Serial Abuse in Children Who Are Shaken

Randell Alexander, MD, PhD; Linda Crabbe, MD; Yutaka Sato, MD;
Wilbur Smith, MD; Thomas Bennett, MD

• **Serious injury can occur to children who are shaken, especially if the shaking is repeated or part of a pattern of abuse. Serial abuse in connection with children who are shaken and their siblings has important therapeutic and legal ramifications. From an ongoing study of child abuse and head trauma, 12 of 24 victims of shaking that resulted in intracranial injury were identified who had coexisting evidence of direct external trauma. Seventeen children (71%) had evidence of prior abuse, neglect, or both, including 8 who had multiple intracranial hemorrhages. Of the 21 families represented, 9 had more than one child, 3 (3%) of which had several siblings who had been victims of child abuse. Shaking of children usually is not an isolated event, as it frequently has been preceded by other types of abuse.**

(*AJDC*. 1990;144:58-60)

The signs associated with an episode of repetitive and violent shaking (retinal hemorrhages or intracranial hemorrhages) were described in 1946.[1] In 1971, Guthkelch[2] first implied that such injuries resulted from "whiplash" forces.[2] Shortly thereafter, Caffey[3,4] (in 1972 and 1974) further described repeated shaking as a cause of retinal hemorrhages and intracranial injuries without visible signs of external trauma. The shaken baby syndrome (SBS) usually implies the application of repeated forces over one or more episodes.[5] Such repetitive insult suggests that the perpetrator has less self-control or more rage, with the possibility of prior abuse for the index child or siblings.

Accepted for publication July 24, 1989.

From the Departments of Pediatrics (Dr Alexander) and Radiology (Drs Sato and Smith), The University of Iowa Hospitals and Clinics, Iowa City, and the Department of Pediatrics, University of Cincinnati (Ohio) (Dr Crabbe). Dr Bennett is the Iowa State Medical Examiner, Des Moines.

Presented in part at the 18th Annual Child Abuse and Neglect Symposium, Keystone, Colo, May 24, 1989.

Reprint requests to 209 University Hospital School, Iowa City, IA 52242 (Dr Alexander).

The recidivism rate for all child abuse in Iowa is approximately 33%, which corresponds to the national frequency of recidivism.[6] The prospect of further injury to a shaken child and to other siblings has serious medical and legal ramifications. Old and new intracranial injuries,[7,8] optic nerve sheath injuries,[9] and sibling deaths[10] have been described. To the best of our knowledge, no systematic documentation of serial abuse in shaken children and their siblings has been undertaken. Our study was intended to examine the rate of recidivism for shaking and to determine if prior abuse occurred with extracranial injuries and for siblings.

SUBJECTS AND METHODS

All children seen between July 1, 1984, and December 31, 1988, at The University of Iowa Hospitals and Clinics, Iowa City, with a diagnosis of SBS (confirmed by a multidisciplinary team of child abuse professionals) have been included in an ongoing study of head trauma and child abuse. Additionally, all children with SBS were included from among those examined in the Iowa Medical Examiner's Office, Des Moines, during the same period. We determined whether other siblings were abused and examined their medical records and imaging studies for evidence that they had been shaken. Information about abused siblings was obtained by intensive child protective service and prosecutor investigations in each instance. At least one of us (R.A., W.S., or T.B.) participated in the medical and legal aspects of each case. Evaluation consisted of the following: physical examination; skull roentgenograms; a skeletal survey; computed tomography (CT), magnetic resonance imaging (MRI), or both; and an autopsy (when applicable). The CT, MRI, and autopsy findings were specifically examined for evidence of intracranial hemorrhage of differing ages. The participation of personnel from Iowa Child Protective Services provided access to previous reports of child abuse, the results of current investigations, old medical records, and the status of other children in the family.

The ages of the intracranial injuries were dated by evaluation using CT or MRI. Signal intensities of CT and T_2-weighted MRI images were compared with known patterns of hemoglobin breakdown.[11,12] Autopsy findings, as provided by a forensic pathologist, supplemented the data. Estimates of the dates for bruises were made by their color[13] and for fractures by their degree of callus formation.[14]

RESULTS

As displayed in Table 1, 12 of the 24 patients sustained external head trauma in addition to being shaken. Although the SBS has been defined by the absence of visible external trauma,[3,4] we applied stricter criteria to distinguish instances of shaking only. These criteria included absence of evidence of direct external trauma as determined by the following: physical examination; roentgenograms; CT, MRI, or both; and autopsy findings. Seventy-one percent (17) of all patients (58% of those shaken alone) had evidence of prior abuse, neglect, or both. Previous traumatic injuries (ie, intracranial hemorrhages of different ages or prior extracranial abuse) were more common than neglect; no instances of sexual abuse were found. Shaking was a multiple occurrence for 25% of those without signs of direct cranial impact injuries (33% of all cases). No significant differences in frequency or types of prior abuse or neglect were found between the group that had only been shaken and those who were shaken and suffered injuries of cranial impact.

