

**PAPER****PATHOLOGY AND BIOLOGY**

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## Accidental Hanging Deaths in Children in Konya, Turkey Between 1998 and 2007\*

**ABSTRACT:** In general, hanging cases are the result of suicide, and accidental and homicidal hanging cases are rarely seen. This study retrospectively investigated 4571 death examinations and autopsies that were performed at The Konya Branch of the Forensic Medicine Council (Turkey) between 1998 and 2007; hanging was involved in 201 (6.5%) of the cases. There were a total of 13 accidental hanging cases, where 12 of these involved children. In seven of the cases, the accidental hanging involved a scarf that wraps around swing-like cradles and is intended to prevent infants from falling down. It was concluded that accidental hanging deaths can be reduced by replacing swing-like cradles with cribs that are designed for children, removing ropes in and around the house, and preventing children from reaching and/or playing with rope-like objects.

**KEYWORDS:** forensic science, hanging, asphyxia, children, death, accident

Children have an increased risk for injury or death from accidents for a variety of reasons compared to adults. Perhaps the greatest reason is their natural curiosity, which leads them to explore their environment and investigate situations where they often do not recognize potential hazards (1). Nevertheless, accidental hangings are still very uncommon in the pediatric population (2,3). Most reported cases of hanging occur in adults, and the majority are attributed to suicide (4). A number of articles have discussed the general features of hanging and several have included cases involving child victims (4–6). Unlike adult hangings, cases involving children are typically accidental and most frequently occur in the child's bedroom (3,4). The present study evaluated the circumstances of 12 accidental hanging cases that involved children.

### Materials and Methods

This study retrospectively investigated 4571 death examinations and autopsies that were performed at The Konya Branch of the Forensic Medicine Council (Turkey) between 1998 and 2007; hanging was the cause of 201 (4.4%) of the deaths. There were a total of 13 (6.5%) accidental hanging cases and 12 of these involved children. The present study evaluated those 12 cases with respect to their demographic characteristics, the location of the incident, the manner of the incidents that took place, and the findings of the scene investigation and autopsy.

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### Results

The ages of the cases ranged from 6 months to 11 years, with an average age of  $3.4 \pm 3.9$  years. There were ten boys and two girls. In seven cases, death resulted from entanglement with a ligature (scarf, handmade sash, braid rope) that was wrapped around a handmade swing-like cradle (e.g., hammock), which was intended to prevent the baby from falling down (Table 1, Fig. 1). As the infant leaned out of the cradle, the ligature wrapped around his/her neck and caused the asphyxiation. Three of the cases involved a rope in the yard of the home. Of the remaining two cases, one involved a rope hanging down from a construction wall and the other occurred when the child's neck was entangled in a tight electrical heater cable while he was crawling on the floor (Table 2). The scene investigations and autopsies determined that all 12 deaths had occurred as a result of hanging.

External examination during the autopsy revealed that ligature marks were clear in 11 cases, while the mark was only superficial in one case (Table 1, case 5). In the latter case, the hanging occurred when the victim leaned out of a swing-like cradle and a handmade sash tied around the cradle wrapped around his neck. Petechial hemorrhages on the facial and/or conjunctival tissue were evident in five cases. All of the cases showed petechial hemorrhages at the undersurface of the scalp, and under the pleura and epicardium. Congestion and edema in the brain and lungs as well as ecchymosis in the soft tissues under the ligature marks were also visible in all 12 cases. The hyoid bone and thyroid cartilage did not fracture in any of the cases. Detailed case information is outlined in Tables 1 and 2.

Victims had been removed from the ligatures during the rescue attempts for all but one of the cases (Table 2, case 1) and had therefore been moved from the original position before the scene investigation. However, representations of the victims' original positions were reenacted by the persons who had found the bodies (Fig. 3). One victim (Table 1, case 5) died in the hospital from

TABLE 1—Properties of the accidental hanging cases occurring in swing-like cradles\*.

