

# MILITARY LAW REVIEW

---

Volume 210

Winter 2011

---

## SHAKEN BABY SYNDROME: *DAUBERT* AND MRE 702'S FAILURE TO EXCLUDE UNRELIABLE SCIENTIFIC EVIDENCE AND THE NEED FOR REFORM

MAJOR ELIZABETH A. WALKER\*

Audrey Edmunds' day as a child care provider began like any other, but ended in her being accused of murdering seven-month-old Natalie Beard.<sup>1</sup> Natalie was fussy that morning when her mother dropped her off at approximately 7:30 a.m..<sup>2</sup> Edmunds placed Natalie in the master bedroom, gave her a bottle, and left her alone while she dressed her own daughters.<sup>3</sup> When Audrey checked on Natalie thirty minutes later, the baby was limp and unresponsive.<sup>4</sup> Audrey immediately called 911 and an

---

\* Judge Advocate, U.S. Army. Presently assigned as a Litigation Attorney, Army Litigation Division, U.S. Army Legal Services Agency, Arlington, Va. LL.M., 2010, The Judge Advocate General's Legal Center and School, Charlottesville, Va.; J.D., 2000, Vermont Law School; B.S., 1997, University of Illinois-Urbana-Champaign. Previous assignments include Government Appellate Attorney, Government Appellate Division, U.S. Army Legal Services Agency, Arlington, Va., 2008–2009; Officer-in-Charge/Trial Defense Counsel, 4th Infantry Division Branch Office, U.S. Army Trial Defense Service, Fort Hood, Tex., 2006–2008; Senior Defense Counsel, 4th Infantry Division Field Office, U.S. Army Trial Defense Service, Camp Liberty, Iraq, 2005–2006; Trial Defense Counsel, 4th Infantry Division Branch Office, U.S. Army Trial Defense Service, Fort Hood, Tex., 2004–2005; Trial Counsel, United States Army Field Artillery Center and School, Fort Sill, Okla., 2003–2004; Administrative Law Attorney/Ethics Counselor, U.S. Army Field Artillery Center and School, Fort Sill, Okla., 2002–2003; Legal Assistance Attorney, U.S. Army Field Artillery Center and School, Fort Sill, Okla., 2001–2002. Member of the bars of Massachusetts, the Army Court of Criminal Appeals, the Court of Appeals for the Armed Forces, and the Supreme Court of the United States. This article was submitted in partial completion of the Master of Laws requirements of the 58th Judge Advocate Officer Graduate Course.

<sup>1</sup> *State v. Edmunds*, 598 N.W.2d 290, 293 (Wis. Ct. App. 1999); *see also* Deborah Tuerkheimer, *The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts*, 87 WASH. U. L. REV. 1, 1–2 (2009).

<sup>2</sup> *Edmunds*, 598 N.W.2d at 293.

<sup>3</sup> *Id.*

<sup>4</sup> *Id.*

ambulance rushed the baby to the hospital; Natalie died later that night.<sup>5</sup> The state charge Audrey charged with murder based upon a medical opinion that the baby died from “extremely vigorous shaking.”<sup>6</sup> The baby was diagnosed with retinal and subdural hemorrhages.<sup>7</sup> No witnesses testified that Audrey shook the baby and the government presented no other physical evidence of trauma.<sup>8</sup> Audrey maintained her innocence, yet the court convicted her of murder and sentenced her to eighteen years in prison based on the medical examiner’s testimony that the baby suffered from shaken baby syndrome.<sup>9</sup>

The case of Audrey Edmunds describes the characteristic facts and prosecution of shaken baby syndrome (SBS). Shaken baby syndrome is a “diagnosis” in which doctors believe a caregiver of an infant grabs the infant by the torso and violently shakes the infant, causing the head to thrust back and forth, resulting in a whiplash effect. Studies on SBS originated in the late 1940s when an article written by Dr. John Caffey<sup>10</sup> introduced the diagnosis of “battered infant syndrome.”<sup>11</sup> In the decades that followed, several clinical studies examined infants who presented to hospitals with subdural hematomas, retinal hemorrhaging, and long bone fractures, with no external signs of trauma and no explanation from the parents about the cause of such injuries.<sup>12</sup> Collectively, these clinical examinations fostered the “diagnosis” known as SBS.<sup>13</sup>

---

<sup>5</sup> *Id.*

<sup>6</sup> *Id.*

<sup>7</sup> *Id.*

<sup>8</sup> *Id.* at 294.

<sup>9</sup> *Id.*

<sup>10</sup> Dr. Caffey was a pediatric radiologist who first wrote on the topic of “battered infant syndrome.” See *infra* note 12 (listing many of Dr. Caffey’s published articles).

<sup>11</sup> John Caffey, *Multiple Fractures in the Long Bones of Infants Suffering from Chronic Subdural Hematoma*, 56 AM. J. ROENTGEN 163 (1946). See *infra* note 12 (listing many of Dr. Caffey’s published articles).

<sup>12</sup> *Id.*; A.N. Guthkelch, *Subdural Effusions in Infancy: 24 Cases*, BRIT. MED. J. 233, 233 (1953); A.N. Guthkelch, *Infantile Subdural Haematoma and Its Relationship to Whiplash Injuries*, 2 BRIT. MED. J. 430 (1971); John Caffey, *On the Theory and Practice of Shaking Infants: Its Potential Residual Effects of Permanent Brain Damage and Mental Retardation*, 124 AM. J. DISEASES CHILD. 161 (1972) [hereinafter Caffey, *On the Theory and Practice of Shaking Infants*]; John Caffey, *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*, 54 PEDIATRICS 396, 402 (1974) [hereinafter Caffey, *The Whiplash Shaken Infant Syndrome*].

<sup>13</sup> Caffey, *Multiple Fractures in the Long Bones of Infants*, *supra* note 11, at 163.

For decades, doctors hypothesized that the forces from the shaking resulted in the brain being thrust back and forth inside the skull, causing small veins to tear and bleed inside the skull. The forces from the shaking also have been thought to result in retinal bleeding and brain swelling.<sup>14</sup> The medical criteria for a shaken baby diagnosis eventually developed into the “triad” of symptoms: retinal hemorrhages (bleeding of the back inner surface of the eye), subdural hemorrhages (bleeding between the hard outer layer and the membranes that surround the brain), and cerebral edema (brain swelling).<sup>15</sup> A case in which an infant who presented to a hospital with these three symptoms, but without external signs of trauma and no explanation from the caregiver as to the cause of these physical symptoms, resulted in a shaken baby diagnosis.<sup>16</sup> The diagnosis of SBS permeated the pediatric medical community, virtually unchecked and unchallenged for years.

Biomechanical and clinical studies challenged the assumptions, science, and methodology behind the SBS diagnosis.<sup>17</sup> Biomechanical studies demonstrated the impossibility that a human being could create enough force by shaking alone to cause brain injuries in young infants and children.<sup>18</sup> Other studies concluded that the amount of shaking force necessary to cause brain injuries would result in neck and spinal injuries before brain injuries would occur.<sup>19</sup> Yet, further studies demonstrated that shaking alone would not cause retinal hemorrhaging.<sup>20</sup> Collectively, these studies created a contentious debate between pediatricians and

---

<sup>14</sup> *Id.*

<sup>15</sup> See Caffey, *On the Theory and Practice of Shaking Infants*, *supra* note 12, at 167; Tuerkheimer, *supra* note 1, at 3. Hereinafter, the term “triad” will refer to subdural hemorrhages, retinal hemorrhages, and brain edema.

<sup>16</sup> Ann-Christine Duhaime et al., *The Shaken Baby Syndrome. A Clinical, Pathological, and Biochemical Study*, 66 J. NEUROSURGERY 409 (1987); Mark N. Hadley et al., *The Infant Whiplash-Shake Injury Syndrome: A Clinical and Pathological Study*, 24 NEUROSURGERY 536 (1989); Faris A Bandak, *Shaken Baby Syndrome: A Biomechanics Analysis of Injury Mechanisms*, 151 FORENSIC SCI. INT’L 71 (2005).

<sup>17</sup> See generally Duhaime et al., *supra* note 16; Hadley et al., *supra* note 16; Bandak, *supra* note 16; Sarah Smith et al., *Infant Rat Model of the Shaken Baby Syndrome: Preliminary Characterization and Evidence for the Role of Free Radicals in Cortical Hemorrhaging and Progressive Neuronal Degeneration*, 15 J. NEUROTRAUMA 693 (1998); Patrick D. Barnes et al., *Traumatic Spinal Cord Injury: Accidental Versus Non-accidental Injury*, 15 SEMINARS PEDIATRIC NEUROLOGY 181 (2008).

