

# Inflicted Childhood Neurotrauma

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In this article, we review literature related to inflicted childhood neurotrauma (ICN). We discuss the rationale for use of the term “ICN,” rather than the more benign, commonly used “shaken baby syndrome.” The change in language alters the discourse about a potentially lethal outcome or lifelong problem for survivors. A description of ICN is followed by a discussion of ethical parameters and obligations of those who care for infants and children and professionals who are sentinels to these events such as law enforcement officials, nurses, physicians, and social workers. **Key words:** *child abuse, child rights, inflicted childhood neurotrauma, shaken baby syndrome*

**T**HE Convention on the Rights of the Child was adopted by the UN General Assembly in 1989 and was ratified by all nations except for the United States and Somalia.<sup>1</sup> Annually, 3750 infants are treated for symptoms of inflicted neurotrauma in the United States, an alarming rate at which the rights of infants in the United States are violated.<sup>2</sup> About one third of these infants will die and another third will suffer long-term sequelae.<sup>2</sup> The inconceivability that a parent or a caregiver could inflict a life-threatening injury on a child in his or her charge probably underlies use of the words “shaken baby syndrome.” This terminology “normalizes” a violent act.

In this article, we review literature related to inflicted childhood neurotrauma (ICN). We discuss the rationale for use of the term “ICN,” rather than the more benign, commonly used term “shaken baby syndrome.” The change in language alters the discourse about a potentially lethal outcome or lifelong problem for survivors. A description of ICN is followed by a discussion of ethical parameters and obliga-

tions of those who care for infants and children and professionals who are sentinels to these events such as law enforcement officials, nurses, physicians, and social workers.

## INCIDENCE, CIRCUMSTANCES, AND COSTS

In 2005, more than 899 000 children were abused or neglected.<sup>3</sup> Child abuse directly costs the United States an estimated \$24 billion annually for hospitalizations, chronic health problems, and child welfare. It indirectly costs an estimated \$94 billion annually in special education and loss of productivity.<sup>4</sup>

The most common perpetrators of ICN in descending order of frequency are the biological father, mother's boyfriend, mother, and childcare providers.<sup>5</sup> When perpetrators live in the home, alternative living arrangements for the child are difficult to secure within the child welfare system. An estimated 517 000 children are in foster care in the United States because of abuse or neglect.<sup>6</sup>

Although children at any age can be abused, infants are at the greatest risk. Of child abuse fatalities, 43.6% occurred in children younger than 1 and 78.7% in children younger than 3.<sup>7</sup> Based on data from 34 states, rates for infant fatalities (younger than 1 year) due to maltreatment are 17.7 for boys and 14.1 for girls per 100 000 population.<sup>7</sup>

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These rates are more than double the rates for older children. The most common injurious abuse for children younger than 1 year is ICN.<sup>5</sup>

## RISK FACTORS

Risk factors for ICN have been examined via retrospective health records, identification of infant risk characteristics, and parent attributes. Interventions have been offered to prevent the infliction of injuries.

Overpeck et al<sup>8</sup> examined more than 34 million infant birth and death certificates, for all births in the United States between 1983 and 1991, for risk factors for infant homicide. Maternal factors positively correlated with child abuse were mothers younger than 19 years, educational level less than 12 years, single marital status, African American or Native American ethnicity, no or limited prenatal care, and newborns of less than 28 weeks' gestational age. The researchers in this study acknowledged that educational level might be confounded by age.<sup>8</sup> Ethnicity may be confounded by economics. Information about perpetrators was excluded because this information is not consistently available on death certificates; death certificates would have to be linked to medical records, police reports, court documents, or other sources. While this illuminates risk of infant deaths, risks for nonfatal injuries should also be considered.

