Short Report

Subdural hemorrhages and severe retinal hemorrhages in a short fall with a rotational component

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We present the case of a 5-month-old referred for child abuse investigation with subdural hemorrhages and extensive retinal hemorrhages following a short fall from a swivel chair seen on video footage. Subdural hemorrhages with extensive retinal hemorrhages are not typically seen as the result of short household falls. Reviewing the footage, contributing factors may have included increased rotational and deceleration forces.

Case Report

We present the case of a previously well 5-month-old infant with subdural hemorrhages (SDHs) and retinal hemorrhages (RHs) following a short fall. It was reported that an adolescent was caring for the infant while his parents were unwell. The adolescent placed the patient on the lap of a 5-year-old who was seated on an office swivel chair. The chair was turned, and the baby fell less than 3 feet headfirst onto a wooden deck. He cried immediately and then became drowsy.

Emergency Medical Services were called, and he was transferred to a community hospital emergency department. He was reported to be lethargic and irritable. Computerized tomography (CT) of the head documented right-sided SDHs and no skull fractures. The case was reported to Child Protective Services (CPS), and the infant was transferred to a tertiary care pediatric center for assessment by Neurosurgery and the Suspected Child Abuse and Neglect (SCAN) team. CPS and police conducted a joint investigation.

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On review by the SCAN team, there were no visible signs of soft tissue injury, scalp swelling, or bruising. Comprehensive laboratory evaluation and Hematology consult did not identify a coagulopathy. There was no personal history or family history of bleeding.

A repeat CT of the head was reviewed by two neuroradiologists, who reported a hyperdense, 9 mm right frontoparietal subdural hematoma, with no indication of effacement or loss of gray-white matter differentiation. Ophthalmology assessment with dilated funduscopy documented bilateral RHs too numerous to count and involving multiple retinal layers (Figure 1). The hemorrhages were mostly in the posterior pole but extended to the periphery. There was no obvious traumatic retinoschisis; however, optical coherence tomography scans were not available. Skeletal survey and testing for occult abdominal trauma were normal.

Police provided the SCAN team with home security footage. The footage demonstrated a well-appearing infant sitting on the lap of a child on a plastic swivel chair with rollers, on an outdoor wooden deck. The baby was seated facing forward, with his back to the child. An adolescent was standing to the right of the chair and turned the chair less than a quarter of a turn (estimated 90°) without releasing it. The baby fell sideways from the child's lap, landing with impact on his forehead and subsequent impact to the right side of the head as he rotated to land on his back. The recorded event immediately preceded clinical deterioration; no other concerns or social risk factors were identified by police and CPS. The final SCAN opinion was that the documented SDHs and RHs were compatible with the injury event documented in the footage of an accidental rotational fall with impact to the head.

Discussion

We report the case of a 5-month-old infant with SDH and multilayered RHs extending to the periphery and too numerous to count, which are unusual findings not typically occurring following a short household fall.

The predominant opinion supported by the literature is that SDHs associated with extensive RHs are exceedingly rare in infants who sustain short falls.[1,2] Systematic reviews from Canada, the United Kingdom, and Australia have reported that SDH and RH are strongly correlated with abusive head trauma (AHT), particularly if no adequate history is provided.[3-5] In cases of AHT, RHs are more likely to be numerous, bilateral, and in all layers of the retina, and to extend to the periphery.[5]

While more extensive RHs have been reported in higher-force accidental injury events, such as staircase falls,[6] occipital impact falls,[7] or crush injury events,[8] a study of children with translational short falls noted the rarity of documented more extensive RHs.[9] Ibrahim and colleagues[1] reported that of 24 infants who fell <3 feet and had ophthalmologic examination, only 1 infant had RHs, which were described as unilateral, scattered, intraretinal hemorrhages (not extensive).[1] A study exploring head

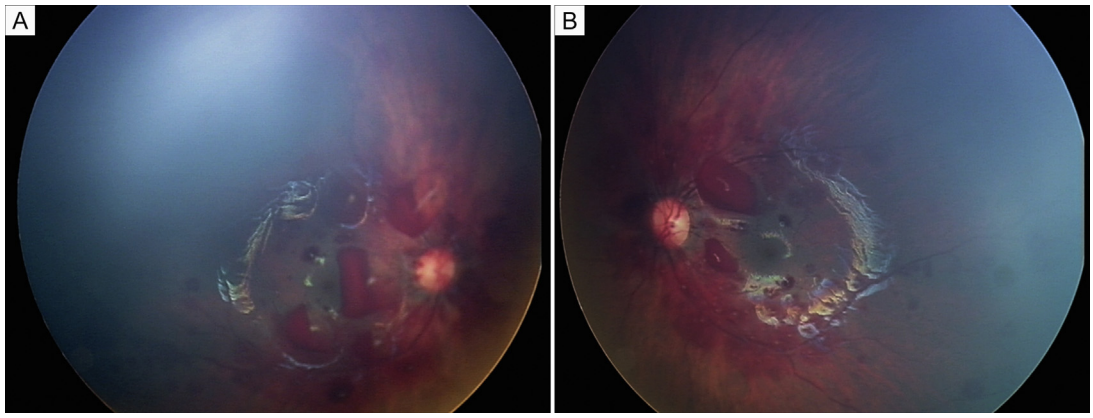

FIG 1. Fundus photographs of the patient's right eye (A) and left eye (B) showing retinal hemorrhages involving multiple retinal layers and extending to the periphery that were too numerous to count. The optic nerves are not swollen.

injuries in children under 2 years of age found no RHs in short falls witnessed by a nonrelative.[2] A study of accidental falls with occipital impacts demonstrated RH in 8 infants.[7] Only 1 infant had bilateral, more extensive RHs, although the injury event involved some complexity, with a fall from standing on a couch, with occipital impact on a table and subsequently the floor. This literature is reflected in the American Academy of Pediatrics statement and supports the opinion frequently provided by child abuse pediatricians that SDH and RH are rare following accidental household falls and that such findings raise concern for AHT.[10]

In our case, security footage was of key importance in illustrating the fall dynamics. Emergency responders described the height of the chair as 2 feet. Even with the addition of the 5-year-old seated on the chair, it is likely that the total distance was under 3 feet and would be considered a low height fall by most. The infant landed near the base of the chair, without significant forward projection from the chair. There was rotational force involved in the fall, although the chair underwent only a quarter of a full rotation. Additionally, the turning of the chair may have introduced additional momentum and more significant deceleration on impact. There was direct impact over the front and right side of the face and possibly directly over the eye, perhaps contributing to the retinal hemorrhaging. Therefore, this case involved a short fall with an element of rotational force and our findings are not generalizable to all short falls. The findings of SDH and severe RH following a short fall in this case appropriately raised concern for AHT initially, leading to a child protection investigation. Careful review of the clinical findings and the video evidence of the event led to the conclusion that the SDH and RH were the result of the fall.

This case highlights the possibility of SDH and severe RH occurring even from a short fall if rotational force is involved: we do *not* propose that these findings can occur after all reported short falls. We believe that this case is an outlier; nevertheless, it adds to our understanding of short falls in infants and underscores the need for nuanced and evidence-based investigations in any such case. Our findings do not obviate the need for a child protection investigation in cases involving SDH and severe RH. Finally, although a thorough assessment by SCAN, pediatric neurosurgery, pediatric neuroradiology, and the investigation by CPS and police did not yield evidence of prior head injury in this case, previous head injury could never be ruled out completely. Detailed history of injury events, particularly in the context of a reported accidental injury with unexpected findings, is foundational.

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