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Asphyxial Deaths Due to Hanging in Children

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ABSTRACT: A review of the records for five years from the Coroner's Offices of Marion County, Indiana and Franklin County, Ohio, which have a combined population of 2.4 million, yielded 12 cases of hanging deaths in children 13 years of age or younger. The age range was 2½ to 13 years and only two of the 12 victims were female. There were three unequivocal suicides, five accidental deaths and four cases where, despite extensive investigation, the manner of death remained undetermined. The scene and autopsy findings are presented and the cases discussed with regard to determination of manner of death. Additionally, the significance and pathophysiology of petechiae are discussed.

KEYWORDS: pathology and biology, asphyxia, hanging, manner of death, forensic pathology, autopsy, petechiae

Hanging as a means of suicide is well described in the adolescent and adult populations, but asphyxial deaths due to hanging in children are rare occurrences [1]. In addition, accidental and homicidal hangings in the pediatric population are generally perceived as very uncommon. This series discusses 12 hanging deaths in children 2 to 13 years of age; three separate groups, that is, accidental, suicidal and, equivocal, are described with regard to the circumstances of death.

Materials and Methods

The autopsy records for Marion County, Indiana and Franklin County, Ohio, each with a population of approximately 1.2 million, were searched for the period 1985 to 1990 and all hanging deaths in children 2 to 13 years of age were reviewed for inclusion in this study. The manner of death was classified as "accident," where there was no intent or expectation that a given situation or act would result in harm. In the suicide

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cases, both an expressed intent to end one's life as well as an act to carry out that intent were present. In those cases classified as "equivocal," insufficient information about the victim's history, the circumstances of death and the death scene was available to classify the death as either an accident or a suicide.

Case Reports

Accidental Hangings (See Table 1)

Case 1—This 2½-year-old white girl, who slept on the lower level of a twin bunk bed, liked to climb to the upper bunk and sleep with her 7-year-old brother. The parents placed the child in the lower bed at 10:00 p.m. and she was found by her brother at 6:30 a.m. the next morning hanging completely suspended with her head entrapped between a safety rail and the bed mattress on the upper bunk with her face pressed into the mattress. At autopsy, the child was a well-developed white female with a depressed horizontal compression mark (3 by ½ inch) on the face extending obliquely from the bridge of the nose, down to the right and under the eye. Fixed lividity was present on either side of the mark. A superficial abrasion with a woven pattern measuring 1½ by 1 inch was seen on the undersurface of the chin corresponding to the blanket found under the child's head. There was also a midline horizontal compression mark, 1 by ⅜ inch, on the back of the head. The internal structures of the neck and larynx were normal; there was no hemorrhage around the strap muscles. A few petechiae were scattered on the undersurface of the frontal scalp.

Case 2—This 2½-year-old white boy was riding a small battery powered four wheel motorcycle in the basement. He apparently tried to negotiate the vehicle under the edge of a ping-pong table and his neck became caught on the edge of the table. The victim did not attempt to put the vehicle in reverse or turn off the motor and his neck was held against the edge of the table by the forward momentum of the vehicle resulting in partial suspension. The autopsy revealed a well developed, well nourished male with a C-shaped superficial abrasion measuring ¾ by ¼ inch on the left side of the lower neck. Adjacent to this was a ¼ inch, square superficial purple contusion. Multiple fine petechiae were noted within the reflected scalp. In addition, there was generalized visceral congestion and edema, but no evidence of injury to the internal neck structures.

Case 3—This 5-year-old white girl was playing at her aunt's house while wearing an oversized blue jean jacket. While climbing on a monkey bar slide/swing set, her jacket became entangled in the monkey bar. She hanged on the bar totally suspended by her neck through a tear in her jacket for a period of 5 to 10 minutes until she was rescued by two children who were passing by on their way home from school. The autopsy showed a complex, ⅛ inch wide ligature furrow of the neck extending anteriorly 4 inches from the right mandibular angle. The middle one-half of the ligature furrow had a complex woven pattern corresponding to the torn fibers of the blue jean jacket. Petechiae were noted internally within the posterior scalp; there were also multiple fine, pinpoint petechiae externally in the inferior periorbital regions bilaterally. Multiple blue petechiae measuring up to 3 mm were in a butterflylike distribution between the shoulders posteriorly. Internal examination revealed no injuries to the neck organs.

