Korea so that neurosurgeons must alert AHT even in infants with head trauma.

Keywords: Pediatrics; Child abuse; Infant; Traumatic brain injury; Shaken baby syndrome

INTRODUCTION

Child abuse constitutes a serious criminal offense that can permanently leave not only physical damage but also mental and psychological aftereffects. Among them, pediatric abusive head trauma (AHT) is a serious and repeated child abuse that causes grave brain damage.¹⁰⁾ Patients usually have multiple signs that distinguish them from non-accidental head injuries. And the prognosis of AHT was poor than accidental head injuries. There have been many AHT reports in the USA and Japan during the last 20 years; however in Korea, the number of AHT cases, including child abuse, were very few until recent dramatic increase up to more than 5-fold.^{1,14,17)} We also encountered increasing number of children AHT diagnosis in our institute. In particular, it can be concluded that the hard-to-recover head damage suffered in infancy has a fatal adverse effect on life-sustaining. So, we present the demographic data, ophthalmologic examination, imaging study, and outcomes of rare cases of AHT in infants during last 2 years.

CASE REPORT

The characteristics of the 4 cases are summarized in **TABLE 1**.

Case 1

The 1st case was an 8 month-old male infant without any birth problem who came to the emergency room (ER) with a generalized tonic-clonic type seizure after a 50 cm bedside fall. His initial mental state in the ER was semi-coma, and his pupil size was bilateral 5 mm dilatation without light reflex. Ophthalmologic examination revealed multiple retinal hemorrhages (RHs) in both eyes, and brain computed tomography (CT) scan showed acute subdural hemorrhage (SDH) on both intracranial convexity with a 1 cm left-shifted midline. After emergent bilateral fronto-temporo-parietal craniectomy, severe brain swelling progressed aggressively resulting in massive brain herniation through the craniectomy cranial window (**FIGURE 1**). Electroencephalography was nearly compatible with brain death on the 9th hospital day. He died on the 19th day of hospitalization.

Case 2

The 2nd case was a 7-month-old female infant who was transferred to the ER with post-ictal stuporous mentality and gingival hemorrhage. Her caregiver was a young single mother, and her boyfriend said she had no trauma history. Brain CT scans showed massive subacute SDH in the right fronto-temporo-parietal area without skull fracture. Emergent wide craniectomy on the right fronto-temporo-parietal area for brain decompression and evacuation of SDH was done. She underwent tracheostomy on the 21th postoperative day. A ventriculoperitoneal shunt was performed on the 49th postoperative day and cranioplasty on the 133th postoperative day (**FIGURE 2**). She was in the vegetative state at the time of transferring to the long-term care facility on the 254th postoperative day.

Case 3

The 3rd case was a 6-month-old female who came to the ER with respiratory arrest after febrile convulsion. Her parents performed cardiopulmonary resuscitation about 3 minutes. Brain CT scans revealed acute SDH in both fronto-temporo-parietal areas with severe brain swelling and multiple skull fractures (**FIGURE 3**). Her parents denied any history of

TABLE 1. Characteristics of 4 cases

Cases	Demographic data	CT findings	Suggestive findings of AHT (except CT findings)	Outcomes
Case 1	-8 month old boy -50 cm fall down -Semi-comatous mentality -Bilateral fixed, dilated pupil -No trauma history	Acute SDH on both side	Diffuse RHs on both eyes	-Brain death on EEG -Expired at the 19th hospital day
Case 2	-7 month old girl -Post-ictal stuporous mentality -No trauma history	Massive SDH on left side	-Gingival hemorrhage -More severe status than caregiver's statement	Vegetative status
Case 3	-6 month old girl -Post CPR status -No trauma history	Acute SDH on both side	-Multiple skull fracture -More severe status than caregiver's statement	-Brain death on brain SPECT -Expired at the 24th hospital day
Case 4	-2 month old boy -Respiratory arrest -Semi-comatous mentality -Bilateral fixed, dilated pupil -No trauma history	Acute SDH on both side	-Diffuse RHs on both eyes -Multiple periosteal reaction on all extremities	Vegetative status

CT: computed tomography, SDH: subdural hemorrhage, AHT: abusive head trauma, RH: retinal hemorrhage, EEG: electroencephalography, CPR: cardiopulmonary resuscitation, SPECT: single photon emission computed tomography.

