

## He Fell from Dad's Arms: Subdural Hemorrhages in an Infant

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A 3-month-old male infant was brought by his parents to his primary care physician with a history of falling from his father's arms onto hardwood flooring as the father tripped over the family dog. The baby cried immediately and eventually settled down. He was intermittently fussy and vomited 3-4 times in the 4 hours prior to presentation. The father waited for the mother to come home from work before bringing the baby to the local community emergency department where bilateral subdural hemorrhages (SDHs) were diagnosed. He was admitted to the Children's Hospital, and the family was reported to child protective services.

The baby was born full term via normal spontaneous vaginal delivery to a 32-year-old school teacher. His Apgar scores were 9 at 1 and 5 minutes. The prenatal and perinatal histories were noncontributory, and he was discharged home on day 2. His New York State newborn screening tests were negative. The mother had 1 prior uncomplicated pregnancy.

Examinations in the pediatrician's office occurred at 2 weeks and 2 months of age for preventive care. At the 2-month visit, his height, weight, and head circumference were following his previous curves and at the 50th percentiles for age. He received 1 set of immunizations at 2 months after which he became irritable.

Our patient had several episodes of vomiting within a few days and multiple documented phone calls to the pediatrician's office. He was evaluated in the office 2 weeks prior to this presentation and diagnosed with gastroenteritis. His height and weight continued to track at the 50th percentile for age. His head circumference plotted between the 50th and 75th percentile. His fontanel was flat. There was a small brown bruise under his left eye. The symptoms and bruise resolved, and he was well until this episode.

The father recently lost his job and was responsible for the daily care of both children. There was no history of domestic violence or child abuse. The baby was cared for by maternal grandmother, father, or mother. There was no family history of bleeding disorders, congenital abnormalities, bone defects, childhood seizures, developmental delay, or unexplained deaths.

On admission, the baby was irritable and slightly pale. His temperature was 37.5 degrees Celsius, heart rate 133 beats per minute, respiratory rate of 42 breaths per minute, and systolic blood pressure of 62 over a palpable diastolic. His oxygen saturation was 100% on room air. Weight and height were at the 50th percentile for age, but his head circumfer-

ence was now at the 95th percentile. His anterior fontanel was bulging in both sitting and lying positions. He was tracking with normal extra-ocular movements. An indirect dilated retinal examination was performed by a pediatric ophthalmologist on day 4 of hospitalization and no hemorrhages reported. His skin examination was normal with no bruises to his face or scalp. He moved all 4 extremities symmetrically without tenderness or swelling.

The evaluation for child abuse included multiple screening tests as outlined in the American Academy of Pediatrics Clinical Report for the evaluation of suspected child abuse.<sup>1</sup> This included tests for hematologic disorders, liver injury, pancreatic injury, renal trauma, fractures, and head injury. A urine toxicology screen to assess for passive inhalation of drugs of abuse was negative. Results for urine organic acids to screen for glutaric aciduria type 1 were also negative.

Laboratory analysis showed mild anemia (hematocrit 30.1, hemoglobin 9.5), thrombocytosis (platelet count of 846 000), and normal coagulation factors. Urinalysis, electrolytes, liver function tests, amylase, and lipase were within normal limits. Three guaiac tests were negative.

A skeletal survey and computed tomography (CT) of the brain were performed at the community hospital, followed by magnetic resonance imaging (MRI) on day 2 of admission. No fractures were identified on the skeletal survey.

The CT report indicated a left subdural fluid collection with increased attenuation. A small amount of subdural fluid was noted on the right with lower attenuation. High attenuation areas were interpreted to represent areas of acute bleeding or clot retraction.

The MRI demonstrates a right subdural hematoma outlining the right cerebrum and measuring 10 mm in the greatest area of thickness (**Figure**). The area has a high signal on T1- and T2-weighted imaging. A left subdural hematoma is also noted measuring 8 mm in greatest thickness, with an isointense signal on T1- and T2- weighted imaging. There are no other areas of abnormal signal intensity in the brain, no acute infarction, no intra axial fluid collections, no masses, mass effect, or midline shift. The subdural hematomas with different signal intensities were interpreted as representing blood collections of different ages.