Case 4—This 8-year-old white boy was playing in the attached garage of his grandparents' house. The grandfather went to check on the child and found him outside the garage hanging partially suspended from a window of a newly installed "minibarn." The bottom of the window was approximately 4 feet off the ground. The child had tried to gain entrance to the locked minibarn through the window and the window slid down

TABLE 1—*Accidental hanging deaths.*

Case #	Age	Sex	Circumstances	Location of petechiae	Degree of suspension ^a
1	2½ years	F	Caught neck in bunk bed rail	Subgaleal	Complete
2	2½ years	M	Caught neck on edge of table while riding toy indoors	Subgaleal	Partial
3	5 years	F	Caught jacket on monkey bar	Subgaleal, periorbital, between shoulder blades	Complete
4	8 years	M	Neck caught in window	*	Partial
5	9 years	M	Caught neck in swing rope	Subgaleal and neck above ligature furrow	Complete

*Family strongly objected to autopsy—external examination only.

^aComplete suspension: body free swinging.

Partial suspension: feet or other body part touching surface.

trapping his neck against the window sill. There were multiple marks on the side of the minibarn where the child had kicked the wall while struggling. Injuries included a 2½ inch linear abrasion in the right occipital area of the scalp. There was also a 3 by ½ inch patterned abrasion on the under surface of the chin (Fig. 1).

Case 5—This 9-year-old boy was found by his mother hanging with his feet approximately 12 inches above the ground with a swing rope twisted around his neck in the back yard. The boy had stated approximately 5 minutes earlier that he was going outside to play “cowboy.” The child was resuscitated, but was pronounced brain dead later that day. The autopsy showed a well developed, well nourished child with a ligature furrow on the anterior surface of the neck. There were no laryngeal or vertebral injuries. Petechiae were noted in the scalp, and neck superior to the ligature mark.

Suicidal Hangings (See Table 2)

Case 6—This 8-year-old black boy and his 7-year-old brother came home from school for lunch to discover that their parents were out of the state for the day. The victim told his 7-year-old brother that unless he skipped school with him, he would hang himself. The younger brother stated that he was returning to school for the afternoon. At that point, the decedent went into the parents’ bedroom where he hanged himself by a scarf attached to a clothes rod in the closet. There was a simple slip knot on the right side. The younger boy saw his brother hanging and gasping with his toes touching the floor, but returned to school. When the brother returned home at 3:10 p.m., he saw his brother still hanging in the closet. He then watched television before calling authorities who arrived at 4:10 p.m. The 7-year-old boy believed that the paramedics would be able to revive his brother.

The autopsy showed a well developed, well nourished child with a ligature furrow extending diagonally from the posterior border of the right ear, downward to the anterior portion of the neck. There were prominent areas of abrasion, ½ inch in width, on either side of the mark. Internal examination of the neck strap muscles and laryngeal organs revealed no injuries. There were bilateral conjunctival petechiae.

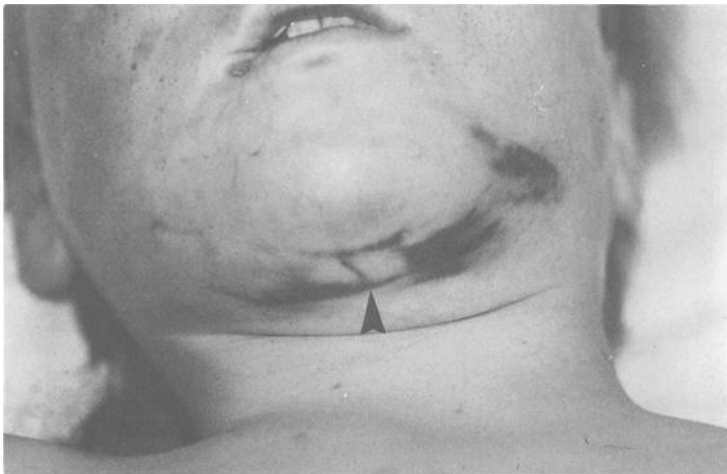


FIG. 1—*Case 4. The complex abrasion resulting from the entrapment of this 8-year-old boy's neck in a window is evident. Note the area that corresponds to the window latch (arrow).*

TABLE 2—*Suicidal hangings.*

Case #	Age	Sex	Race	Circumstances	Location of petechiae	Degree of suspension ^a
6	8 years	M	B	Made threat; hanged self in closet	Conjunctival	Partial
7	10 years	M	W	Confrontation with parents; hanged self from bunk bed	None	Complete
8	13 years	M	W	Mentioned suicide; hanged self in closet	Face and neck	Partial

^aComplete suspension: body free swinging.