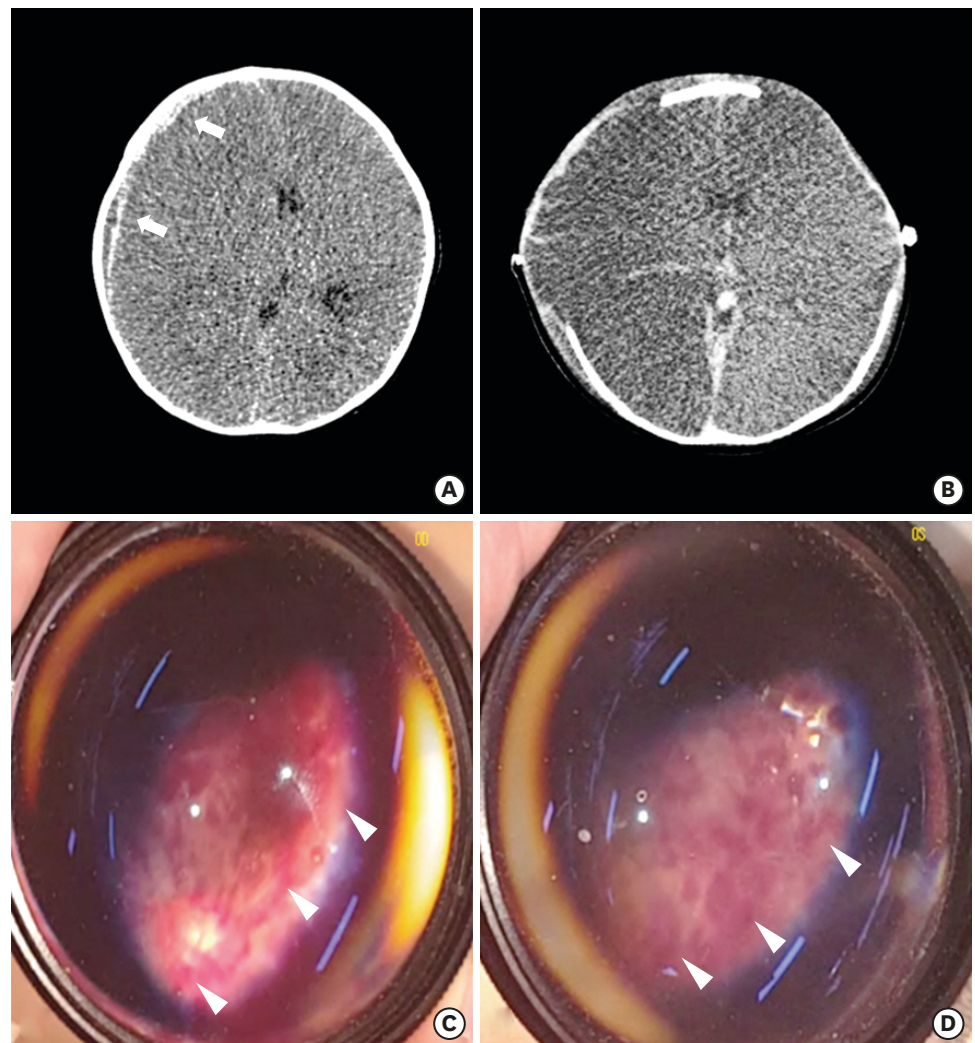


FIGURE 1. CT scans and fundus examination of case 1. (A) Acute subdural hemorrhage was found (arrow) in initial brain CT scan. (B) After bilateral craniotomy, with right side hemispheric hypoxic damage. Ophthalmologic fundus examination of right eye (C) and left eye (D) in emergency room. There are multiple hemorrhagic spots in both retina (arrowhead). CT: computed tomography.

head trauma but the degree of injuries was severe compared to the statement. Emergent craniectomy for brain decompression and hematoma evacuation was performed. On 5th day in the hospital, single photon emission CT of the brain was compatible with brain death. He died on the 24th day of hospitalization.