Number	Age (Months)	Sex	Type of Ligature	Facial and/or Conjunctival Petechiae	Autopsy Findings <sup>†</sup>
1	6 m	M	Scarf	+	Ligature mark on the right neck region, petechiae at the base of the tongue, ecchymosis in the neck muscles
2	6 m	M	Scarf	–	Ligature mark on the anterior neck region, ecchymosis in both tonsils
3	7 m	M	Scarf (Figs. 2 and 3)	+	Ligature mark on the anterior neck region (Fig. 4), ecchymosis at the base of the tongue
4	12 m	F	Scarf	+	Ligature mark on the right neck region, ecchymosis at the base of the tongue and in the right tonsil
5 <sup>‡</sup>	12 m	M	Handmade sash	–	Superficial ligature mark on the left neck region, ecchymosis in the neck muscles
6	18 m	M	Scarf	+	Ligature mark on the anterior neck region, ecchymosis at the base of the tongue
7	24 m	M	Braid rope	–	Ligature mark on the anterior neck region, petechiae at the base of the tongue

\*As the victim leaned out of the cradle, the ligature that was tied around the swing-like cradle wrapped around the child's neck, resulting in asphyxia.

<sup>†</sup>Neither the hyoid bone nor the thyroid cartilage fractured in any of the cases. All of the cases showed petechial hemorrhages at the undersurface of the scalp as well as under the pleura and the epicardium, congestion and edema in the brain and in the lungs and ecchymosis in the soft tissues under the ligature mark.

<sup>‡</sup>The victim died of hypoxic brain syndrome 12 h after he was brought to the hospital. The remaining victims died at the scene of the accident.



FIG. 1—Handmade swing-like cradle and handmade sash.

hypoxic brain syndrome 12 h after the incident. The remaining 11 victims died at the scene of the accident.

## Discussion

Although varying in the details, many studies have identified that the most common causes of accidental death for children are motor vehicle accidents, drowning, and fires/burns (7,8). Accidental asphyxia can occur in childhood as a result of a variety of common and rare situations (9).

In a review of 201 hanging death cases, Bowen (4) reported that 5% were accidental. Three of those cases involved infants and in each case, their clothing had apparently become caught on part of a crib. Similarly, 13 of the 201 hanging deaths (6.5%) in this study were accidental, and 12 of the 13 (92.3%) occurred in children. Our findings demonstrate that accidental hanging cases (in this region) predominantly occur in children. There are two typical scenarios for hanging deaths in children, either accidental hanging in infancy (in a crib or pram) or accidental hanging at play (usually involving young boys) (3).

Over a 34-year study period, Byard (9) reported a total of 40 cases of accidental asphyxia that resulted from unsafe sleeping circumstances, including 20 wedging/positional asphyxias, 13 hangings, 4 suffocations, and 3 over-layings. Sturner et al. (10) reported 45 cases of accidental asphyxia deaths involving children, including 11 cases

of wedging. Another study identified broken cribs and pacifier cords as other causes (11). Accidental asphyxia can occur in younger children and infants, who may move into positions in which their airways become occluded, their bodies become wedged so that they are unable to breathe, or they become suspended from their clothing or restraining harnesses (1,12–14). Cooke et al. (3) noted three main causes of crib hangings: entanglement in restraining harnesses, suspension by clothing or pacifier cords, and entrapment against a crib's structural framework. The study identified seven cases of accidental asphyxia that resulted from entanglement in restraining harnesses designed to restrain infants within their cradles.

Many houses in Turkey (especially those situated in the villages and slums) are built with metal rings mounted in the ceilings, so that the occupants can set up swing-like cradles, which are hammock-like in nature. The cradles are constructed by tying two ropes between the two metal rings and connecting them with cloth. Infants are placed in these cradles on top of cushions, and ligatures (e.g., scarf, rope, or sash) are tied around the cradles to prevent them from falling out. However, the ligature can wrap around the neck and asphyxiate the infant if it leans out of the cradle. Seven of the accidental hanging cases in this study were caused by this simple cradle safety mechanism; detailed information about these cases is given in Table 1.