Partial suspension: feet or other body part touching surface.

Case 7—This 10-year-old white male with a history of behavioral problems lived with his mother and stepfather. The deceased stated numerous times that he wanted to be “bad” like his biological father who was incarcerated. The victim was apparently punished at school for attempting to fondle female students and became very combative when confronted by his parents. He was ordered to his room and was found 10 minutes later totally suspended hanging by a belt from his upper bunk bed. Further details concerning the nature of the suspension are unavailable since the hanging occurred in another jurisdiction 75 miles away and the child was not pronounced “brain dead” until five days after the event. The autopsy showed a 4 inch area of interrupted, granulating abrasion in the right submandibular area. Examination of the larynx and neck musculature revealed no injury. There were no petechial hemorrhages.

Case 8—This 13-year-old white boy was found by his father hanging by a belt ligature from a “chin-up” bar in his bedroom closet with his feet touching the floor. Details of the ligature arrangement were not recorded by the scene investigator. The deceased had repeatedly mentioned suicidal ideations to a friend and had been noticeably depressed for about 3 months. The autopsy revealed two abrasions under the chin on the right and left side of the anterior neck. Petechiae were present on the cheeks, eyelids and nape of the neck. There was no hemorrhage in the neck. No fractures of the larynx, hyoid or cervical spine were observed.

Equivocal Hangings (See Table 3)

Case 9—This 6-year-old white boy had been playing with a bicycle chain and lock before being sent to clean his room at 5:50 p.m. The fully clothed victim was found by his sister at 6:05 p.m., totally suspended from the upper post of a bunk bed with a bicycle chain wrapped around his neck. The 37 inch chain was wrapped around the bedpost at 51 inches above the floor. The lock was fastened to the end of the chain, which was wrapped on the bedpost. The chain completely encircled the neck once. There was no mention of suicide by the victim or signs of depression noted by the family. The autopsy showed a patterned abrasion of the ligature around the anterior neck. The anterior neck on the left side also demonstrated a small amount of contusion hemorrhage in the lateral left strap muscles. There was no fracture of the larynx. Petechiae were present on the undersurface of the frontal scalp and on the visceral pleura.

Case 10—A 10-year-old fully clothed black boy was found by his 11-year-old sister hanging suspended with his feet several inches above the floor by a cloth belt that was wrapped around his neck and attached to the horizontal side rail of the top bunk bed in his bedroom. The father denied that his son had discussed suicide or that he had appeared depressed. The autopsy showed a well developed black male with a faint abrasion band, $\frac{5}{8}$ inch in width, located above the thyroid notch and extending superiorly toward the posterior neck. There were focal areas of contusion of the strap muscles bilaterally in the neck, but no injuries of the larynx or trachea. A few petechial hemorrhages were seen at the base of the tongue. Gastric contents with particulate food matter occluded the mainstem bronchi and extended deep into the distal bronchi. A trace amount of ethanol was detected in the victim’s blood.

Case 11—An 11-year-old white boy was playing by himself in a barn adjacent to the house; the boy was later found sitting on the barn floor with a rope wrapped around his neck and secured to an overhead beam. The rope was removed by the hysterical mother and further details of the suspension were not recorded. There had been no previous mention of suicide by the victim who was fully clothed. At autopsy, there was a 6 by $\frac{1}{2}$ inch contusion that extended from the undersurface of the right midmandible, under the

TABLE 3—*Equivoval hangings.*

Case #	Age	Circumstances	Location of petechiae	Degree of suspension ^a
9	6 years	Sent to clean room; found hanging by chain & lock	Subgaleal, subpleural	Complete
10	10 years	Hanged by belt on upper bunk	Tongue	Complete
11	11 years	Sitting in barn with rope around neck	Sclerae epiglottis	Partial
12	12 years	Sat down with rope around door knob and tied to doorstop	Conjunctival	Partial

^aComplete suspension: body free swinging.

