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**CASE REPORT**

**PATHOLOGY/BIOLOGY**

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# TV Tip-Over Morbidity and Mortality in Children*

**ABSTRACT:** Twenty-eight non-fatal cases of TV related injuries were noted in San Diego in the 2 years prior to September 2008. We reviewed the scene, witness reports, past history, and autopsy findings from three fatal cases and distinguished them from abusive head trauma. The recent literature was also reviewed. Our fatal cases resulted from TVs falling on small children and causing severe head injury. The literature review showed increasing injuries and deaths relating to TV tip-over, TV stands and dressers. Most of the fatalities were head injuries in small children. The reporting methods may not be complete or accurate. Some authors in the literature review suggested preventive measures so as to decrease these injuries. Forensic scientists should become familiar with these injuries and measures so that they may communicate effectively with their communities.

**KEYWORDS:** forensic science, forensic pathology, TV tip-over, TV injuries, head injuries, abusive head trauma, children

The incidence of pediatric motor vehicle- and bicycle-related injuries has decreased in the United States because of public awareness, use of infant car seats and seat belts, and bicycle helmets (1). However, TV tip-over injuries in childhood in the United States and worldwide are increasing, in part, because of the lack of public awareness and preventive measures (1–16). In fact, many parents and caregivers are unaware that this mechanism accounts for injuries and leave their children unattended during these circumstances (3,5). Forensic pathologists have recently taken note of these injuries (13–15).

Three recent cases of TV-related tip-over deaths seen in the San Diego County Medical Examiner's Office motivated the authors to describe them, to distinguish them from abusive head trauma (AHT) (13,14), and review the recent literature of this phenomenon. The findings and limitations of the literature search are shared. Some of the authors in the literature (9,16,17) have offered preventive measures to decrease these injuries.

## Background

Physicians and staff at Rady Children's Hospital in San Diego revealed that there were 15 non-fatal cases during an earlier 18 month interval and 13 cases in the 8 months preceding our cases (written communication from Susan A. Cox, Trauma Services Director, Rady Children's Hospital of San Diego, California) (18).

A young child spends approximately 4 h watching TV (1). Older cathode ray tube-type TVs are heavy (> 150 pounds), and their corners are sharp. Newer flat TVs are larger and have heavy front ends (1). They tend to be unstable unless secured to a wall or furniture. In addition, children tend to pull on TV cables, seek toys on the tops of TVs, and try to manipulate TV controls. Most of the fatalities are in children less than 4 years of age (8,9). Seventy percent of the injuries involve the head and neck, and result in moderate to severe injury with death in up to 2.7% of the cases (1). Bernard et al. (2) noted that "the dynamics of head injury depend on many factors including elasticity, compressibility, and viscosity of body tissues" and that "a 36 inch television set with a typical weight of 78 kg falling just 1 meter creates the momentum equivalent to a 1 year old weighing 10 kg falling from 10 stories (60 meters)."

## Case Reports

Three cases illustrate the risk of head injury and death following TV tip-over injuries. These must be distinguished from AHT.

### *Case 1*

A 3-year-old girl was in her bedroom alone. Her father heard a loud crash and ran to her. She was found unresponsive between a five-drawer, 4 ft dresser and a 27 in. cathode ray tube-type TV which had fallen to the floor (Fig. 1). The father picked up the dresser, and the child was transferred to the hospital where she expired 24 h later. Her height and weight were in the 90th percentile. There were no prior injuries by X-ray or examination. The autopsy revealed right orbit ecchymosis with a fracture extending to the maxillary sinus, and diffuse brain edema. Extensive basilar subarachnoid and severe posterior atlanto-occipital junction hemorrhage were noted (Fig. 2). No aneurysms or vascular lesions were discerned, nor were there any skull or cervical neck fractures or dislocations. Chest and abdominal X-rays and toxicology studies were negative. Bilateral optic nerve sheath hemorrhage, but no retinal hemorrhages were found. Her death was attributed to hyperextension of the neck from the impact with possible C1-vertebral artery injury.