<sup>18</sup> Duhaime et al., *supra* note 16, at 414; Smith et al., *supra* note 17, at 700–03.

<sup>19</sup> Bandak, *supra* note 16, at 78; Panos Koumellis et al., *Spinal Subdural Hematomas in Children with Nonaccidental Head Injury*, 94 ARCHIVES DISEASES CHILD. 216–19 (2008).

<sup>20</sup> K. Ommaya et al., *Whiplash Injury and Brain Damage: An Experimental Study*, 204 J. AM. MED. ASS’N 285, 285 (1968).

other medical professionals regarding the reliability of an SBS diagnosis. In essence, biomechanical studies exposed the unreliability of the shaken baby diagnosis.

Defense counsel have used these biomechanical studies to challenge SBS expert testimony and its inability to meet several of the *Daubert* admissibility factors, such as: whether the theory or technique can be and has been tested, whether there is a known or potential rate of error, and whether the theory or technique enjoys general acceptance within a relevant scientific community.<sup>21</sup> However, because Military Rule of Evidence (MRE) 702 and *Daubert* contain such liberal standards, and judges are given broad discretion in determining the admissibility of expert testimony, such challenges are often fruitless. With this frequent admissibility of unreliable scientific expert testimony, reform is necessary. The Military Rules of Evidence must be amended to require corroborating physical evidence of abuse, irrespective of the “triad” of injuries, or a voluntary confession as a prerequisite of admissibility of SBS evidence.

This article explores the history of the shaken baby diagnosis, how it proliferated the medical community, and the basic assumptions of the diagnosis. The biomechanical studies challenging the very foundation of the diagnosis are discussed in order to highlight the controversial nature of the so-called “diagnosis.” This article then applies the *Daubert* factors to the SBS diagnosis to demonstrate its inability to satisfy those admissibility factors. Lastly, this article argues for the need for reform on this issue and proposes a military rule of evidence to address SBS evidence.

## I. Shaken Baby Syndrome

### A. Creation of a Faulty Hypothesis and Diagnosis

In 1946, Dr. John Caffey, a pediatric radiologist from Pennsylvania, wrote an article on what he termed the parent-infant stress syndrome (PITS) or “battered baby syndrome.”<sup>22</sup> Caffey explored the correlation

---

<sup>21</sup> *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993).

<sup>22</sup> To assist the reader in understanding the significance of Dr. Caffey’s role in the creation of what became known as “SBS,” it is relevant to understand his role within the pediatric community. Dr. Caffey graduated from the University of Michigan Medical

between the occurrence of long bone fractures and chronic subdural hematomas in infants.<sup>23</sup> The article explored six clinical cases of infants who suffered from both injuries.<sup>24</sup> None of the cases presented a history of injury to which long bone injuries were reasonably attributable, nor was there clinical or x-ray evidence of skeletal disease which would predispose the infant to the skeletal fractures.<sup>25</sup> Caffey thus proffered, “the traumatic theory of the causation of subdural hematoma has been accepted almost to the exclusion of all other causes despite the fact that a history of injury is lacking in almost one-half of the cases.”<sup>26</sup> Dr. Caffey theorized that trauma (abuse) caused the subdural hematomas and skeletal fractures despite his lack of either circumstantial or direct evidence to support that conclusion. From these six cases he concluded that subdural hematomas, intraocular bleeding, and long bone injuries were “essential elements” in cases of identifying battered babies.<sup>27</sup> These “essential elements” later became known as the “triad” of symptoms

---

School in 1919. Bertram R. Girdany, *John Caffey, 1895–1978*, 132 AM. J. OF ROENTGENOLOGY 158–60 (1979). In 1929, during his tenure at the Babies Hospital of Columbia University of Physicians and Surgeons, he became interested in radiology and developed a pediatric radiology department. *Id.* Dr. Caffey was “perhaps the most eminent of the pioneers in pediatric radiology” and wrote several articles on infant injuries, cited within this article. N. Thorne Griscom, *John Caffey and His Contributions to Radiology*, 194 RADIOLOGY 513 (1995). His career became “increasingly distinguished with recognition in both pediatrics and radiology.” *Id.* at 514. “The most important of Dr. Caffey’s other contributions was his advancement of the understanding of the battered child syndrome.” *Id.* at 515.

<sup>23</sup> *Id.* at 163. “Chronic refers to something that continues or persists over an extended period of time. A chronic condition is usually long-lasting and does not easily or quickly go away.” A.D.A.M. MEDICAL ENCYCLOPEDIA, <http://www.nlm.nih.gov/medlineplus/ency/article/002312.htm> (last visited Apr. 21, 2011). A subdural hematoma is:

a collection of blood on the surface of the brain. Subdural hematomas are usually the result of a serious head injury. . . . Acute subdural hematomas are among the deadliest of all head injuries. The bleeding fills the brain area very rapidly, compressing brain tissue. This often results in brain injury and may lead to death.

A.D.A.M. MEDICAL ENCYCLOPEDIA, <http://www.nlm.nih.gov/medlineplus/ency/article/000713.htm> (last visited May 22, 2012). The symptoms of a subdural hematoma in infants are feeding difficulties, high-pitched cry, increased head circumference, increased sleepiness or lethargy, irritability, persistent vomiting, and bulging fontanelles (the “soft spots” of the baby’s skull). *Id.*

<sup>24</sup> Caffey, *Multiple Fractures in the Long Bones of Infants*, *supra* note 11, at 163.

<sup>25</sup> *Id.*

<sup>26</sup> *Id.* at 172.

<sup>27</sup> *Id.*

thought to be diagnostic of SBS.<sup>28</sup>

While Dr. Caffey hypothesized that subdural hematomas in infants were caused by parental abuse, other researchers recognized the possibility that the subdural hematomas were largely caused by birth trauma.<sup>29</sup> In 1953, A.N. Guthkelch conducted a clinical study of twenty-four infants.<sup>30</sup> A comprehensive history was available for sixteen of the infants.<sup>31</sup> Of those, eight sustained definite birth trauma.<sup>32</sup> An additional four infants were of twin pregnancies born prematurely.<sup>33</sup> Thus, in Guthkelch's clinical examination of sixteen infants with subdural hematomas, 75% of the infants experienced an abnormal or difficult labor.<sup>34</sup> Guthkelch also noted the fact that the subdural hematomas manifested within the first few months of life, suggesting that the cause of the bleeding was at or near the time of birth.<sup>35</sup> This fact further supported his conclusion that the subdural hematomas were the result of birth trauma.<sup>36</sup>

Nearly twenty years later, Guthkelch abandoned the conclusion that subdural hematomas in infants were largely the result of birth trauma.<sup>37</sup> He reviewed the research of professional peers and concluded that, "subdural hematoma is one of the commonest features of the battered child syndrome, yet by no means do all the patients so affected have external marks of injury on the head."<sup>38</sup> He considered a 1969 study conducted by colleagues that involved two cases of subdural hematomas in which both victims sustained whiplash injuries to the neck as a result of an automobile accident but exhibited no signs of external injuries to

---

<sup>28</sup> See *supra* note 15.

<sup>29</sup> One such study of subdural hematomas in infants found evidence of birth trauma in 25% of the infants. See Guthkelch, *Subdural Effusions in Infancy*, *supra* note 12, at 233. Birth trauma is a general term used to describe a difficult birth event in which an infant may sustain intracranial injury as a result of natural vaginal birth. See generally Ronald H. Uscinski, *Shaken Baby Syndrome: An Odyssey*, 46 *NEUROLOGIA MEDICO CHIRURGICA* 57, 59–60 (2006).

<sup>30</sup> Guthkelch, *Subdural Effusions in Infancy*, *supra* note 29.

<sup>31</sup> *Id.* at 233.

<sup>32</sup> *Id.*

<sup>33</sup> *Id.*

<sup>34</sup> *Id.*

<sup>35</sup> *Id.*

<sup>36</sup> *Id.*

<sup>37</sup> A.N. Guthkelch, *Infantile Subdural Haematoma and its Relationship to Whiplash Injuries*, 2 *BRIT. MED. J.* 430 (1971).