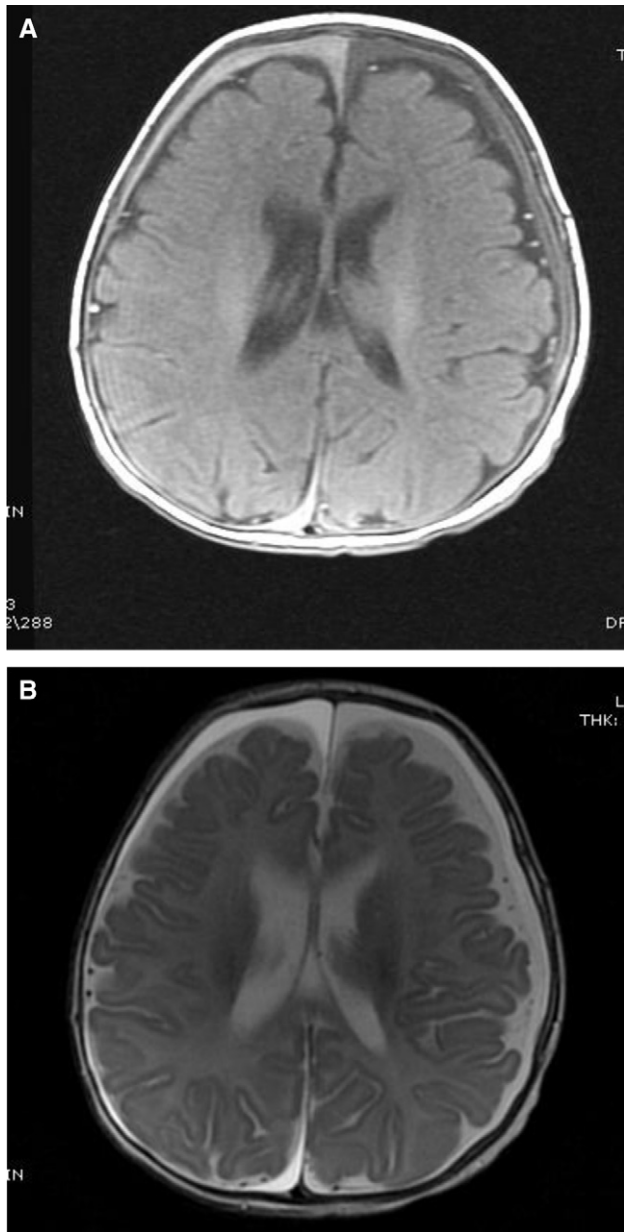
The CT and MRI are consistent with each other, demonstrating a potentially older SDH on the right cerebrum and a more acute bleed on the left.

AHT	Abusive head trauma
CT	Computed tomography
MRI	Magnetic resonance imaging
SDH	Subdural hemorrhage

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**Figure.** **A**, T1-weighted image. **B**, T2-weighted image. A right subdural hematoma outlining the right cerebrum measuring 10 mm in greatest thickness is noted demonstrating high signal on T1- and T2-weighted imaging. A left subdural hematoma is also noted measuring 8 mm in greatest thickness demonstrating isointense signal on T1- and T2-weighted imaging. These likely indicate subdural collections of different ages. Bleed on the left is probably newer (acute) compared with the bleed on the right.

### SDHs in Infants

Abusive head trauma (AHT) is a major cause of SDH in infants and young children.<sup>2,3</sup> The rate of hospitalization for infants with AHT has been reported to be as high as 30 per

100 000 infants.<sup>3</sup> Other causes of SDH in infants and children include accidental or birth trauma, coagulopathies, meningitis, congenital vascular malformations, neoplasms, and metabolic disorders. Most birth related SDH are small and asymptomatic and resolve spontaneously by 1 month of age.<sup>4</sup> The infant in this case is beyond the expected time frame for birth related hemorrhage, and other causes are extremely unlikely based on laboratory and radiologic testing.

As described by Schein et al, risk factors for increased mortality after AHT include the presence of retinal hemorrhages, cerebral edema, and a low Glasgow Coma Score.<sup>5</sup> Chronic SDH was significantly associated with decreased mortality in a subgroup of children with severe AHT and retinal hemorrhages.

Infants and children with SDHs may be asymptomatic or have symptoms and/or signs of lethargy, irritability, vomiting, apnea, loss of consciousness, seizures, sudden cardiopulmonary arrest, paleness, respiratory changes, bulging fontanel, poor tone, enlarging head circumference, and bruising. The severity of symptoms usually corresponds to the severity of intracranial injury but may also correspond to severity of extracranial physical injury.

When head trauma is not accompanied by neurologic symptoms, missed diagnoses of SDH and child abuse may occur. In a study of infants and children in whom child abuse was suspected, 38 children with no clinical signs of intracranial injury underwent neuroimaging and 29% (11/38) had an undiagnosed intracranial injury.<sup>6</sup> Others have reported similarly that child abuse is commonly missed by medical providers because of lack of suspicion of head trauma<sup>7-9</sup> Repeated or serial abuse should be considered when child abuse is suspected.

Mild symptoms of SDH may mimic viral illnesses.<sup>7</sup> Because accidental bruises are rare in nonambulatory children,<sup>10</sup> subtle injuries may be sentinels to more significant trauma.<sup>11,12</sup> Delays in seeking care after childhood injuries, whether abusive or accidental, are not uncommon and should not be the sole reason for suspicions of abuse.<sup>13</sup>

Reasons for physicians not recognizing or reporting child abuse to the authorities are multiple and include familiarity bias, prior experiences with child protective services, and other factors such as a sense of reassurance because of normal laboratory or radiographic testing.<sup>14</sup> A parent's profession, such as this mother's career as a teacher, may also inadvertently influence a provider because of bias and concern regarding the effects of a false allegation. Failure to report suspected child abuse may result in criminal and civil penalties.<sup>15</sup>

Whether or not the acute SDHs could have resulted from a short fall from the father's arms is critical to the legal investigation. SDHs may be caused by accidental trauma but do not commonly occur from a short fall such as this.<sup>16</sup> Although the medical treatment remains the same, the suspicion that there is an older SDH as well as a more acute SDH often complicates the investigation. More than 1 adult may have had access to the infant during earlier and later time frames. This complication could become pivotal to later

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