Cooke et al. (3) reported that a looped curtain cord was the cause of death of a 1-year-old girl who was found suspended by her neck near her bed. In another case, a 1-year-old boy was found suspended by his neck after becoming entangled in a loose electric heater cable while crawling (Table 2, case 1). A third case involved a 5 year-old girl found suspended by her neck in a rope-ring lock on the garden toilet's door (Table 2, case 2). Such cases highlight the potential accidental hanging risk posed by ropes found in or around the house that are either stretched or tied to a fixed point. Several more studies are available to reinforce this point. One study attributed the hanging deaths of three Western Australian boys to ropes attached to a garden shed, a verandah roof, and a tree (3). Polson et al. (15) described three cases of accidental hanging involving children at play; in one case, a 6-year-old boy was playing "cowboys" with a rope and the remaining two involved younger girls playing with swings. These authors also mention accidental hanging as a result of boys climbing trees or railings. Two child hanging deaths were reported by Perrot et al. (16), a 5-year-old boy found suspended from a light fixture in a backyard

TABLE 2—Properties of the accidental hanging cases that did not involve swing-like cradles.

Number	Age	Sex	Location of the Incident	Manner of the Incidents that Took Place	Findings of the Scene Investigation	Facial and/or Conjunctival Petechiae	Autopsy Findings*
1	1	M	House	Suspension by an electric heater cable while he was crawling	The victim was in a pulled back position by an electric heater cable stretched across the living room (Fig. 5)	+	Ligature mark on the anterior neck region (Fig. 6), petechiae at the base of the tongue
2	5	F	Toilet in the garden of the house	Suspension by a rope ring tied on the wooden toilet door while she was playing with it	Rope ring tied on the toilet door used for opening/closing it	–	Ligature mark on the anterior neck region, petechiae at the base of the tongue
3	7	M	Garden of the house	Suspension by a stretched clothesline while he was dropping down from a wooden door	Clothesline stretched over the upper region of a wooden door	–	Ligature mark on the left neck region, ecchymosis at the base of the tongue
4 <sup>†</sup>	10	M	Garden of the house	Suspension by a clothesline while he was dropping down from the roof of the house	Stairs propped up to the tree, ropes tied on the branches of the tree, clothesline tied to a wooden beam situated over the roof with 10 m height (Fig. 7)	–	Ligature mark on the anterior neck region (Fig. 8), ecchymosis at the base of the tongue and tonsils
5	11	M	Window of the house	Suspension by a clothesline while he was dropping down from the window of the house	Clothesline tied on an iron stick found above the window	–	Ligature mark on the anterior neck region, ecchymosis at the base of the tongue and in the neck muscles

\*Neither the hyoid bone nor the thyroid cartilage fractured in any of the cases. All of the cases showed petechial hemorrhages at the undersurface of the scalp as well as under the pleura and the epicardium, congestion and edema in the brain and in the lungs and ecchymosis in the soft tissues under the ligature mark.

<sup>†</sup>The victim told his mother 2 days prior to his death that he was able to drop down from the roof of the house, which had two floors. He was taking medication for attention deficit/hyperactivity disorder.



FIG. 2—The scene of the incident for case 3 (Table 1).



FIG. 3—Father demonstrating position of infant at the scene investigation (Table 1, case 3).



FIG. 4—Ligature mark and facial petechiae (Table 1, case 3).



FIG. 6—Ligature mark and facial petechiae (Table 2, case 1).



FIG. 5—The child's neck was entangled in a tight cable of the electric heater while he was crawling on the floor of the living room (Table 2, case 1).



FIG. 7—Clothesline tied to a wooden beam situated over the roof at a height of 10 m (Table 2, case 4).

shed and a 6-year-old girl who was suspended from the T bar of a clothesline. Another study reported the successful resuscitation of a 6-year-old boy after an accidental hanging, which was likely the result of imitative behavior; the boy had witnessed a “judicial” hanging scene in a television movie (17).

This study identified one case that involved a 7-year-old boy who was found suspended by a rope that was drooping down from a wooden door in his house's garden (Table 2, case 3). Two cases were identified in which boys were imitating climbers they had seen on television and were hung by a rope when they dropped down from the roof or the window of their houses (Table 2, cases

4 and 5). The 10-year-old boy was taking medication for attention deficit/hyperactivity disorder (Table 2, case 4).