Case 4

The last patient was a 2-month-old male infant, who came to the ER with respiratory arrest during breast feeding. The initial mental status in the ER was semi-comatous with bilateral 5 mm pupil dilatation without light reflex. According to his parents, there was no history of head trauma. Ophthalmologic examination revealed diffuse RHs and macular hemorrhages in both eyes, multiple periosteal reaction in simple extremity x-rays, and brain CT showed acute SDH in the bilateral fronto-temporo-parietal area (left side dominant) and tentorial hemorrhage (**FIGURE 4**). He underwent emergent burr-hole drainage in the right parieto-

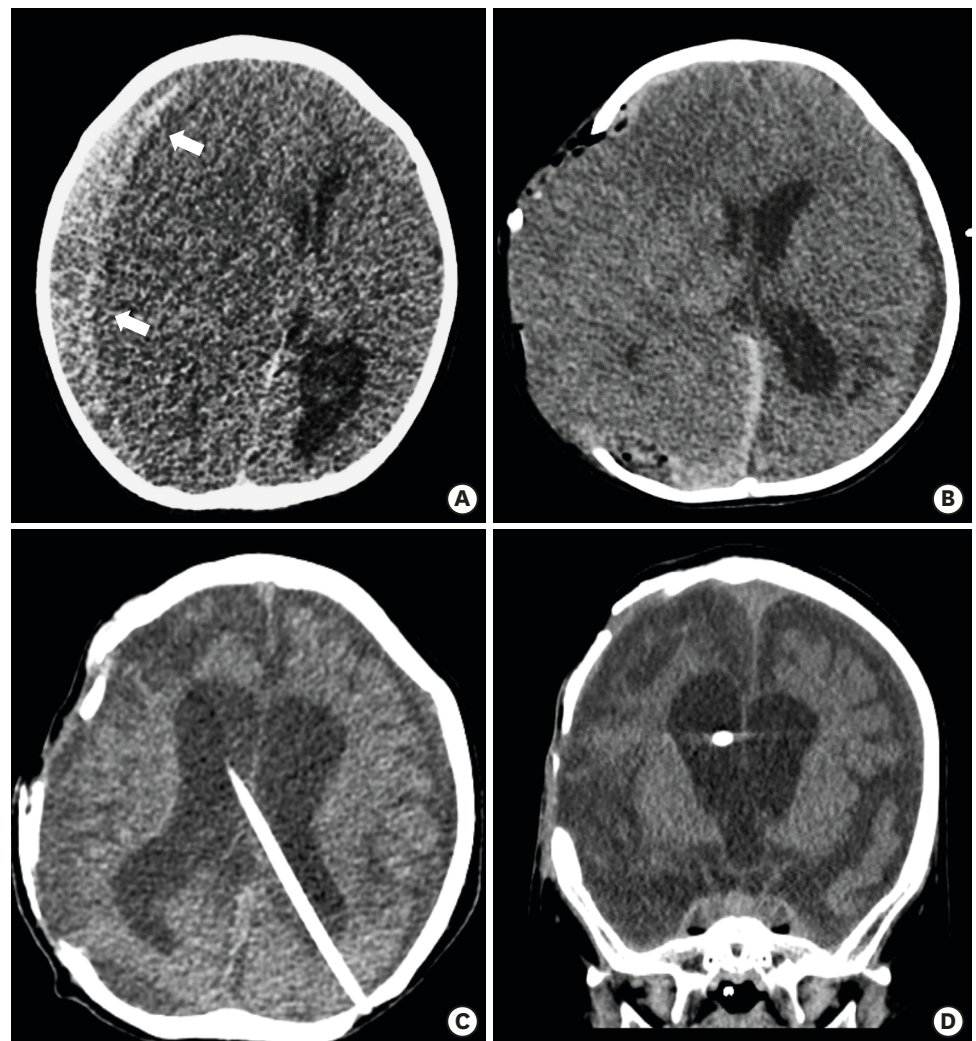


FIGURE 2. CT scans of case 2. (A) Right side massive acute subdural hemorrhage (arrow) with severe brain swelling causing midline shift to left seen in brain CT in emergency room and (B) after decompressive craniotomy. (C) After she underwent the ventriculo-peritoneal shunt operation, severe brain atrophy was noticed in brain CT axial view and (D) coronal view. CT: computed tomography.

occipital area. He received ventilator care in the intensive care unit in a vegetative state on the 199th postoperative day.