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FIG. 1—*Case 1. Scene with dresser and fallen TV.*

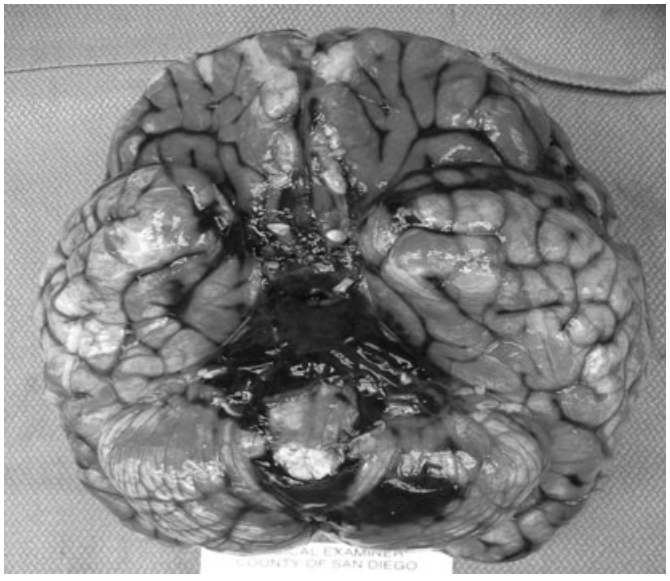

FIG. 2—*Case 1. Diffuse basilar subarachnoid hemorrhage.*

*Case 2*

A 21-month-old girl was in a room with her older sibling. Her carer heard a loud crash and found that a 150 lb, 27 in. cathode ray tube-type TV had fallen 3 ft from a shelf in which three wooden pegs and the shelf had become dislodged (Fig. 3, reconstructed scene and Fig. 4, actual scene). The sibling volunteered that he had apparently broken the TV, not realizing the injury to the victim who died 70 min later. The decedent was in the 50th percentile for height and weight, and there were no prior injuries or domestic difficulties in the household.

The autopsy revealed abrasions and contusions of the posterior scalp and back, consistent with the TV edges, and multiple basal skull fractures in each fossa. The fracture of the posterior fossa extended to the foramen magnum and caused posterior atlanto-occipital separation (Fig. 5). The spinal cord, spine, and neck were not injured. There were no retinal or optic nerve sheath hemorrhages.

FIG. 3—*Case 2. Reconstructed scene with shelf in place.*

FIG. 4—*Case 2. Actual scene with fallen shelf and TV.*

*Case 3*

An 11-month-old girl was in a bedroom with her 4- and 6-year-old siblings. The older sibling pulled the drawers from a dresser (Fig. 6) and attempted to climb up onto a 126 lb, 21 in. cathode ray tube-type TV that was on top of the 36 in. high dresser. The TV fell and struck the victim's right head while she was apparently on the floor. The dresser remained upright. Blood was emitting from the right ear. She was unresponsive and expired in 3 days. A computed tomography (CT) scan revealed pneumocephalus. Her height and weight were at the 90th percentile, and there were no other injuries, other than in the skull, by X-ray or CT scan. The family history was negative for family violence or prior injuries in any of the children.

The autopsy revealed cephalohematoma, diastasis of both coronal sutures with a posterior fracture extending from the right coronal suture, and a "ping-pong" indented fracture of the right parietal bone (Fig. 7). There were numerous basal skull fractures and a deep fracture of the right petrous bone. The latter accounted for the right ear hemorrhage and pneumocephalus. Thin EDH, SDH, and SAH were seen. The brain showed hemorrhagic necrosis of the anterior right frontal lobe (Fig. 8), bilateral infarcted cingulate gyri and right thalamus and pontine hemorrhage. The left brain was ischemic and swollen due to compression of the left anterior