Rimsza et al<sup>5</sup> reviewed the death records of all children younger than 18 years from 1995 to 1999 in Arizona in an attempt to determine the cause of death, whether any of the deaths were mislabeled as natural despite evidence of abuse or whether any deaths were preventable. Abuse-related deaths in children younger than 1 year were most frequently attributed to shaken infant syndrome. Rimsza et al concluded that 61% of these deaths were preventable. Child protective services, either in Arizona or in another state, had previously been involved with the families in several cases. Medical records of several infants indicated abuse that was either unacknowledged

or unreported by medical personnel. In addition, other family members had not acted to stop the abuse.<sup>5</sup>

Infant characteristics viewed as less than perfect or incongruent with the parents' expectations of what the child should be like have been proposed as risk factors for abuse. Infants who cry frequently and are difficult to console may evoke feelings of inadequacy in parents predisposing infants to abuse.<sup>9</sup> Infants who are born prematurely, are of low birth weight, or have physical, cognitive, or sensory problems are at increased risk for abuse.<sup>8,10</sup>

## PARENTAL ATTRIBUTES AND PREVENTION EFFORTS

Bugental and Happaney<sup>10</sup> examined attributes of parents prior to the birth of their children as predictors of abuse, with a sample of 73 families recruited on the basis of risks assessed using Kempke's Family Stress Checklist. Families were randomized to 3 groups: home visitation with problem-solving training, home visitation focusing on education and social support, and usual care (control). In Bugental and Happaney's,<sup>10</sup> study, the Parent Attribution Test measured parental attributes, the Conflicts Tactic Scale identified harsh parenting, the Framingham Safety Scale and the Accidental Injury Interview measured safety neglect, and the Beck Depression Inventory assessed maternal depression. Mothers with low perceived power were more likely to both use corporal punishment and maintain low levels of safety in the home, resulting in more child injuries.<sup>10</sup> Families that received home visitation less frequently used punishments such as spanking, shoving, or throwing objects at the child. Children from families that received home visitation had fewer falls, burns, and bruises. Participants were economically and educationally disadvantaged; the majority of parents were recent immigrants to the United States.<sup>10</sup>

Dias et al<sup>11</sup> have attempted to decrease the incidence of ICN using a hospital-based

intervention via a short videotape and a pamphlet on shaken baby syndrome. More than 65 000 parents of newborns from 8 counties received education. The incidence of head trauma in the 6 years preceding the educational intervention was compared with the incidence following the implementation. Dias et al noted a 53% reduction in traumatic head injuries during the period of the intervention. In comparison, the incidence of injuries in a neighboring state during the same time frame did not decrease.<sup>11</sup>

## ICN AS A MEDICAL PROBLEM

### Historical context

Medical literature reveals a constellation of signs and symptoms associated with ICN. Although not a new phenomenon, documentation of child neurological injuries has emerged only in the last 30 to 40 years. A review of the historical context of pediatric care highlights reasons for delays in identifying child abuse as a problem.

In late 19th-century America, infant mortality was high due to infectious disease and nutritional problems. Corporal punishment was the norm and young infants were rarely treated by physicians or admitted to hospitals. These children already had low survival rates and the medical community had few interventions to offer.<sup>12</sup> The field of pediatrics did not formally emerge until the 1880s. By the early 20th century, preventive care for infants began. Radiography aided in the diagnosis of recent and healing fractures. As pediatrics developed, physicians became experts on childhood diseases and child rearing; Dr Benjamin Spock became the definitive authority on childcare. In time, physicians addressed safety and abuse issues.<sup>12</sup>

Prior to the early 1960s, screening for child abuse was not in the domain of healthcare. Abuse was viewed as a family problem to be dealt with by police or by social services. Mandatory reporting laws of the late 1960s gave physicians a legal role regarding child abuse.<sup>12</sup> Inflicted injuries were reframed as medical problems and terminology shifted from "abuse" to a "syndrome."<sup>12</sup>

At the federal level in the United States, the Child Abuse Prevention and Treatment Act was enacted in 1976 and, subsequently, has been revised multiple times. To qualify for federal funding under this act, each state has laws requiring mandatory reporting of child abuse. Although variations exist from state to state, all states require professionals including teachers, nurses, and physicians to report abuse. In addition, some states have broadened their laws to require any person with knowledge of abuse to report it to authorities.<sup>13</sup>

### Patterns of injury in ICN

The injury pattern associated with violently shaking infants started emerging in voluminous medical literature in the 1970s.<sup>14</sup> This provided a description of an associated constellation of signs and symptoms to aid clinicians with diagnosis.<sup>15,16</sup> An overview of the presentation and diagnosis of ICN is discussed; details of physical examination, history taking, and imaging are beyond the scope of this article. Signs and symptoms associated with ICN are abundant and are summarized in Table 1.

