



### **G6 Fatal Acute Intracranial Injury With Subdural Hematoma and Retinal Hemorrhages in an Infant Due to Stairway Fall**

Patrick E. Lantz, MD\*, Department of Pathology, Wake Forest University, School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157-1072; and Daniel E. Couture, MD, Department of Neurosurgery, Wake Forest University School of Medicine, Medical Center Boulevard, Winston Salem, NC 27157

The goals of this presentation are to discuss the significance of retinal hemorrhages in an infant with a traumatic brain injury and an acute subdural hematoma and the discordance of published articles about serious injuries or fatalities in infants and young children associated with stairway or short falls.

This presentation will impact the forensic science community by emphasizing the importance of a meticulous investigation required when an infant or young child dies following a history of a short fall coupled with a critical examination of the current literature on short fall fatalities.

Mistaking a fatal accidental head injury in a young child for abusive head trauma can cause serious and protracted consequences. A case of an infant with an acute subdural hematoma (SDH) and severe hemorrhagic retinopathy due to a fatal accidental head injury from a short fall down carpeted steps will be described. The clinical, autopsy, and investigative findings of this case refute the pervasive belief of many physicians that a short fall down stairs by infants and young children are invariably trivial events and cannot cause serious intracranial injuries and extensive retinal hemorrhages.

According to the mother, her 7¼-months-old son had been active, playful, and crawling on the floor when she heard a loud thud and found him supine on the basement steps' landing. He was transported by ambulance to the medical center's emergency department. The child was *in extremis* and cranial computed tomography revealed a left-sided acute SDH with a midline shift. He was taken immediately to the operating room; however, in the surgical suite he became asystolic. The neurosurgeon evacuated the blood but resuscitative efforts were unsuccessful.

Neuropathological examination verified the radiological findings of an acute intracranial injury with compressive effects from a left-sided acute SDH. He had bilateral multilayered retinal hemorrhages (left > right), optic nerve sheath hemorrhages, macular edema and microscopic retinal detachments.

The upper half of the stairway from the hallway to the landing was a flight of six carpeted steps with a carpet over hardwood landing (total units of rise = 7). The stairway pitch was 37° and the rise of each step was 0.2032 m with a total rise of 1.42 meters. The oak runners and landing were 2.0 cm thick and the synthetic carpet and pad over the steps and landing measured 1.9 cm in thickness.

The accounts of the incident by the mother were repeatedly consistent and unchanging as provided to the emergency dispatcher, paramedics, emergency department physicians and nurses, neurosurgeon, detectives, and medical examiner. A multidisciplinary team of medical professionals and law enforcement personnel reviewed the investigative reports, scene images plus clinical and autopsy findings. All concurred that his injuries were due exclusively to the stairway fall.

Published studies on stairway falls and serious injuries or fatalities from short falls involving young children are discordant. Joffe and Ludwig (1988) maintained that falls down stairs seldom result in serious injury. In contrast, Chiavillo et al. (1994) concluded that while most stairway-related injuries in young children are minor, severe head injury can occur. Hall et al. (1988) reported that falls accounted for 5.9% of childhood deaths due to trauma and 41% of the falls were minor.

Williams (1991) reported that falls witnessed by two or more people or by a non-related person were associated with less severe injuries suggesting alternate mechanisms in the unwitnessed group. Chadwick et al. (1991) described seven children who died in short falls and had other injuries (5/7 with retinal hemorrhages). They concluded that when children incur fatal injuries in falls of < 4 ft, the history is false. Reiber (1993) reviewed coroner's records (1983-1991) and analyzed relevant articles. He concluded that while children on occasion suffer fatal head injuries from short falls, such events are rare. Plunkett (2001) described 18 head injury deaths resulting from playground falls in the National Electronic Injury Surveillance System database over 12 years (1988–1999). He concluded that an infant or child can sustain a fatal head injury with retinal hemorrhages from a fall of less than three meters. Wang et al. (2001) reported on low and high-level falls in a pediatric population and found a mortality rate of 1% for low-level (<15 feet) falls. Chadwick et al. (2008) reviewed the current literature plus a statewide injury database and asserted that the best current estimate of short fall mortality rate for infants and young children was <0.48 deaths per one million young children per year.

The clinical, radiographic, autopsy and investigative findings of this case will be presented followed by a critical examination of published articles on stairway-related injuries and fatalities from short falls involving young children. Lastly, caution is urged in attributing an acute SDH and traumatic brain injury with extensive retinal hemorrhages solely to abusive head trauma in an infant or young child following a stairway or short fall based on the current medical literature.



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Short Fall, Subdural Hematoma, Retinal Hemorrhages