Accidental and suicidal hanging deaths are predominantly caused by compression of the blood vessels supplying the brain, where these (the major veins and the carotid and vertebral arteries) can be compressed with relatively little force (18). Unconsciousness can occur very rapidly, causing the body to become limp and intensifying compression of the blood vessels. The presence of a ligature is not necessary to classify such a death as hanging, provided that constriction of the neck as a result of the victim's body weight can be demonstrated (5).

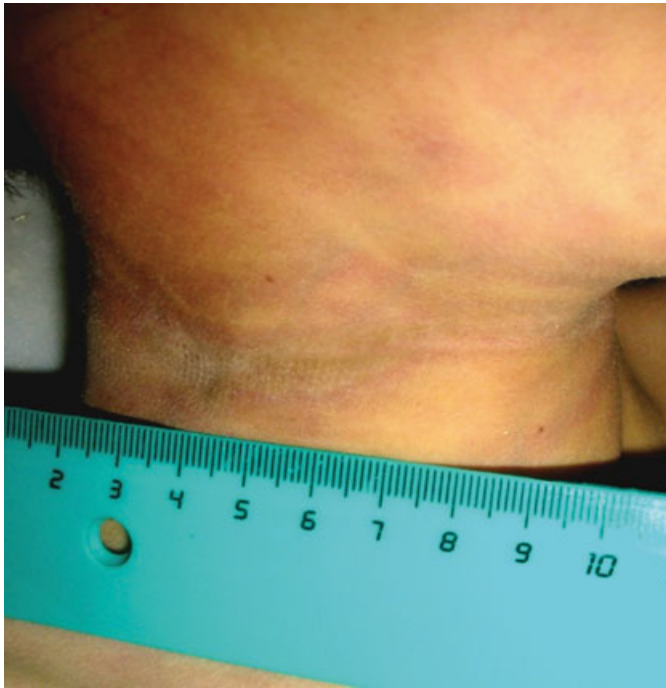


FIG. 8—Ligature mark (Table 2, case 4).

Hanging deaths are readily identifiable at autopsy by the ligature marks around the neck and occasionally by facial petechiae. Ligature marks were clear in 11 of the 12 autopsy cases in this study (Table 1, case 5). The ligature marks were superficial in the 12th case, which was caused by a sash tied around a cradle. Petechial hemorrhages on the face and/or conjunctivae were evident in five cases, but were present at the undersurface of the scalp, as well as under the pleura and the epicardium in all of the cases. Macroscopic and microscopic hemorrhages were seen in the soft tissues localized under the ligature marks. All cases also had congestion and edema of the brain and the lungs, but the hyoid bone and thyroid cartilage were not fractured in any of the cases, which was likely due to the elasticity of these structures in children.

Scene investigation is very important in accidental hanging cases, as the causal factors can be identified by examining the scenes of death. Beyond their importance in determining the cause of death, the causal factors may have direct implications for public health policy and legislation (9,19). However, when the victims in our study were found suspended, they were immediately removed from their ligatures and taken to local hospitals for resuscitation. As a result, all but one of the victims (Table 2, case 1) were not in their original positions during the scene investigation. In these situations, the circumstances of the case are generally explained by examining the hanging mechanism and having the persons who found the suspended victims recreate their original positions.

Although it is not possible to predict every dangerous circumstance, knowing a range of causes may enable us to make certain generalizations regarding child safety (20). Swing-like cradles are predominantly used by poor and/or uneducated families in Turkey. When asked by the Public Prosecutor if the victims' deaths were the result of parental negligence, the Forensic Medicine Expert often believed (in the cases of swing-like cradles) that the parents

were unaware, due to poor education, that the ligatures they used to keep their infants in their cradles could cause the infants' deaths. Educating families on the risks of rope-suspended cradles could prevent future accidental hanging cases.

In conclusion, the number of childhood accidental hanging deaths can be reduced by replacing swing-like cradles with beds that are designed for children, removing ropes in and around the house in which children might get entangled, and preventing children from reaching and/or playing with rope-like objects.

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