Most frequently, ICN presents with apnea and/or respiratory arrest, hypotension, and increased intracranial pressure due to brain edema. These acute problems require prompt intervention and diagnostic imaging. Subdural and/or subarachnoid hemorrhage, retinal hemorrhage, and hypoxic-ischemic brain injury are common. Misdiagnosis of head trauma occurs when children present with nonspecific, more benign symptoms including irritability, lethargy, poor feeding, vomiting, and fever. Unfortunately, nonspecific symptoms are associated with a multitude of common pediatric problems; when other causative factors do not explain the symptoms, additional diagnostic studies are warranted.<sup>15,16</sup>

A detailed history in conjunction with the physical examination helps determine the cause of injuries. Infants ordinarily do not obtain neurological injuries from household accidents.<sup>20</sup> Comparisons of inflicted versus

**Table 1.** Signs and symptoms associated with inflicted childhood neurotrauma

<i>History</i> <sup>2,16,17</sup>
Sudden onset of symptoms
Explanation inconsistent with injuries
Delay in seeking treatment
Multiple injuries of various ages
<i>Presentation</i> <sup>2,16,17</sup>
Respiratory arrest
Unexplained loss of consciousness
<i>Physical examination</i> <sup>2,15-18</sup>
Apnea
Hypotension
Increased intracranial pressure
Change in level of consciousness
Lethargy
Irritability
Vomiting
Poor feeding
Fever
Facial or scalp injuries
Additional injuries such as bruising or abdominal injuries
<i>Ophthalmic examination</i> <sup>16,17,19</sup>
Retinal hemorrhage
<i>Imaging</i> <sup>5,16,17,20-22,27</sup>
Computed tomographic scan
Subdural hemorrhages (crescent shaped)
Subarachnoid hemorrhage
Extra-axial hemorrhage
Cerebral edema
Skull fractures
Magnetic resonance imaging
White matter shearing
Subdural hematoma
Intraparenchymal lesions
Skeletal survey
Skull fractures
Long bone fractures
Rib fractures

accidental brain injuries in 40 children demonstrated distinct findings of inflicted injuries, such as subdural hemorrhages, retinal hemorrhages, and long-term neurobehavioral abnormalities.<sup>21</sup>

Neuroimaging reveals characteristic areas of crescent-shaped subdural hemorrhages in the brain. Hemorrhages at different stages

of evolution suggest exposure to multiple shaking episodes. Magnetic resonance imaging (MRI) reveals white matter shearing. Retinal hemorrhages can be detected by ophthalmologic evaluation. Skeletal surveys reveal long bone fractures occurring after violent shaking.<sup>11,17</sup> The American Academy of Pediatrics has issued recommendations for imaging in suspected child abuse cases including use of ultrasound versus MRI to diagnose injuries.<sup>18</sup>

### Long-term outcomes of ICN

Children surviving traumatic brain injury suffer high morbidity.<sup>24</sup> Longitudinally, outcomes are dependent upon severity of injuries. Thirty-six percent of children have severe neurological disabilities, including speech and language difficulties, seizure disorders, and visual impairment. Behavioral problems occur in 52% of the children, including "self-injurious and self-stimulatory behavior, hyperactivity, temper tantrums, impulsivity, and rage."<sup>24</sup> Also, 47% of children scored low on socialization, and the majority scored low on cognitive measures. After ICN, children seem developmentally normal at 2 to 3 years of age, with disabilities emerging at school age.

In summary, a unique pattern of injuries can be attributed to ICN, and technology now exists to aid in identifying it. Statistics bear out the frequency of infants critically injured. Risk factors are identified and negative long-term outcomes are documented.

## DETERMINING THE MECHANISM OF INJURY

### Perpetrator statements

Clarity is lacking about mechanism of injury. Currently, perpetrator statements are available; however, the information may be questionable about extent of force inflicted on the infant. Conflicts arise when there is a discrepancy between the suspected mechanism of injuries revealed by imaging and description of how injuries were inflicted as

reported by perpetrators or reconstructed by prosecutors.