<sup>38</sup> *Id.* at 430.

the head, such as bruising, redness, or bleeding.<sup>39</sup> Brain injuries manifested several days after the accident.<sup>40</sup> Guthkelch proffered that the conditions that exist in battered child syndrome are favorable to the creation of subdural hematomas in infants by a similar mechanism as that of the whiplash experienced in a car accident.<sup>41</sup> The assumption by researchers was that the force of jerking or swinging a child around would cause whiplash injuries similar to those of a car accident.<sup>42</sup> Based on examining just those few cases, Guthkelch concluded that, in some cases, the repeated acceleration and deceleration of the head being whipped back and forth was the cause of the subdural hematomas in infants rather than direct violence such as a direct blow to the head.<sup>43</sup> This hypothesis also supported the fact that some of the subdural hematomas in battered children were bilateral due to the back and forth motion of the shaking.<sup>44</sup> He concluded that:

[i]t follows that since all cases of infantile subdural haematoma are best assumed to be traumatic unless proved otherwise it would be unwise to disregard the possibility that one of these has been caused by serious violence, repetition of which may prove fatal, simply on the basis that there are no gross fractures or other radiological bone changes in the limbs, nor any fractures of the skull.<sup>45</sup>

Guthkelch ultimately determined that, from a medical perspective, it was simply easier to assume that all cases of infantile subdural hematomas were a result of trauma (abuse) unless the parents or care-provider proved otherwise. He also emphasized that the lack of obvious

---

<sup>39</sup> *Id.*

<sup>40</sup> *Id.*

<sup>41</sup> *Id.*

<sup>42</sup> *Id.* Kempe and others conducted a study which noted that the battered child is pulled by the arm to jerk the reluctant child to his feet and sometimes the legs are held while the child's body is swung around. *Id.* Guthkelch studied twenty-three cases of proven or "strongly suspected" cases of battered children under the age of three years. Guthkelch discovered subdural bleeding in thirteen children (57%) with ten of the children exhibiting bilateral bleeding in the brain and six (26%) exhibiting long bone fractures. *Id.* He also discovered skull fractures in eight cases (33% of total children studied and 61% of those suffering from subdural hematomas) and six of those suffered a subdural hematoma. *Id.*

<sup>43</sup> *Id.*

<sup>44</sup> *Id.*

<sup>45</sup> *Id.* at 431.

signs of trauma, such as bruising, did not preclude the assumption that an infant's brain injuries were caused by intentional and violent shaking by a caregiver,<sup>46</sup> as "[o]ne must keep in mind the possibility of assault in considering any case of infantile subdural hematoma, even when there are only trivial bruises or indeed no marks of injury at all, and inquire, however guardedly or tactfully, whether perhaps the baby's head could have been shaken."<sup>47</sup> The assumption that, in the absence of external trauma, shaking caused internal brain injuries in infants continued to permeate the medical community.

In 1972, Dr. Caffey further explored the area of child abuse in young children when he released an article in the *American Journal of Diseases of Children* on whiplash shaking of an infant.<sup>48</sup> He proffered that during the twenty-five years since his seminal article, substantial research had accumulated which suggested "whiplash shaking and jerking of abused infants are common causes of the skeletal and cerebrovascular lesions."<sup>49</sup> He further theorized that the shaking and jerking of infants are "frequently pathogenic"<sup>50</sup> and often results in grave permanent damage to the infantile brain and eyes.<sup>51</sup> Caffey even speculated that there are many innocent and accepted practices that could lead to permanent brain damage in young infants, such as: "tossing the baby into the air," "riding the horse" (the infant faces the parent while sitting on his shin), "cracking the whip," or grabbing an infant by his ankles and swinging him in circles around the parent's head could lead to serious brain injuries.<sup>52</sup> In Caffey's opinion, subdural hematomas were practically always traumatic in origin and found commonly in infants younger than twenty-four months with a peak incidence during the sixth month.<sup>53</sup> He concluded that the vulnerability of the infant to "traumatic intracranial bleeding is due to the combination of heavy head and weak neck muscles, which renders [the infant's] brain especially susceptible to whiplash stresses caused by shaking."<sup>54</sup> Caffey dismissed the possibility that the intracranial and retinal bleeding observed in infants was a result

---

<sup>46</sup> *Id.*

<sup>47</sup> *Id.*

<sup>48</sup> Caffey, *On the Theory and Practice of Shaking Infants*, *supra* note 12.

<sup>49</sup> *Id.* at 161.

<sup>50</sup> Pathogenic means "[c]ausing disease or capable of doing it." MEDICINET, <http://www.medterms.com/script/main/art.asp?articlekey=6384> (last visited May 22, 2012).

<sup>51</sup> Caffey, *On the Theory and Practice of Shaking Infants*, *supra* note 12, at 161.

<sup>52</sup> *Id.* at 165.

<sup>53</sup> *Id.* at 166.

<sup>54</sup> *Id.*



of impact injuries to the head. Rather, he concluded that “there were several features of the subdural hematomas that indicated they were not caused by direct impact to the head, but caused by indirect acceleration-deceleration forces” as a result of the head whipping back and forth from the infant being shaken.<sup>55</sup> Dr. Caffey based this conclusion on a lack of physical evidence of impact in the infants, such as bruises to the face or scalp and skull fractures.<sup>56</sup> The fact that a majority of the infants studied suffered from bilateral subdural hematomas and retinal bleeding supported his conclusion that the injuries were a result of the forces caused from the infant being shaken back and forth.<sup>57</sup> Caffey predicted that retinal bleeding caused by shaking would become a valuable sign in the future diagnosis of unexplained, chronic subdural hematomas and a productive screening test for whiplash shaking incidents.<sup>58</sup>

A few years later in 1974, Caffey introduced the concept of “whiplash shaken infant syndrome” which became commonly known as shaken baby syndrome. Caffey postured that “manual whiplash shaking of infants is a common primary type of trauma in the so-called ‘battered infant syndrome.’ It appears to be the major cause in infants who suffer from subdural hematomas and intraocular bleeding.”<sup>59</sup> Dr. Caffey based his opinion on “both direct and circumstantial” evidence.<sup>60</sup> He hypothesized that the “essential elements of infantile whiplash shaking syndrome” were infants who exhibited bleeding within the head (subdural hematoma), bleeding in the interior linings of the eyes (retinal hemorrhages), with “no history of trauma of any kind.”<sup>61</sup> Dr. Caffey

---

<sup>55</sup> *Id.* at 169. Caffey’s conclusion that shaking caused subdural hematomas was based upon a mere twenty-seven clinical cases in which a child inexplicably died or suffered traumatic brain injury and a parent or care-provider admitted to shaking the child in some form. *Id.* at 163. The article never addressed the forum or manner in which these “admissions” were obtained nor did it address the exact substance of the alleged admission by the care-provider. *Id.* From these twenty-seven cases, Caffey extrapolated that this small sample represented “an infinitesimal portion of the uncounted thousands of moderate and unadmitted, undetected and unrecorded whiplash-shakings which probably occur every day in the United States.” *Id.* at 167. Yet, Caffey concludes in his article that the evidence upon which he theorized that whiplash shaking of infants caused severe brain and retinal hemorrhaging does not lend itself to satisfactory statistical analysis and that “‘universal’ samples of a total population of shaken infants have not yet been obtained.” *Id.* at 168–69.

<sup>56</sup> *Id.* at 169.

<sup>57</sup> *Id.*

<sup>58</sup> *Id.* at 167.

<sup>59</sup> Caffey, *The Whiplash Shaken Infant Syndrome*, *supra* note 12, at 402.

<sup>60</sup> *Id.*

<sup>61</sup> *Id.*

explained that the shaking of an infant by holding him by his trunk causes a two-phase cycle of “rapid, repeated, to-and-fro, alternating acceleration-deceleration flexions of the head” which then causes the head to strike the chin followed by the reverse forces on the head and neck when the head swings the opposite direction and strikes the baby’s back.<sup>62</sup> He believed that these forces caused the subdural hematomas and retinal hemorrhages<sup>63</sup> seen in cases of infants with no history of trauma.<sup>64</sup> He suggested to the medical community that the concept of “whiplash shaken infant syndrome” warranted careful diagnostic consideration in infants with unexplained convulsions, projectile vomiting, irritability, and bulging fontanel.<sup>65</sup> Dr. Caffey proposed that routine eye examinations would provide a “superior screening method” for early detection of whiplash shakings.<sup>66</sup> He went on to state in the article that, “[c]urrent evidence, though manifestly incomplete and largely circumstantial, warrants a nationwide educational campaign on the potential pathogenicity of habitual, manual casual whiplash shaking of infants, and on all other habits, practices and procedures in which the heads of infants are habitually jerked and jolted (whiplashed).”<sup>67</sup> As a result of Dr. Caffey’s suggestion that an educational campaign be initiated, the nation began cautioning mothers, fathers, and caregivers to never shake a child. Although this was good advice, Dr. Caffey pointed out that his suggestion was not based on any type of scientific study.<sup>68</sup>

---

<sup>62</sup> *Id.* at 401.