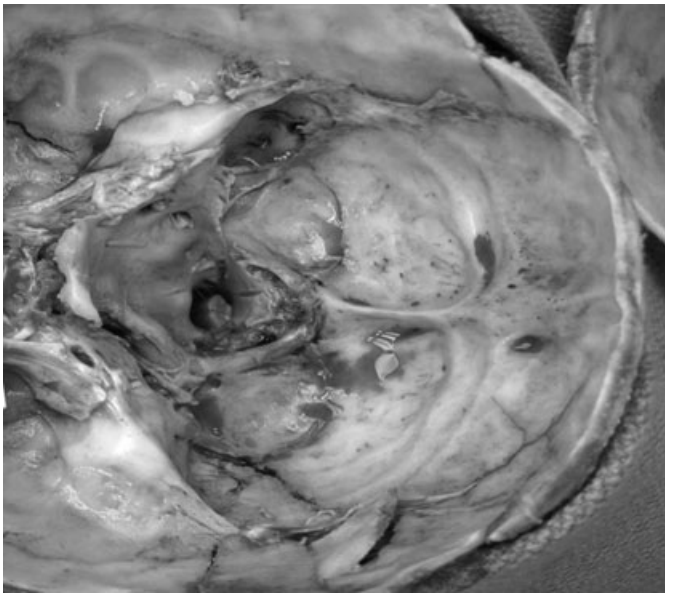

FIG. 5—*Case 2. Posterior fossa fractures extending to the foramen magnum.*

FIG. 6—*Case 3. Scene with opened drawers and upended TV on floor.*

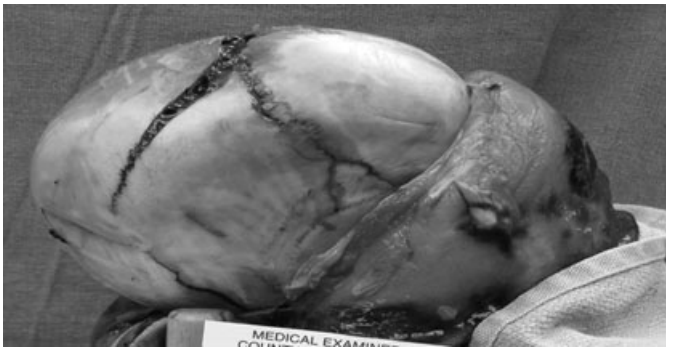

FIG. 7—*Case 3. Coronal suture diastasis with linear skull fracture and "ping-pong" right parietal bone fracture.*

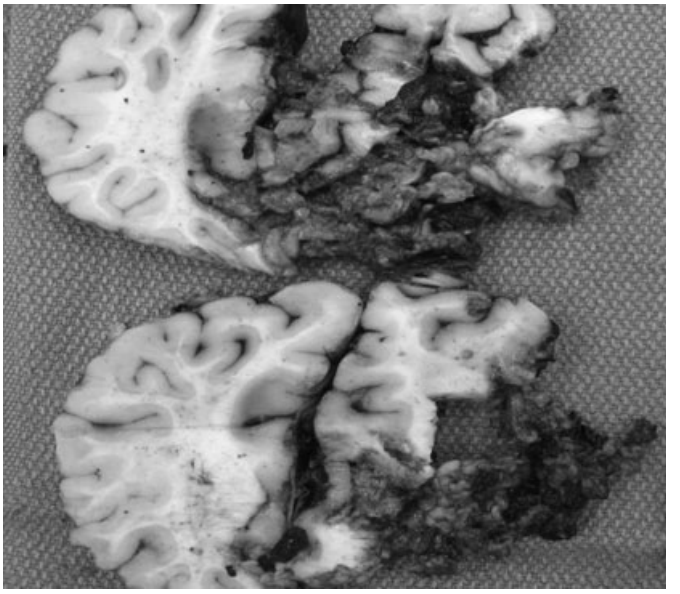

FIG. 8—*Case 3. Hemorrhagic necrosis of right brain and edema of left brain.*

cerebral artery distribution. Bilateral optic nerve sheath and retinal hemorrhages were evident.

### Distinction from Abusive Head Trauma

Our cases were distinguished from AHT using criteria suggested by Matshes et al. (13) and Lopez et al. (14). The scene examination, statements of the witnesses, and the clinical history were carefully correlated with the injuries, the hospital records and findings, the autopsy, toxicology, and all radiological data. All prior injuries or evidence of abuse were ruled out. Each child had normal growth, development, and nutrition. All the toxicology studies were negative. Complete autopsies were performed, and the neurological findings were reviewed by a neuropathologist.