DISCUSSION

In general, AHT involves skull fracture or intracranial injuries in an infant or child younger than 5 years old as a result of violent shaking or blunt impact. The incidence of AHT between 10 and 30 per 100,000 infants per year in the USA.³⁾ The outcome ranges from complete recovery to significant brain damage and death.¹⁵⁾

Most of the time, the parents or caregivers state there was no trauma history or a minor history such as a fall from 30 cm height.⁵⁾ This is thought to be to conceal the behavior of the caregivers because AHT patients suffered head trauma mainly due to parental carelessness or

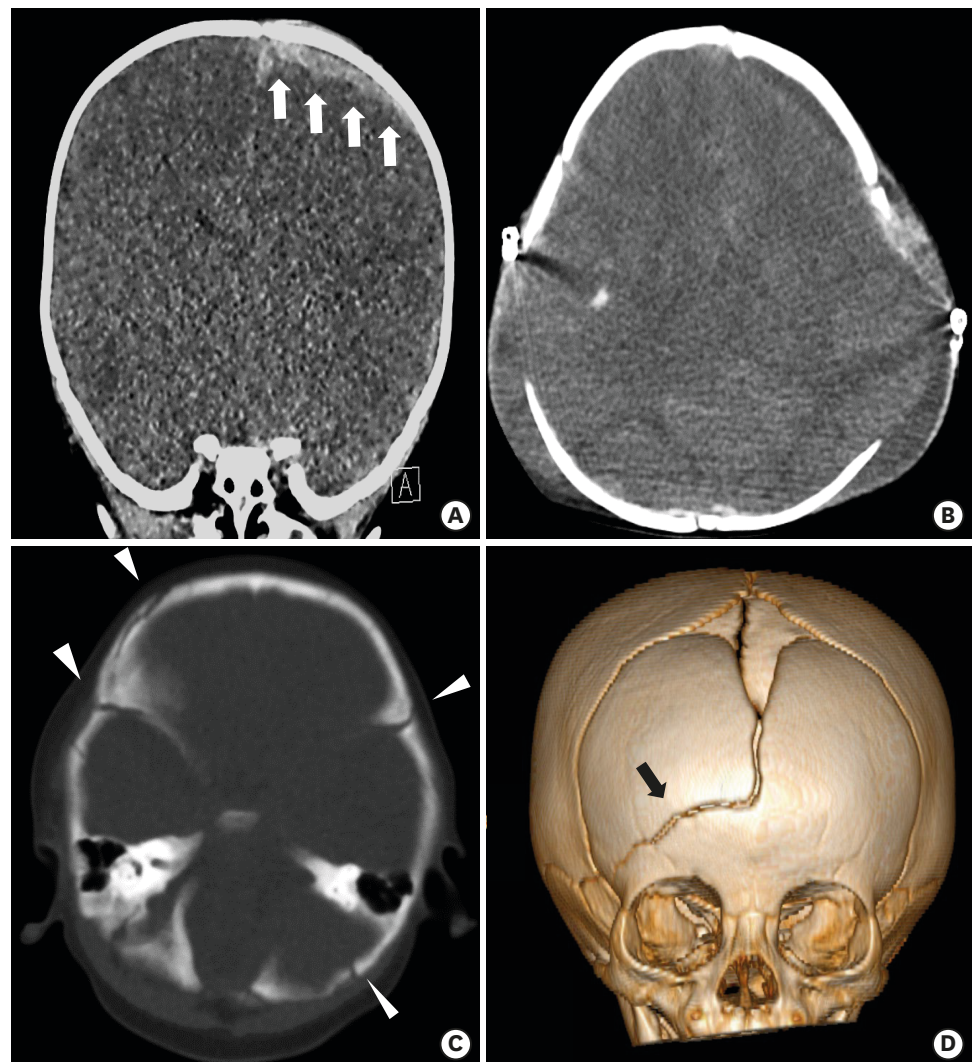


FIGURE 3. CT scans of case 3. (A) Initial brain CT scan with severe brain swelling and acute subdural hemorrhage (white arrow) causing midline shift and ventricle collapse, and (B) brain CT after bilateral craniotomy, persistent brain swelling causing brain herniation was detected. (C) He had multiple skull fracture (white arrowhead), (D) predominantly involving the right frontal bone (black arrow). CT: computed tomography.

intentional behavior.⁹⁾ This behavior was apparent in the caregivers of the 3rd and 4th cases in the present report. However, radiologic images and fundus examination have frequently shown clear signs of traumatic damage. Therefore, the most important part of identifying AHT in pediatric head trauma patients is the clinician's suspicion.

In fundus examination, the focus should be on the evaluation of presence or absence of RHs because these are significantly more common in AHT than in infants injured accidentally. Except for head injury during the birth of a newborn, severe head trauma due to a high impact road traffic accident or post-CPR status, RHs were rarely found in accidental trauma.¹⁶⁾ In a study by Johnson et al.,¹¹⁾ only 2 of 140 children with accidental head trauma had RHs. Therefore, finding RH during initial fundus examination is an important clue to AHT diagnosis among daily accidents. These are the first and fourth cases of our report.