<sup>63</sup> “Retinal hemorrhage is the abnormal bleeding of the blood vessels in the retina, the membrane in the back of the eye.” The Free Dictionary, <http://medical-dictionary.thefreedictionary.com/Retinal+hemorrhage> (last visited Apr. 21, 2012). “Retinal hemorrhages can be caused by injuries, usually forceful blows to the head during accidents and falls, as well as by adverse health conditions.” *Id.*

<sup>64</sup> Dr. Caffey noted in his article that two of the first six battered babies he studied in 1946 suffered from retinal hemorrhages and subdural hematomas. Caffey, *The Whiplash Shaken Infant Syndrome*, *supra* note 12, at 399. He also relied on the fact that similar intraocular lesions were reported in two cases by Guthkelch. *Id.* Dr. Caffey further relied on a study by Mushin, who found ocular changes in ten of twelve battered infants. *Id.*

<sup>65</sup> *Id.* at 403. A fontanel is the “soft spot” of the infant’s head. “A bulging fontanelle is an outward curving of an infant’s soft spot” which is believed to be caused by brain swelling. MEDLINE PLUS, <http://www.nlm.nih.gov/medlineplus/ency/article/003310.htm> (last visited Apr. 21, 2012).

<sup>66</sup> Caffey, *The Whiplash Shaken Infant Syndrome*, *supra* note 12, at 403.

<sup>67</sup> *Id.*

<sup>68</sup> See Caffey, *On the Theory and Practice of Shaking Infants*, *supra* note 12, at 168.

Dr. Caffey based these conclusions on a study conducted by A. K. Ommaya<sup>69</sup> who experimented with rhesus monkeys in 1968.<sup>70</sup> The Ommaya experiment studied the potential whiplash injuries of rhesus monkeys by seating them in a rigid carriage and simulating a rear-end collision by driving a piston into the back of the carriage at various force levels.<sup>71</sup> The purpose of this research was to study whiplash on humans in automobile accidents.<sup>72</sup> The researchers measured the forces on the monkey's head from being whipped back and forth.<sup>73</sup> The experiment produced injury to nineteen out of fifty monkeys.<sup>74</sup> Monkeys were used for the experiment, instead of humans, because the monkeys were killed in order to examine their brains for injury.<sup>75</sup> It was supposed to illustrate that injuries could occur to primates through sheer acceleration forces without any impact to the monkey's head.<sup>76</sup> Researchers in the Ommaya study produced an impact curve that predicted at what level of acceleration the monkeys would start to experience brain injuries from

---

<sup>69</sup> Dr. Ayub K. Ommaya was a neurosurgeon and an "internationally known expert on brain injuries." He "received his medical degree from King Edward Medical College in Pakistan in 1953. Joe Holley, *Ayub K. Ommaya*, 78; *Neurosurgeon and Authority on Brain Injuries*, WASH. POST, July 14, 2008, at B04, <http://www.washingtonpost.com/wp-dyn/content/article/2008/07/13/AR2008071301791.html>. Dr. Ommaya "came to the United States in 1961 as a visiting scientist at the National Institutes of Health" (NIH). *Id.* He "began teaching at George Washington University in 1970" and served as the chief of neurosurgery of NIH from 1974 to 1979. *Id.* "In 1997, Dr. Ommaya was called as a defense expert witness in the highly publicized trial of Louise Woodward, a British au pair accused of killing an 8-month-old baby in her care." *Id.* "He maintained that the child, Matthew Eappen, could not have been killed by violent shaking, as prosecutors claimed." *Id.*

<sup>70</sup> Caffey, *The Whiplash Shaken Infant Syndrome*, *supra* note 12, at 401–02. This study concluded that:

[e]xperimental whiplash injury in rhesus monkeys has demonstrated that experimental cerebral concussion, as well as gross hemorrhages and contusions over the surface of the brain and upper cervical cord, can be produced by rotational displacement of the head on the neck alone, without significant direct head impact. These experimental observations have been studied in the light of published reports of cerebral concussion and other evidence for central nervous system involvement after whiplash injury in man.

Ommaya et al., *supra* note 20, at 285.

<sup>71</sup> *Id.* at 286.

<sup>72</sup> *Id.* at 285.

<sup>73</sup> *Id.*

<sup>74</sup> *Id.* at 286.

<sup>75</sup> *Id.*

<sup>76</sup> *Id.* at 285.

the sheer acceleration forces without any impact on the head.<sup>77</sup> They called this level the “threshold of injury.”<sup>78</sup>

Many medical professionals used Ommaya’s study as a basis for the proliferation of the whiplash shaken syndrome/SBS in infants. Researchers improperly interpreted Ommaya’s study in several ways. First, researchers assumed that by extending the impact curve they could accurately predict what threshold level of injury was necessary to produce injury to infant human brains.<sup>79</sup> While it was possible to predict the threshold at which injuries were observed in monkeys, these results could not be extended to predict injuries to humans; although similar in structure, humans have larger heads in proportion to their bodies.<sup>80</sup> This determination required further research. Second, researchers failed to recognize that some of the monkeys hit their heads on the back of the seat during the acceleration process, potentially causing impact injuries.<sup>81</sup> Additionally, whipping a head back due to acceleration forces one time in an acceleration chair is a different kind of motion than shaking a child repeatedly by holding on to the child’s torso.<sup>82</sup> While this study appeared to support the SBS hypothesis, it contained many flaws which were ignored as the SBS “diagnosis” continued to permeate the medical community.

An examination of the history of the SBS diagnosis reveals that researchers based the diagnosis upon assumptions about the cause of brain injuries and retinal bleeding in infants when there were no other external physical injuries. Even Dr. Caffey admitted that he did not base his assumptions regarding the “battered infant syndrome” upon any actual direct evidence or science. These assumptions underlying the diagnosis make it unreliable, and potentially dangerous, courtroom evidence.

---

<sup>77</sup> *Id.* at 288.

<sup>78</sup> *Id.*

<sup>79</sup> Bandak, *supra* note 16, at 76–77.

<sup>80</sup> *Id.*

<sup>81</sup> Testimony of Dr. Ronald H. Uscinski during Daubert hearing in Commonwealth of Kentucky v. Christopher A. Davis, No. 04 CR 205. Trial Court Opinion April 17, 2006 Greenup Circuit Court, <http://www.aapsonline.org/sbs/daubert.pdf> (last visited Apr. 21, 2012).

<sup>82</sup> *Id.*

## B. Core Assumptions Regarding the Mechanisms of Shaken Baby Syndrome

Within this historical framework, the SBS “diagnosis” proliferated the medical community in the 1970s as a form of child abuse whose common triad of injuries included brain edema,<sup>83</sup> subdural hemorrhages, and retinal hemorrhaging, with a complete lack of any external injuries such as bruising, skin redness from an impact, or other signs of injury.<sup>84</sup> A classic case of SBS also included a care provider’s explanation that seemed inconsistent with the constellation of injuries observed by medical professionals.<sup>85</sup> Research challenging the scientific basis of SBS recognized that there is a set of core assumptions in the medical literature regarding the mechanisms of SBS that require validation in the medical community before accusing a caretaker of SBS.<sup>86</sup> The core assumptions about SBS are as follows:

- (1) ‘Low’ falls in infants (less than four feet) are not likely to cause skull fractures, subdural hemorrhages, or brain injury;<sup>87</sup>
- (2) Retinal hemorrhages in abused infants are caused directly from repetitive shaking of the head, which produces disruption of bridging veins and results in subdural hemorrhages/hematomas,<sup>88</sup>

<sup>83</sup> “Edema means swelling caused by fluid in your body’s tissues.” A.D.A.M. MEDICAL ENCYCLOPEDIA, <http://www.nlm.nih.gov/medlineplus/edema.html> (last visited May 2, 2012).