Retrospective reviews compare perpetrator statements with injuries sustained by the children.<sup>25,26</sup> In these studies, onset of symptoms occurred immediately after the event and the perpetrators described shaking without blunt force trauma.

### **Specific theories of modes of injury**

Acceleration/deceleration forces generated by violent shaking have been theorized to cause shearing injuries, resulting in diffuse axonal damage; others suggest that an impact is also necessary.<sup>13</sup> Axonal damage was rarely found in a study examining sliced brain tissue of 37 murdered infants (nonaccidental head injury fatalities).<sup>23</sup> The researchers hypothesized that moderate shaking damaged the lower brainstem or cervical spine area because of the relatively large head size and weak neck musculature of infants. Brain damage and swelling presumably resulted from hypoxia versus primary tissue damage.

Legal problems occur when there are discrepancies between the proposed mechanism of injury and the type of tissue damage seen. Theories suggesting that “normal” actions cause significant damage may be heartily welcomed by defense attorneys; however, if these theories were correct, significantly more infants would have accidental brain stem and spinal cord injuries.<sup>22</sup>

The variation in differences identified via imaging highlights the need for further research and has implications for prosecuting perpetrators. Proving that a deliberate action caused a specific type of injury is necessary to prosecute perpetrators. Without clear delineation of injury, legal cases are in jeopardy. Understanding why and under what conditions this crime occurred would aid prevention; predictive factors in perpetrators have received little attention.

### **TERMINOLOGY**

The term “ICN” has emerged recently. Although ICN is more descriptive of the

problem, this term remains less familiar to providers than shaken baby syndrome.<sup>17</sup> The term also more accurately describes clinical presentations of injured infants and dispels doubt about whether the event was purely accidental, regardless of intention.

Shaking is a term that can describe normal interactive contacts with infants. For example, infants are often held and bounced, and bouncy seats, beds, and swings are used to provide vestibular motion that is soothing. In common vernacular, shaking is used to awaken a person. A continuum from gentle shaking to vigorous to violent shaking may be conceptualized. This view of shaking supports that inflicted injuries are accidental and that normal infant contact has gone only slightly awry. The term ICN makes a clearer distinction between outcomes of common caregiving activities and abuse.<sup>22</sup>

Shaken baby syndrome focuses on shaking rather than on the effects it has on the infant. To shake mirrors an image of trying to awaken and moving back and forth and does not include other actions that heretofore have been established as potential causes of the “syndrome.” These include battering, gripping, throttling, choking, shoving, and slamming. The ICN permits the possibility that, for example, blunt force may be used against the infant. Thus, the term ICN refocuses attention on an actor in the picture and the significant neurological injuries suffered. It highlights the morbidity of the problem.

### **ETHICAL CONSIDERATIONS**

The severe phenomena included under the term *ICN* are not only highly consequential to health but also constitute a breach of human rights of children. Shaken baby syndrome presupposes a scenario in which the caregiver is frustrated and dismayed by, for instance, uncontrolled crying. Even in this case, why should it be assumed a natural response to shake the baby? That one is frustrated by another is not acceptable as a basis for the assault of adults. The concepts of

marginalization<sup>28</sup> and exteriority<sup>27-32</sup> provide a framework for understanding the injustices involved in the ICN. An aspect of the dilemma is that the baby may be perceived by a perpetrator as a threat, a cause of displaced affection, and a burden, and thus the supposed caregiver marginalizes the child, meaning that he or she is not a member of the dominant majority of persons and is considered as other, as different, justifying the violent treatment. Furthermore, in a perception of threat, the baby may, even further, be exteriorized or not thought of fully as a human being. The child's crying, incontinence, smell, or otherwise not doing what adults can do is not understandable, and the ICN may be purposeful, even if there is ignorance of differences in the physical makeup of the child, versus an adult.

One root of the problem is a collective inability to realize that anyone is capable of this degree of force being used on an innocent child who is so young. Anyone, especially in adolescence or in adulthood, has the capability to assault an infant. If anyone can do this, it includes "me." A barrier to stopping perpetrators' actions and culpability is that ICN is "unthinkable."