Most patients (57%) came from families in which no other siblings were present (Table 2). In one instance, an earlier sibling had been given up for adoption at birth; the other patients were firstborns and only children. For families with two or more children, no evidence of prior abuse or neglect was found if the index patient had a combination of shaking and impact injuries. Of the families

Downloaded from jamanetwork.com by University College London user on 03/17/2025

Table 1.—Abuse or Neglect in the Same Child

Characteristics	Shaking and Direct Blow(s)	Shaking Only
No. of patients	12	12
Patients with evidence of the following:		
Prior abuse, neglect, or both*	10	7
Intracranial hemorrhages of different ages	5	3
Prior extracranial abuse	4 definite and 1 possible	3
Neglect or failure to thrive	2	2

*Some patients had more than one type of prior abuse or neglect.

Table 2.—Abuse or Neglect Within the Family

Characteristics	Shaking and Direct Blow(s)	Shaking Only
No. of families	12	9*
Families with other siblings	4	5
Siblings with SBS	0	3
Siblings with other abuse or neglect	0	1

*Two families each had three siblings: there were three children with shaken baby syndrome (SBS) in one family, and two of three had SBS in the other family.

with more than one child in which one child had received shaking injuries alone, three (60%) of five also had another abused or neglected child. In two of these families, siblings also suffered shaking injuries without detectable external head trauma. In the other family, a child abuse report was substantiated for neglect of a sibling 6 years before the death of the patient.

COMMENT

Shaking was associated frequently with other instances of abuse. For 50% (12) of the children, shaking was directly accompanied by some form of external cranial trauma. The types of injuries were similar to those seen by Sinal and Ball[10] (1987), who found 17 patients with SBS among 24 children with head trauma caused by abuse, although they did not use MRI as a diagnostic aid (one of our patients was classified as having had direct trauma based on MRI findings alone).[8] Prior abuse or neglect of the patient was common (71%). Among all patients, 33% had been previously shaken, corresponding to the 33% recidivism rate reported for child abuse in general (but less than the 71% rate of prior abuse or neglect found in the patients). Usually, the patient was the only child in the family. The risk of abuse to any subsequent siblings may be approximated by the finding that in 33% of families with more than one child, two or more siblings experienced abuse or neglect. Because all previous medical records were not routinely reviewed on the siblings in each case and not all abuse is reported, the percentage of abused siblings might be an underestimate. In two families, more than one child was shaken sufficiently to cause the death of one sibling and injury in the other(s).

The risk of subsequent abuse is likely an underestimate. We evaluated only those patients presenting with sufficient symptoms for medical recognition. Subacute shaking that caused concussion or more subtle long-term effects in these children or their siblings may have gone undetected.[4] An increase in the use of MRI has helped detect old and new intracranial injuries and has aided in the recognition of subtle instances of repetitive shaking.[8,15] Children who died of an acute assault may have suffered future additional abusive intracranial injury had they survived. Social service and legal intervention in some cases may have attenuated the risk to other siblings, thereby blunting a possible repetition of abusive shaking behavior. Although the risk of subsequent abuse under the same circumstances is an important assessment, failure to intervene is not ethically acceptable.

The importance of establishing repetitive abuse has indirect and direct legal implications. Indirectly, the risk of further abuse to the patient or to other siblings must be weighed along with the seriousness of such injuries when deciding placement issues and prognosis for reunification of the family. Shaking children rather than hitting them may be misperceived by parents as less "abusive,"[2] despite data that indicate that shaking alone in comparison with shaking and direct cranial trauma has an equal fatality rate (R.A., Y.S., W.S., and T.B., unpublished data, 1989) and that shaking often results in significant morbidity.[16] The fact that shaken children, and possibly their siblings, often have been previously abused should correct the notion that shaking is an isolated and somewhat "unintentional" event. Such misperception by judges or juries may be partly responsible for the ultimate verdict of involuntary manslaughter. From the perspective of the protection of the child or the criminal prosecution of the abuser, it is not as important to distinguish the precise mechanism of injury as it is to determine whether the event was accidental or nonaccidental. Pediatricians should not be deterred from testifying just because the cause of the nonaccidental injury is not entirely clear.

More direct legal implications were illustrated by two children who died of SBS, for whom findings of repetitive abuse resulted in first-degree murder convictions. The first, a 7½-month-old male infant, had bilateral retinal hemorrhages and subdural hematomas diagnosed on CT, MRI, and at autopsy. Two 8-week-old twin half-brothers in another state had been previously shaken, resulting in subarachnoid hemorrhages (one child had old and new hemorrhages on CT). The biologic father of all three children was convicted of first-degree murder based on prior knowledge, ie, he knew the effects of shaking after previously abusing his two other children.