<sup>84</sup> Caffey, *On the Theory and Practice of Shaking Infants*, *supra* note 12, at 169; Caffey, *The Whiplash Shaken Infant Syndrome*, *supra* note 12, at 397; Duhaime et al., *supra* note 16, at 409; Hadley et al., *supra* note 16, at 536–40; Bandak, *supra* note 16, at 72.

<sup>85</sup> See Caffey, *supra* note 11, at 172; *On the Theory and Practice of Shaking Infants*, *supra* note 12, at 168–69.

<sup>86</sup> A.K. Ommaya et al., *Biomechanics & Neuropathology of Adult & Pediatric Head Injury*, 16 BRIT. J. NEUROSURGERY 223, 227 (2002).

<sup>87</sup> *Id.*; Ann-Christine Duhaime et al., *Disappearing Subdural Hematomas in Children*, 25 PEDIATRIC NEUROSURGERY 116–22 (1996) [hereinafter Duhaime et al., *Disappearing Subdural Hematomas*]; Ann-Christine Duhaime et al., *Longterm Outcome in Infants with the Shaken-Impact Syndrome*, 24 PEDIATRIC NEUROSURGERY 292–98 (1996) [hereinafter Duhaime et al., *Longterm Outcome in Infants*]; Ann-Christine Duhaime et al., *Nonaccidental Head Injury in Infants—the ‘Shaken-Baby Syndrome,’* 338 NEW ENG. J. MED. 1822–29 (1998) [hereinafter Duhaime et al., *Nonaccidental Head Injury in Infants*].

<sup>88</sup> See Ommaya et al., *supra* note 86, at 227; M.J. Greenwald et al., *Traumatic Retinoschisis in Battered Babies*, 93 OPHTHALMOLOGY 618–25 (1986); A.C. Tongue,

(3) The time interval between the cause of the brain injury and the onset symptoms is always of short duration, i.e. the time for onset of symptoms and signs of SBS is always brief;<sup>89</sup> and

(4) Head-injured patients who appear normal and then quickly deteriorate or die is not caused by an asymptomatic subdural hematoma which then rebleeds following minimal head trauma.<sup>90</sup>

Researchers who have conducted studies challenging these assumptions view them as ambiguous and incorrect.<sup>91</sup> To fully understand the weaknesses in SBS as a diagnosis, it is critical to first understand each of these assumptions and some of the challenges to each one.

The first assumption about SBS is that “low” falls in infants (less than four feet) are not likely to cause skull fractures, subdural hemorrhages, or brain injury.<sup>92</sup> This assumption is relevant to the diagnosis since it allows medical professionals to dismiss an accidental short fall as the cause of the brain injuries often seen in shaken baby

---

*Discussion of Report on ‘Traumatic Retinoschisis in Battered Babies,’* 93 OPTHAMODOLOGY 624–26 (1986).

<sup>89</sup> See Ommaya et al., *supra* note 86, at 227; Duhaime et al., *Nonaccidental Head Injury in Infants*, *supra* note 87, at 1825; Marcus Nashelsky & Jay Dix, *The Time Interval Between Lethal Infant Shaking and Onset of Symptoms: A Review of the Shaken Baby Syndrome Literature*, 16 AM. J. FORENSIC MED. PATHOLOGY 154–57 (1995).

<sup>90</sup> See Ommaya et al., *supra* note 86, at 227; Ann-Christine Duhaime et al., *Head Injury in Very Young Children: Mechanisms, Injury Types, and Ophthalmologic Findings in 100 Hospitalized Patients Younger than 2 Years of Age*, 90 PEDIATRICS 179 (1993); Ann-Christine Duhaime et al., *The ‘Big Black Brian’: Radiographic Changer After Severe Inflicted Head Injury in Infancy*, 100 J. NEUROSURGERY 59 (1993) [hereinafter Duhaime et al., *The Big Black Brain*]; *Nonaccidental Head Injury in Infants*, *supra* note 87, at 1825–26.

<sup>91</sup> See generally Ommaya et al., *supra* note 86, at 227; John Plunkett, *Fatal Head Injuries Caused by Short-Distance Falls*, 22 AM. J. MED. PATHOLOGY 1, 10 (2001); Bandak, *supra* note 16; Barnes et al., *supra* note 17; Duhaime et al., *supra* note 16, at 409–14; Ronald H. Uscinski, *Shaken Baby Syndrome: Fundamental Questions*, 16 BRIT. J. NEUROSURGERY 217, 218 (2002); Smith et al., *supra* note 17, at 700–03.

<sup>92</sup> See D.L. Chadwick et al., *Death from Falls in Children, How Far Is Fatal?*, 31 J. TRAUMA 1353–55 (1991); R.A. Williams, *Injuries in Infants and Small Children Resulting from Witnessed and Corroborated Free Falls*, 31 J. TRAUMA 1350–52 (1991); T.J. Lyons, R.K. Oates, *Falling Out of Bed: A Relatively Benign Occurrence*, 92 PEDIATRICS 125–27 (1993); C. Swalwell, *Head Injuries from Short Distance Falls* 14 AM. J. FORENSIC MED. PATHOLOGY 171–72 (1993); F. Sheridan et al., *Head Injuries from Short Distance Falls*, 14 AM. J. FORENSIC MED. PATHOLOGY 172–73 (1993).

cases. Despite this assumption, clinical studies have demonstrated that a short-distance fall could cause serious head injury or death.<sup>93</sup> Biomechanical studies using animals, adult human volunteers, and models have shown that serious head injuries can occur from a distance as short as two feet.<sup>94</sup> A report conducted at a hospital of seven children treated after an accidental fall of 1.5 to 4.5 feet revealed they suffered subdural hemorrhages.<sup>95</sup> Another study conducted by Dr. John Plunkett included eighteen children who died of a head injury as a result of short fall.<sup>96</sup> In that study, most of the falls occurred at school, on a public playground, or at home.<sup>97</sup> In ten of the cases, the distance of the fall ranged from 1.5 feet to 9 feet.<sup>98</sup> These studies indicate that serious or fatal head injury can occur in short distance falls. Thus, explanation by a caretaker that a short fall caused the head injuries in an infant or young child should not be dismissed by medical professionals.

Another assumption surrounding SBS is that retinal hemorrhages in abused infants are caused directly from repetitive shaking of the head.<sup>99</sup> Many medical professionals assume that SBS is a correct diagnosis merely on the basis of observed retinal hemorrhages alone.<sup>100</sup> In suspected SBS cases, ophthalmologists often examine the child to

---

<sup>93</sup> Plunkett, *supra* note 91, at 8; *see also* J.R. Hall et al., *The Mortality of Childhood Falls*, 29 J. TRAUMA 1273 (1989); G.D. Rieber, *Fatal Falls in Childhood: How Far Must Children Fall to Sustain Head Injury: Report of Cases and Review of the Literature*, 14 AM. J. FORENSIC MED. PATHOLOGY 201 (1993); I. Root, *Head Injuries in Short Distance Falls*, 13 AM. J. FORENSIC MED. PATHOLOGY 85 (1992); B. Wilkins, *Head Injury: Abuse or Accident?*, 76 ARCHIVES DISEASES CHILDREN 393 (1997).

<sup>94</sup> Plunkett, *supra* note 91, at 8; *see also* E.S. Gurdjian et al., *Protection of the Head and Neck in Sports*, 182 J. AM. MED. ASS'N 509, 509–12 (1962); T.E. Reichelderfer et al., *X-ray Playgrounds*, 64 PEDIATRICS 962–63 (1979); E.S. Gurdjian et al., *Tolerance Curves of Acceleration and Intracranial Pressure and Protective Index in Experimental Head Injury*, 6 J. TRAUMA 600–04 (1966).

<sup>95</sup> Plunkett, *supra* note 91, at 8.

<sup>96</sup> *Id.* at 2. The study included children ranging in age from twelve months to thirteen years with a mean age of five years. *Id.* The falls were from horizontal ladders, swings, stationary platforms, and a retaining wall. *Id.*

<sup>97</sup> *Id.*

<sup>98</sup> *Id.*

<sup>99</sup> Ommaya et al., *supra* note 86, at 227.