Partial suspension: feet or other body part touching surface.

chin, to the left mandible below the inferior attachment of the left ear. The ligature furrow was abraded on the right side. There were numerous petechiae of the sclerae and epiglottis. There was also hemorrhage into the strap muscles and the perithyroid connective tissue. No fractures of the larynx or trachea were present.

Case 12—This 12-year-old white boy was fully clothed when he was found by his mother with a rope wrapped around his neck looped over the doorknob on the inside of his bedroom door and tied to the doorstop on the inside of the door. The mother had to force the door open because the victim's body, which was in a sitting position, was blocking the entrance. There had been no recognized suicidal ideation or depression. The autopsy showed injuries including a 9 by ¼ inch abraded ligature furrow that extended from left to right on the anterior neck. There was petechial hemorrhage on the bulbar conjunctiva of the lower lids. No injuries were seen in the deep neck muscles or larynx.

Discussion

Hanging deaths in children are reported as rare occurrences [1] and our study of a population of 2.4 million over a five year period identified only 12 deaths as a result of hanging in the 2 to 13 age group. There were no homicidal hangings and no deaths resulting from autoerotic sexual asphyxia. Six of the eight accidental deaths involved victims 5 years of age or younger which is similar to the experience of Cooke et al. from Western Australia [2]. There were three cases of suicidal hangings which involved 8, 10, and 13 year old boys using various types of ligatures in their own homes and in a bedroom. The manner of death in the final four cases of our series remained undetermined following autopsy and thorough investigation of the circumstances of deaths and the past history of the victim. In each of these four cases, the victim was a fully clothed male, age of 6 to 12 years, with no indication that the death scene had been altered by the family to disguise an autoerotic death, suicide or homicide. In contrast to cases 4 and 5, there was no evidence suggesting that death resulted from an accident during play activities.

Petechial hemorrhages are considered to be a hallmark of asphyxial death [1,3] and are frequently seen above the ligature furrow in hangings. The proposed mechanism of the formation of petechiae is the blockage of venous outflow by pressure on the neck while there is continued arterial perfusion of the head by the carotid and vertebral arteries. The resultant local hypertension is thought to result in the rupture of capillaries, which is then visualized as petechiae [3]. Conjunctival and facial petechiae are more common in hangings where the victim was not suspended, but this correlation is far from absolute [3,4]. For example, we saw petechiae of the scalp and periorbital areas in one 5-year-old victim (Case 3) who was completely suspended for 5 to 10 min. Overall, however, petechiae are generally reported less commonly in children than adults with no explanation [2]. Recently, petechiae have been reported in victims of non-asphyxial death who were subjected to prolonged cardiopulmonary resuscitation (CPR). It is speculated that local tissue acidosis damages capillaries resulting in increased permeability and the formation of petechiae with prolonged perfusion during CPR [5]. Additionally, petechiae are a well recognized part of the anatomic findings in cases of disseminated sepsis such as Waterhouse-Friderichsen Syndrome where bacterial toxins cause damage to capillary walls.

At least one standard textbook of forensic pathology states that internal scalp petechiae are a traumatic artifact of scalp opening and retraction and not a sign of asphyxia [6]. We would disagree with this statement in that we do not see internal scalp petechiae in all autopsies and almost never observe them in hospital autopsy cases. Certainly some scalp petechiae can be produced by the autopsy procedure, but this is not a consistent finding in all autopsies. It is our observation that such petechiae are much more common

in asphyxial deaths than in other types of cases. It may well be that the tissue acidosis of asphyxia damages the scalp capillaries in such a fashion that they are more easily damaged by the trauma of scalp reflection than in cases where tissue acidosis did not precede death. This finding certainly warrants future study.

Hanging deaths in our series are predominantly a male phenomenon with only two of the twelve cases involving female victims. From these twelve cases as well as previous reports [1,2], we conclude that hanging deaths in the age range of 6 years or less are nearly always accidental in nature. Equivocal cases as well as clear-cut suicidal deaths which all involved male victims began to occur at age six in our series. A recurrent problem with some of these cases is the lack of data concerning the ligature, knot and details of suspension. This is in large part attributable to hysterical parents, relatives, or friends attempting to resuscitate a child. Such efforts are seen much less commonly with adult hanging victims. Our series does not include any homicides or autoerotic hangings. Homicidal hangings at any age are either extremely rare or rarely reported in the literature [7-9].

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