### Review of the Literature; Limitations

Case reports from 1998 to 2009 (1–15) were reviewed. The most recent and extensive reports were by Gipson (8) and Gottesman et al. (9). Gipson reviewed data from 2000 to 2006 using the U.S. Consumer Product Safety Commission (CPSC) National Electronic Injury Surveillance System (NEISS). There were 180 appliance-, furniture only-, furniture and TV-, and TV only-related deaths from 2000 to 2006. Sixty-two of these deaths were TV only related. In 2006, there were an estimated 15,900 injuries and 33 deaths related to the four impacting objects. Seventeen of the deaths were TV only related. The number of injuries and deaths increased annually. The largest number of cases occurred in children 1–4 years of age. More males than females were affected. Since children begin to ambulate between 1 and 2 years of age and tend to climb on objects and explore their environment, most of the injuries in Gipson's report were in this age range. Because of their relative height and size in relation to the TVs and stands, head and neck injuries were more common. Older children obtained chest and extremity injuries. These children were apparently not cognizant of the risks of their activities and could not respond quickly. Their parents were generally unaware of the risks of these injuries; thus, the children were unattended in their homes under these circumstances (3,5).

Gottesman et al. (9) also used CPSC NEISS data from 1990 to 2007 to analyze children and adolescents. She studied the mechanism of the injury (TV only tip-over, pulling oneself or climbing onto furniture causing it to fall, being pushed by another onto furniture or a TV, or by collision or striking furniture). She also noted

the body regions that were impacted, the types of furniture involved, and the ages of the cases. Her Table 1 extensively depicted the elements of the data. She identified 8506 actual cases and estimated that there were 264,200 injuries and 300 deaths nationwide. There was a 41% increase in the episodes from 1990 to 2007. More males were affected, and 76% of the cases were 6 years of age or less. The peak age was 2 years. Ninety percent of the episodes occurred at home, and 2.8% were admitted to a hospital. The head and neck were impacted in younger children whereas the older children sustained torso or lower extremity injuries.

Similar findings were noted in Canada (4,7), Israel (6), and in Australia (11), and in the United States. Recently, TV-related deaths have been reported by forensic pathologists. Matshes et al. (13) reported three cases from Dallas, Lopez et al. (14) identified seven cases from Houston, and four TV cases were noted in Florida (15). These cases were distinguished from AHT, and their findings were similar to the other cases reported in the literature.

Bernard et al. (2) used data from NEISS, the National Pediatric Trauma Registry (NPTR), and Medical Examiner (MECAP). Di Scala et al. (1) used data from the NPTR.

### *Limitations of the Reviews*

In these studies, data were obtained from the National Electronic Injury Surveillance System (NEISS), National Pediatric Trauma Registry (NPTR), and Medical Examiner (MECAP) reports. The NPTR relied on information from 78 pediatric trauma centers from 28 states, whereas the NEISS obtained data from 91 hospitals which have 24 h emergency departments. The data were extracted and weighed in relation to national populations, a method which may skew the findings. There was a lag in reporting; our cases had not been entered in the NEISS data base when we searched for them. In addition, in these studies, there were inconsistencies in the definitions of "tip-over," "instability," and the use of "product code numbers" which described the furniture.

## Suggestions to Reduce These Injuries

Gottesman et al. (9), the Consumer Products Safety Commission (16), and Gardner (17) have offered suggestions that might reduce these injuries. These included alerting parents to these risks, ways of keeping TV stands stable, securing TVs to furniture, and paying attention to dresser drawers and objects on top of TVs.

## Conclusion

TV tip-over and other TV-related injuries and deaths are increasing worldwide as noted from a review of recent literature. Three fatal TV tip-over cases presented herein describe the circumstances, findings, and suggestions for distinguishing them from AHT. Some authors have offered suggestions so as to decrease the risks of these injuries. Forensic scientists should become familiar with these injuries and risks so as to effectively communicate with their communities.

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