<sup>100</sup> A.B. Eisenbrey, *Retinal Hemorrhage in the Battered Child*, 5 CHILD'S BRAIN 40–44 (1979); M.J. Greenwald et al., *supra* note 88, at 618–24; N. Rao et al., *Autopsy Findings in the Eyes of Fourteen Fatally Abused Children*, 39 FORENSIC SCI. INT'L 293–99 (1988); S.G. Elner et al., *Ocular and Associated Systemic Findings in Suspected Child Abuse: A Necropsy Study*, 108 ARCHIVES OPHTHALMOLOGY 1094–1101 (1990); D.F. Williams et al., *Posterior Segment Manifestations of Ocular Trauma*, 10 RETINA 535–44 (1990); N.M. Rosenberg et al., *Retinal Hemorrhage*, 10 PEDIATRIC EMERGENCY CARE 303–05 (1994).

determine whether retinal hemorrhages exist. Ophthalmologists may even be asked to give a medical opinion as to whether the existence of the retinal hemorrhages indicates deliberate trauma or accidental trauma.<sup>101</sup> Although it is possible that certain types of retinal hemorrhages are a sign of SBS, “to date there is no evidence that clearly establishes that retinal hemorrhages, be they intraretinal, subretinal, or subhyaloid, are indicative of non-accidental trauma.”<sup>102</sup> Nevertheless, “Evidence does exist, however, that retinal hemorrhages . . . [occur] in experimental as well as clinical situations that are not related to child abuse.”<sup>103</sup> Retinal hemorrhaging occurs “in newborns, in some infant eyes after cataract surgery. . . . in infants with subdural or subarachnoid hemorrhages secondary to accidental trauma, and in infants with . . . hemoglobinopathies.”<sup>104</sup> The validity of the notion that retinal hemorrhages are diagnostic of SBS is undermined by the work of one expert who noted:

[T]he term ‘shaken-baby syndrome’ tends to be automatically applied to any infant with a swollen brain, subdural and retinal bleeding. This label, alleging as it does non-accidental injury, effectively precludes any further discussion of how these clinical features might have been caused, even though all of them, both singly and in combination, may be seen in conditions other than trauma.<sup>105</sup>

Similarly, one researcher also observed that “retinal hemorrhages can be explained by rises in intracranial and central venous pressure, with and without hypoxia,” and “retinal bleeding might result from any event that initiated apnea or significant hypoxia, with brain swelling.”<sup>106</sup> Some

---

<sup>101</sup> Andrea C. Tongue, *The Ophthalmologist’s Role in Diagnosing Child Abuse*, 98 *OPHTHALMOLOGY* 1009, 1009 (1991).

<sup>102</sup> *Id.*

<sup>103</sup> *Id.*; see also Ommaya et al., *supra* note 86, at 227; Plunkett, *supra* note 91, at 4; Barnes et al., *supra* note 17, at 182; Duhaime et al., *supra* note 16, at 410–13; Uscinski, *supra* note 91, at 217–18.

<sup>104</sup> Tongue, *supra* note 101, at 1009.

<sup>105</sup> J.F. Geddes et al., *Dural Hemorrhage and Non-Traumatic Infant Deaths: Does It Explain the Bleeding in ‘Shaken Baby Syndrome’?*, 29 *NEUROPATHOLOGY & APPLIED NEUROBIOLOGY* 14, 14 (2003).

<sup>106</sup> *Id.* at 19–20. See also M.G.F. Gilliland, *Head Injury: Are Brain Edema and Retinal Hemorrhages Associated?*, *National Association of Medical Examiners Annual Meeting*, Oct 20–25, 1995; H.S. Hansen, K. Helmke, *Validation of the Optic Nerve Sheath Response to Changing Cerebrospinal Fluid Pressure: Ultrasound Findings During*



researchers questioned the proposition that retinal hemorrhaging “is proof of” a rotational head injury (shaking). While retinal hemorrhages are “associated with” inflicted head trauma, researchers recognized that there are various causes and mechanisms of infant retinal hemorrhaging other than shaking.<sup>107</sup> The authors of one study noted that “[t]he levels of force required for retinal bleeding by shaking to damage the eye directly is biomechanically improbable. The work of [researchers] also indicates that the role of sudden rise of ICP (increased intracranial pressure) is more likely to cause bleeding than the ‘shaken’ hypothesis.”<sup>108</sup> Medical research revealed that retinal hemorrhaging could not be caused by a rotational head injury in a case involving significant brain swelling and raised intracranial pressure.<sup>109</sup> Since there are many causes for retinal hemorrhages, there is a legitimate challenge to the assumption that they are representative solely of SBS.

Regarding the third assumption, medical professionals who diagnose SBS believe that the time interval between the cause of intentional traumatic brain injury and the onset of signs and symptoms of SBS is always brief.<sup>110</sup> This assumption allows the physician to pinpoint a time

---

*Intrathecal Infusion Test*, 87 J. NEUROSURGERY 34 (1997); T.R. Walsh, *Optic Nerve Sheath Hemorrhages*, 34 AM. J. OPHTHALMOLOGY 509 (1951). Cerebral hypoxia refers to a lack of oxygen supply to the outer part of the brain. “However, the term is often used to refer to a lack of oxygen supply to the entire brain.” A.D.A.M. MEDICAL ENCYCLOPEDIA, <http://www.nlm.nih.gov/medlineplus/ency/article/001435.htm> (last visited Apr. 21, 2012).

<sup>107</sup> At least one researcher recognized that:

[T]he specificity of retinal hemorrhages for child abuse and their dating has been questioned. Such hemorrhages reportedly may be seen with a variety of conditions, including accidental trauma, resuscitation, increased intracranial pressure, increased venous pressure, subarachnoid hemorrhage, sepsis, coagulopathy, certain metabolic disorders, and other conditions.

Patrick D. Barnes, *Ethical Issues in Imaging Nonaccidental Injury: Child Abuse*, 13 TOPICS IN MAGNETIC RESONANCE IMAGING 85, 87 (2002). See also Deborah Tuerkheimer, *Science Dependent Prosecution and the Problem of Epistemic Contingency: A Study of Shaken Baby Syndrome*, 62 ALA. L. REV. 513, 516–17 (2011).

<sup>108</sup> Ommaya, *supra* note 86, at 233. The Ommaya study concluded that the biomechanics of retinal hemorrhages made it highly unlikely that retinal hemorrhaging was caused by severe shaking, and determined its most probable cause to be increased intracranial pressure. *Id.*

<sup>109</sup> *Id.*

<sup>110</sup> *Id.* at 227; see also Duhaime et al., *Nonaccidental Head Injury in Infants*, *supra* note 87, at 1822–29; Nashelsky & Dix, *supra* note 89, at 154–57.

of injury and thus the identity of the caregiver during that time period. Proponents of shaken baby doctrine state lucid intervals, or a period of consciousness between initial injury and death, do not exist in fatal pediatric head injuries.<sup>111</sup> Consequently, the legal burden of proof in SBS cases is largely lifted from the shoulders of prosecutors and transferred to the last-known caregiver. If an infant exhibits symptoms consistent with SBS, and the treating physician can come up with no other cause, the doctor presumes that the caretaker of the child at the time symptoms began is the source of the injuries.

Predicting the time interval between the injury and onset of obvious symptoms is a complicated process. One study noted, “[E]nough variability in the interval between injury and the time of severe symptoms or presentation for medical care in fatally injured children exists to warrant circumspection in describing such an interval for investigators or triers of fact.”<sup>112</sup> Another study observed:

Depth of coma does not necessarily define severity; children can be deeply unconscious after a minor head injury and display neurological signs . . . but recover over minutes to hours, or are not unconscious initially, but develop coma later in the first day with cerebral edema and intracranial hemorrhage.<sup>113</sup>

Clinical studies also show that there can be a symptom-free interval.<sup>114</sup> Thus, a blow to the head through a fall may not manifest immediately.<sup>115</sup> Setting a timetable for infliction of head trauma is pure speculation. Ultimately, minimal data exists substantiating the assumption of SBS proponents that the individual caring for the child when symptoms

---

<sup>111</sup> Duhaime et al., *Nonaccidental Head Injury in Infants*, *supra* note 87, at 1822–29; K.Y. William et al., *Restricting the Time of Injury in Fatal Inflicted Head Injury*, 21 CHILD ABUSE AND NEGLECT 929, 930–40 (1997); C. Jenny & K.P. Hymel, *Recognizing Abusive Head Trauma in Children*, 282 J. AM. MED. ASS’N 1421–22 (1999).

<sup>112</sup> Gilliland, *supra* note 106, at 724.

<sup>113</sup> Barry Wilkins, *Head Injury—Abuse or Accident*, 76 ARCHIVES DISEASE CHILDHOOD 393–97 (1997).