The second child, a 6-week-old female infant, had fractures of three ribs and an ankle in three different stages of healing, bilateral retinal hemorrhages, massive bilateral subdural hematomas, and intraparenchymal brain shearing damage at gray-and-white matter inter-

Downloaded from jamanetwork.com by University College London user on 03/17/2025

faces. The pattern of repetitive physical abuse and the acute assault, warranted charges of felony child endangerment. In the course of committing this abuse, the father fatally shook his child. Although no suggestion was made that this action was premeditated, killing in the course of a felony (felony murder) is first-degree murder in Iowa. Thus, in one instance, serial abuse of the siblings resulted in the maximum conviction, while in the second case it was based on serial abuse of the same child.

Shaking a child represents an imminent risk for acute injury. Frequently it is not an isolated event and poses substantial risks for further abuse of the child and his or her siblings. Based on a high index of suspicion for possible child abuse, a diagnosis of shaking should lead to intensive efforts to identify concurrent and previous abuse of the patient (eg, skeletal survey, CT, and MRI) and of the siblings. Recognition of serial abuse is essential in directing appropriate therapeutic interventions to reduce the risk to children and in addressing appropriate criminal sanctions.

James Metcalf, JD, Jerry Partridge, JD, and Barbara Edmondson, JD, contributed to the case studies and legal interpretations of the importance of repetitive shaking. Kelly Lindsey, MD, provided technical assistance, and Rebecca Fitch helped prepare the manuscript.

References

1. Caffey J. Multiple fractures in the long bones of infants suffering from chronic subdural hematoma. *AJR*. 1946;56:163-173.

2. Guthkelch AN. Infantile subdural hematoma and its relationship to whiplash injury. *Br Med J*. 1971;2:430-431.

3. Caffey J. On the theory and practice of shaking infants: its potential residual effects of permanent brain damage and mental retardation. *AJDC*. 1972;124:161-169.

4. Caffey J. The whiplash shaken infant syndrome: manual shaking by the extremities with whiplash-induced intracranial and intraocular bleedings, linked with residual permanent brain damage and mental retardation. *Pediatrics*. 1974;54:396-403.

5. Ellerstein NS. *Child Abuse and Neglect: A Medical Reference*. New York, NY: John Wiley & Sons Inc; 1981.

6. Cohn AH. The pediatrician's role in the treatment of child abuse: implications from a national evaluation study. *Pediatrics*. 1980;65:358-360.

7. Zimmerman RA, Bilaniuk LT, Bruce D, Schut L, Uzzell B, Goldberg HI. Computed tomography of craniocerebral injury in the abused child. *Neuroradiology*. 1979;130:687-690.

8. Sato Y, Yuh WTC, Smith WL, Alexander RC, Kao SCS, Ellerbroek C. MRI evaluation of head injury in child abuse. *Radiology*. December 1989;173:653-657.

9. Lambert SR, Johnson TE, Hoyt CS. Optic nerve sheath and retinal hemorrhages associated with the shaken baby syndrome. *Arch Ophthalmol*. 1986;104:1509-1512.

10. Sinal SH, Ball MR. Head trauma due to child abuse: serial computerized tomography in diagnosis and management. *South Med J*. 1987;80:1505-1512.

11. Forbes GS, Sheedy PS II, Piepgras DG, Houser OW. Computed tomography in the evaluation of subdural hematomas. *Radiology*. 1978; 126:143-148.

12. Zimmerman RD, Heier LA, Snow RB, Liu DPC, Kelly AB, Deck MDF. Acute intracranial hemorrhage. *AJR*. 1988;150:651-661.

13. Wilson EF. Estimation of the age of cutaneous contusions in child abuse. *Pediatrics*. 1977; 60:751-752.

14. Silverman FN. Radiology and other imaging procedures. In: Helfer RE, Kempe RS, eds. *The Battered Child*. 4th ed. Chicago, Ill: The University of Chicago Press; 1987:214-246.

15. Alexander RC, Schor DP, Smith WL. Magnetic resonance imaging of intracranial injuries from child abuse. *J Pediatr*. 1986;109:975-979.

16. Ludwig S, Warman M. Shaken baby syndrome: a review of 20 cases. *Ann Emerg Med*. 1984;13:104-107.

Correction

Incorrect Data.—In the article "Risk Factors for Infant Botulism in the United States," published in the July 1989 issue of *AJDC* (1989;143:828-832), an error appeared because of incorrect information supplied by the author. On page 831, the first complete sentence of the middle column should begin, "The 32 (47%) infants who had at least one BM every 3 days . . ."

Downloaded from jamanetwork.com by University College London user on 03/17/2025