Conversely, physical punishment is still accepted in the care of children. Thus, children are categorically still marginalized. The Convention on the Rights of the Child was drafted in response to child labor, slave sex trade, starvation, and maltreatment.<sup>33</sup> In the case of ICN, care and safety are withheld. Included in the statement on children's rights is this passage that societies should:

...undertake to ensure the child such protection and care as is necessary for his or her well-being, taking into account the rights and duties of his or her parents, legal guardians, or other individuals legally responsible for him or her, and, to this end, shall take all appropriate legislative and administrative measures.

Although this supports actions to remove a child from parents, it still emphasizes parental rights as protective of children. The family is thought of as a safety net for children. Given its scope of influence for the child, it can

just as well be nonprotective, with maltreatment as a consequence. Often a parent, or a close associate known to the family (other caregiver, mother's partner/boyfriend), is the perpetrator of ICN.

Levinas<sup>29,33,34</sup> offers a primary ethic in his discussion of a sense and sensibility that is preverbal, stemming from the face-to-face relation between beings. The ICN may be informed by this ethics of *face-to-faceness* described by Levinas and his notion of exteriority expanded upon by Dussell.<sup>33,34</sup> Levinas<sup>27,31</sup> posited that there is an interpersonal ethical obligation to care and that this is culminated in face-to-face-ness, without "absorption" of one into the other in sameness. When the ethic is broken, either the other being, in this case the infant, or the child is falsely subsumed into the caregiver as object, as "owned." Ironically, this subsuming is ethically "exteriorizing," disposing of the infant's personhood.

Culturally and legally children are considered the property of their parents and, at times, the collective property of the state as well. Therefore, the face-to-face situation of ICN signifies that frustration may lie in a parent's assumption of ownership. When the infant deviates from the expected sameness, or "owned" behavior, for example, by resembling a rejected family member, not eating, or having dirty diapers, the infant/child's face-to-face proximity becomes a locus of intensity. The adult subsequently handles the child's body roughly, even ragefully (throttling, shaking, striking, slamming, or throwing). ICN is too often the result.

Levinas holds that face-to-face reaction, response, and responsibility keep us humane toward the other (eg, hesitancy of soldiers to fire when they have eye contact with the enemy soldier). At a deep level, the face-to-face condition is a sense of obligation before actual speech to relate and preserve the safety of the other. It allows that person to be unlike one's self and to have his or her own view, motives, and perceptions. It likewise requires that the infant should have basic survival needs met by adults. Levinas' views

inform the situation of ICN as a confrontation between the rights of infants and the motive of an adult stemming from the ownership phenomenon. To sense ownership without complete control may explain caregivers' feelings of having been "provoked" by the infant, and therefore responding with force, that is, violence. Although often the face-to face-ness is respected as obligation, that is, as the first ethic, when it is broken, the power imbalance between parent, caregiver, or family friend and an infant or a toddler is evident and extreme.

We suggest that this framework might be useful both in examining the appearance and behaviors of infants and in exploring interpretations of these by potential perpetrators. We need to explore the perceptions and assumptions of caregivers that *precede* the impulse to shake or use blunt force. Face-to-face-ness and the embedded responsibilities form an ethic that mandates safety for infants who cannot speak. We maintain this as a primary ethic that supersedes parental "rights." Application of this primary ethic will require policy and

practice changes on the part of all involved professionals.

## CONCLUSION

We have outlined the history, mechanisms of injury, discrepancies in terminology, and documented signs and outcomes of ICN. We have also offered an ethical framework for furthering the rights of children beyond the safety net of family. The term "shaken baby syndrome" needs to be rejected by health-care professionals, social service workers, law enforcement agencies, and the courts. It implies an unfortunate situation, rather than an egregious violation of the safety of infants who may die or live on as developmentally and educationally impaired persons. The gravity of these infants' existential predicaments cannot be overstated. Through understanding ICN factually and ethically, healthcare professionals can begin to pierce through a mythology that conceals, rather than prevents, this health tragedy and human rights travesty.

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