<sup>114</sup> See Christine Bonnier et al., *Outcome and Prognosis of Whiplash Shaken Infant Syndrome; Late Consequences After a Symptom Free Interval*, 37 DEVELOPMENTAL MED. CHILD NEUROLOGY 943–56 (1995); Plunkett, *supra* note 91, at 8. In this study Dr. Plunkett conducted a clinical study of eighteen children who suffered a short distance fall ranging from 1.5 feet to 9 feet and twelve of the children experienced a lucid interval before the onset of unconsciousness due to head injury. Plunkett, *supra* note 89, at 9.

<sup>115</sup> Plunkett, *supra* note 91, at 8.

manifest themselves caused the injuries.

Proponents of SBS also do not believe that a subdural hematoma could spontaneously “re-bleed” without additional trauma. Medical professionals who diagnose SBS do not believe that an infant could suffer subdural bleeding from head trauma, have a period in which the infant seems normal, and then have an onset of symptoms due to a “re-bleed” of the original subdural hematoma. This assumption dovetails with the previous assumption. This scenario is often dismissed because of the belief that the onset of symptoms following head trauma is immediate.<sup>116</sup> When a doctor first evaluates a child with a subdural hematoma, the child might exhibit fresh blood that is mistakenly interpreted by the doctor as evidence of a recent injury.<sup>117</sup> However, doctors have observed fresh blood from old subdural hematomas in adults, indicating that there need not be a recent injury for fresh blood.<sup>118</sup> Neurosurgeons are very much aware of this re-bleeding, and have observed it even when they know definitively that there has not been an accompanying second trauma.<sup>119</sup> Therefore, for an infant presenting with “ostensibly unexplained intracranial bleeding with or without external evidence of injury under given circumstances, accidental injury from a seemingly innocuous fall, perhaps even a remote one, or even an occult birth injury, must be considered before assuming intentional injury.”<sup>120</sup>

The theory of a subdural hematoma re-bleeding is an important one in the context of SBS. If a child suffers minor head trauma (fall, impact, etc.) resulting in asymptomatic subdural bleeding, the subdural hematoma could re-bleed weeks later due to a minor re-trauma. The new trauma could then cause symptoms such as unconsciousness and unresponsiveness; such subdural bleeding is not recent and not caused by SBS. In short, bleeding in the brain of infants is not necessarily caused by recent head injury due to shaking.<sup>121</sup> Clinical cases have shown that

---

<sup>116</sup> Ommaya et al., *supra* note 86, at 227; Duhaime et al., *Nonaccidental Head Injury in Infants*, *supra* note 87, at 1825; Nashelsky & Dix, *supra* note 89, at 154–57.

<sup>117</sup> Uscinski, *supra* note 29, at 59. Dr. Uscinski, a neurosurgeon, observed, “it has also been demonstrated experimentally that chronic subdural hematomas enlarge by rebleeding from the neurovascular membrane and that this bleeding has been shown to occur without accompanying trauma.” *Id.*

<sup>118</sup> *Id.* at 218.

<sup>119</sup> *Id.* at 59.

<sup>120</sup> *Id.*

<sup>121</sup> Ronald H. Uscinski & Dennis K. McBride, *The Shaken Baby Syndrome: An Odyssey—II Origins and Further Hypotheses*, 48 *NEUROLOGIA MEDICO CHIRURGICA* 151, 152 (2008). “Intracranial bleeding . . . has long been recognized as a complication of the

an event can cause subdural bleeding that stops and bleeds again without significant new trauma.<sup>122</sup> Thus, the assumption that a new subdural hemorrhage must be caused by shaking is unreliable.

Research exposes the faulty core assumptions underlying the SBS diagnosis. Head injury research indicates there are reasonable explanations for the triad of symptoms other than shaking.

## II. Biomechanical Studies and Clinical Research Challenge Shaken Baby Syndrome

An increasing number of experts in recent years have criticized SBS and raised concerns about the validity of the syndrome and the clinical studies that led to its acceptance within the pediatric community.<sup>123</sup> Researchers have conducted biomechanical studies and have shown that: (1) shaking alone could not produce enough force to cause the “triad” of SBS symptoms of brain swelling, subdural brain bleeding and retinal bleeding;<sup>124</sup> (2) the triad of symptoms are caused by some form of blunt impact;<sup>125</sup> and, (3) the shaking forces necessary to cause brain injuries would first cause neck and spinal injuries.<sup>126</sup> Research also has shown that, “central nervous system findings that mimic SBS have been reported in accidental trauma and in a number of medical conditions.”<sup>127</sup>

---

birth process.” In fact, subdural bleeding has been found to be “a consequence of head molding at birth” as a result of the baby’s large head passing through the narrow vaginal birth canal. *Id.*

<sup>122</sup> *Id.*

<sup>123</sup> Uscinski, *supra* note 29, at 59–60; Bandak, *supra* note 16, at 76–79; Duhaime et al., *supra* note 16, at 409–14; Plunkett, *supra* note 91, at 8.

<sup>124</sup> See Duhaime et al., *supra* note 16, at 414; Bandak, *supra* note 16, at 76–79.

<sup>125</sup> See Duhaime et al., *supra* note 16, at 414; Bandak, *supra* note 16, at 76–79.

<sup>126</sup> Bandak, *supra* note 16, at 76–79.

<sup>127</sup> Patrick D. Barnes et al., *Infant Acute Life-threatening Event: Dysphagic Choking Versus Nonaccidental Injury*, 17 SEMINARS IN PEDIATRIC NEUROLOGY 7, 10 (2010); see also Glenn A. Tung et al., *Comparison of Accidental and Non-accidental Traumatic Head Injury in Children on Non-contrast Computed Topography*, 118 PEDIATRICS 627–33 (2006); C.W. Christian et al., *Retinal Hemorrhages Cause by Accidental Household Trauma*, 135 J. PEDIATRICS 125–27 (1999); Paul Steinbok et al., *Early Hypodensity of Computed Tomography Scan of the Brain in an Accidental Pediatric Head Injury*, 60 NEUROSURGERY 689–95 (2007); Mattheiu Vichon et al., *Imaging of Head Injuries in Infants: Temporal Correlates and Forensic Implications for the Diagnosis of Child Abuse*, 101 J. NEUROSURGERY 44–52 (2004); P.D. McNeely et al., *Subdural Hematomas in Infants with Benign Enlargement of the Subarachnoid Spaces Are Not Pathognomic for Child Abuse*, 27 AM. J. NEURORADIOLOGY 1725–28 (2006); Kent Hymel et al., *Intracranial Hemorrhages and Rebleeding in Suspected Victims of Abuse Head Trauma:*

Some of the medical conditions that can cause the “triad” of symptoms used in shaken baby diagnosis are “infection, coagulopathy, metabolic disorders, and others.”<sup>128</sup>

A 1987 study at the University of Pennsylvania produced some surprising results. Dr. Ann-Christine Duhaime,<sup>129</sup> and others, conducted a study to test the hypothesis that infants were particularly susceptible to injury from shaking due to a relatively large head and weak neck.<sup>130</sup> The research team concluded that “the shaken baby syndrome, at least in its most severe acute form, is not usually caused by shaking alone. Although shaking may, in fact, be a part of the process, it is more likely that such infants suffer blunt impact.”<sup>131</sup> Ultimately, “shaking alone does not produce the shaken-baby syndrome.”<sup>132</sup> This experiment demonstrated that the biomechanical forces generated by shaking fell well below the thresholds for causing concussions and subdural hematomas.<sup>133</sup> The team determined that shaking alone cannot cause SBS, and that some type of

---

*Addressing Forensic Controversies*, 7 CHILD MALTREATMENT 329–48 (2002); Patrick D. Barnes & Michael V. Krasnokutsky, *Imaging of the Central Nervous System in Suspected or Alleged Non-Accidental Injury, Including the Mimics*, 18 TOPICS MAGNETIC RESONANCE IMAGING 53–74 (2007).

<sup>128</sup> Barnes et al., *supra* note 17, at 181; *see also* Barnes et al., *supra* note 127, at 53–74; Hymel et al., *supra* note 127, at 329–49.