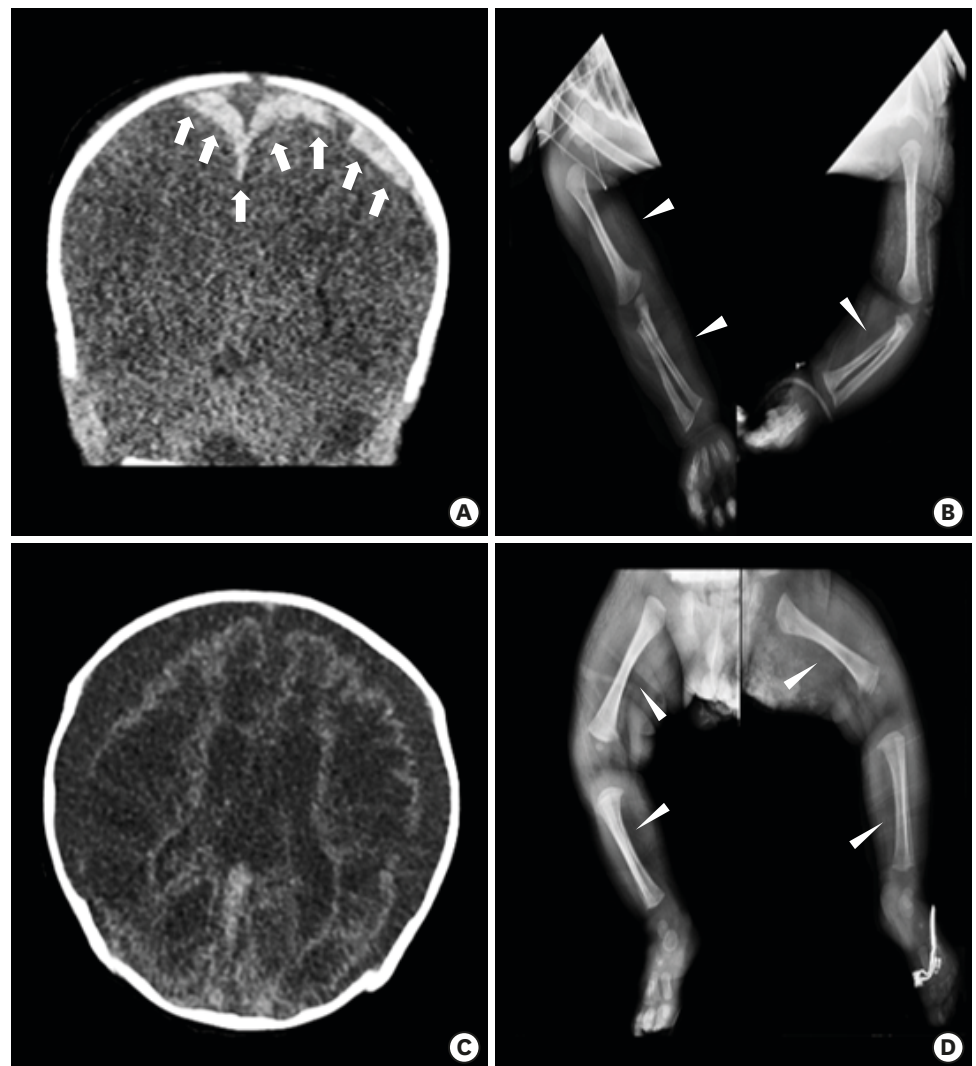


FIGURE 4. CT scans and simple extremities radiographs of case 4. Two-month-old male infant with respiratory arrest during breast feeding, cardiopulmonary resuscitation was performed by his parents. (A) Initial brain CT scan with acute subdural hemorrhage around superior sagittal sinus (arrow). (C) brain atrophy and hypoxic damage was found. There were multiple areas with periosteal resorption in (B) upper and (D) lower extremities (arrowhead). These old fractures might be due to repeated injuries and child abuse was suspected. CT: computed tomography.

Obtaining an ophthalmology consultation within the first 24 hours is important because small-dot or superficial RH often resolves quickly.^{13,16)}

According to the imaging, no single or particular pattern of skull fractures has been found to be specific for AHT. However, there are several findings in AHT patients more than accidental injuries; bilateral head trauma than unilateral, various types of intracranial hemorrhage, often multiple hemorrhagic lesions and hypoxic ischemic brain damage on CT or magnetic resonance imaging scans.

Imaging evaluation of patients who have suffered AHT usually present with or without a skull fracture,^{8,12)} and injuries to various parts of the body with a combination of old compound fractures at various stages of healing and acute lesions.⁷⁾ Particularly, multiple rib fractures

were the most distinguishable clinical features in AHT patients with RHs.²⁾ These suggest AHT more strongly than accidental trauma. There were multiple skull fractures in plain radiographs of the skull in 3rd case, and multiple periosteal reaction sites in simple extremity radiographs in 4th case.

Finally, most of the patients with AHT present with the life-threatening signs and symptoms with poor prognosis. Its mortality rate was estimated to be up to 36%,¹⁵⁾ and 70% of patients survive with neurological deficits, including cognitive or behavioral impairment, seizure, and cerebral palsy.⁶⁾ It is more serious than what the radiological images showed because of the secondary stressful medical conditions like hypoxia, ischemia, and metabolic or inflammatory reactions.⁴⁾ The individual(s) responsible may not seek immediate medical attention for the infant or child in for treatment out of fear of legal repercussions. Therefore, delayed care often has devastating effects on short- and long-term prognoses.⁶⁾ Clinicians who evaluate the pediatric head trauma patients initially must practice high levels of suspicion, alertness, and prompt resuscitative management. In our cases all infant patients had more poor results than pediatric AHT patients in other reports. They were too young to complain symptoms and their caregivers denied their abuse so that the diagnosis of infantile AHT might be frequently delayed. Therefore, we authors emphasized that infant who was suspected to be AHT patient should be actively diagnosed and managed even though history was trivial.

CONCLUSION

The AHT has recently become more frequent in Korea. We suggest that the clinicians can diagnose AHT without medical history through clinical information including ophthalmologic examination and brain imaging studies even though the caregivers gave to them false or unreliable trauma history. Infant AHT patient may had bad prognosis than older patients, and non-accidental head trauma was riskier than they shown, and poor prognosis than accidental trauma. Therefore a focused approach towards prompt management should be practiced to infant patients and neurosurgeons must alert AHT in children with head trauma.

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