<sup>129</sup> To assist the reader in understanding the significance of this study, Dr. Duhaime’s education and experience are relevant: Dr. Duhaime graduated from Brown University with honors in 1977; she obtained her M.D. degree in 1981 from the University of Pennsylvania. In 1989 she took a position as Assistant Professor in Pediatric Neurosurgery at the Children’s Hospital of Philadelphia (CHOP). While at CHOP, Dr. Duhaime helped to establish the Pediatric Neurotrauma Laboratory. In 2001 Dr. Duhaime took a position as Director of Pediatric Neurosurgery and Pediatric Neuroscience at Dartmouth Hitchcock Medical Center. She is Professor of Neurosurgery at the Dartmouth Medical School. She serves as faculty member of the Dartmouth Epilepsy Program as well as the Norris Cotton Cancer Center, and is the Research Director for the Dartmouth Neurosurgery Residency Program. THE SOCIETY OF NEUROLOGICAL SURGEONS, <http://www.societyns.org/society/bio.aspx?MemberID=5851> (last visited May 2, 2012). Dr. Duhaime has written more than sixty papers for various professional medical journals, such as *Brain Research*, *Pediatrics*, and the *Journal of Neurosurgery*. Jennifer Durgin & Ann-Christine Duhaime, *Brain Trust*, DARTMOUTH MED., Dec. 2005, at 64.

<sup>130</sup> Duhaime et al., *supra* note 16, at 411–12. The researchers used models of one-month-old human babies and used both male and female experimenters to shake the models. *Id.* at 413. They replaced the model’s neck with a hinge to allow maximal angular head accelerations. *Id.* at 412. Accelerometers on the head of the model recorded the linear acceleration of the head caused by the repeated shaking. The researchers also recorded the forces to which the head was subjected. *Id.* at 412–13.

<sup>131</sup> *Id.* at 409.

<sup>132</sup> *Id.*

<sup>133</sup> *Id.*

impact or blunt-force trauma is necessary to produce the brain and retinal injuries associated with the syndrome.<sup>134</sup> The study also demonstrated that a baby would most likely receive a neck injury before it would receive a head injury as a result of shaking.<sup>135</sup>

Another experiment conducted by other researchers tested the theory of whether shaking alone could cause brain injuries by using six-day-old rats.<sup>136</sup> The researchers subjected the rats to intermittent shaking for a period of six seconds followed by a six-second pause.<sup>137</sup> They repeated this method sixty times daily for a period of three days.<sup>138</sup> Even with repeated shaking multiple times a day, they were unable to produce subdural hemorrhages from shaking alone.<sup>139</sup> Only hypoxia<sup>140</sup> combined with shaking the rat in an inverted position resulted in any brain trauma, but without any subdural hemorrhaging.<sup>141</sup> Further experiments with appropriate biomechanical data and neuropathology are required for development of a useful model.<sup>142</sup> While this experiment did not measure the forces on the head of the rat while being shaken, this experiment is useful in its conclusion that shaking alone did not cause any subdural hemorrhaging. This finding is important in challenging the very foundation of the diagnosis since, for decades, subdural hemorrhages have been one of the characteristic signs of SBS.

A number of other researchers also concluded that shaking a baby could not produce the type of acceleration-deceleration forces necessary to cause the injuries associated with SBS.<sup>143</sup> A 2002 study analyzed the biomechanics of pediatric traumatic brain injury (TBI) and diagnostic approaches to this type of injury in young children.<sup>144</sup> This study took a multi-disciplinary approach to studying head injuries in infants and young children in that it included the Departments of Neurosurgery and Mechanical Engineering from diverse universities.<sup>145</sup> It considered the

---

<sup>134</sup> *Id.*

<sup>135</sup> *Id.*

<sup>136</sup> Smith et al., *supra* note 17, at 695.

<sup>137</sup> *Id.* at 695.

<sup>138</sup> *Id.*

<sup>139</sup> *Id.* at 701.

<sup>140</sup> *See supra* note 110.

<sup>141</sup> Smith et al., *supra* note 17, at 701.

<sup>142</sup> Ommaya et al., *supra* note 86, at 223.

<sup>143</sup> *Id.* at 220.

<sup>144</sup> *Id.* at 220–21.

<sup>145</sup> *Id.* at 220 (relying on research subjects from George Washington University Medical Center, University of California, Berkeley, and Drexel University); *see also* Bandak,

principles of biomechanics and the role those principles play in predicting the causation of head injuries in young children. The study explained that the “causation of TBI can occur either by impact or by impulsive loading (shaking) which lead to different results.”<sup>146</sup> The researchers proffered that because an infant skull is not a “rigid shell structure,” when impacted, the infant skull will become “deformed.”<sup>147</sup> The deformation would then result in “various types of skull fractures.”<sup>148</sup> The shape changes of an infant skull produce enormous strain throughout the cranium and its contents even without actual skull fractures.<sup>149</sup> In contrast, “shaking would produce minimal deformation of the infant skull” but would cause displacement of the brain, skull, spinal cord, and neck.<sup>150</sup> In addition to questioning the underlying physics of pediatric TBI, this study observed that the acceleration-deceleration forces necessary to cause a head injury by violently shaking an infant would result in severe damage to the neck and spinal cord. The study concluded:

Thus, while it is possible to produce trauma in an infant by shaking, e.g., a SDH . . . particularly when shaking is prolonged and repeated at intervals, the injuries would include the cervical cord and spine, but not the brain case, nor contusions in the cerebrum or cerebellum if no impact was also imposed. It is far more likely that impacts due to falls and other causes are more probable at producing TBI by short duration impulsive loading.<sup>151</sup>

In 2005, Dr. Faris A. Bandak<sup>152</sup> conducted a biomechanical analysis

---

*supra* note 16, at 71–72 (stating that an infant head impacting on a flat, hard surface produces an indentation of the skull which then impinges on the brain causing brain deformations and pressures on the infant brain).

<sup>146</sup> Ommaya et al., *supra* note 86, at 223.

<sup>147</sup> *Id.*

<sup>148</sup> *Id.*

<sup>149</sup> *Id.*

<sup>150</sup> *Id.* at 223, 225.

<sup>151</sup> *Id.* at 226.

<sup>152</sup> Faris Bandak, Ph.D., is an expert in head injury causation & mechanisms. He served as a defense expert consultant for the author in the alleged shaken baby case of *United States v. Specialist Claude Morings*, Fort Bliss, Texas in 2008, which resulted in an acquittal. He currently serves as a research professor in the Department of Neurology at F. Edward Hebert School of at the Uniformed Services University of Health Sciences. He also has held the positions of National Expert in Injury Biomechanics and Director of Head Injury Research at the U.S. Department of Transportation. He has authored over 80

of the consequences of shaking an infant to determine if the fragile infant neck could withstand the SBS-defined forces without injury.<sup>153</sup> He proposed that any SBS analysis requires knowledge and training in what is known as Injury Biomechanics, a distinct discipline not taught in medical school.<sup>154</sup> He even stated that the “[I]lack of education and experience in Injury Biomechanics, amongst other factors, has led in practices to the proliferation and propagation of inaccurate and sometimes erroneous information on SBS injury in the literature.”<sup>155</sup> In evaluating the forces imposed on an infant neck caused by violent shaking,<sup>156</sup> Dr. Bandak studied the velocity levels cited in a shaken baby article written by Dr. Carol Jenny and others.<sup>157</sup> Essentially, Dr. Bandak used the study’s data, which measured the amount of force required to shake an infant hard enough to cause retinal hemorrhaging, subdural hematomas, and brain edema, and evaluated the effects such forces would have on an infant’s neck. His study resulted in several important findings regarding the injury mechanisms of SBS. Some of the most important conclusions of Dr. Bandak’s study are:

Head acceleration and velocity levels commonly reported for SBS generate forces that are far too great for the infant neck to withstand injury.

. . . .

Given that cervical spine injury is reported to be a rare clinical finding in SBS cases, the results of this study indicate an SBS diagnosis in an infant with intracerebral

---

publications including books and book chapters on the biomechanics of traumatic brain injury (Faris Bandak’s *curriculum vitae* is on file with author).

<sup>153</sup> Bandak, *supra* note 16, at 73 *Biomechanics & Neuropathology of Head Injury*, 76.

<sup>154</sup> *Id.* at 71. “[Injury] biomechanics is the subset of Mechanics that deals with the forces, motions, deformations, ruptures, fractures, [and] breaks of living tissue.” *Id.* at 79. It “is the application of Biomechanics to the understanding of causation and mechanism of injury.” *Id.* Dr. Bandak’s position is that injury biomechanics is central to the study of the mechanisms of injury in SBS. *Id.* at 71.

<sup>155</sup> *Id.* at 72.

<sup>156</sup> The forces caused in shaken baby cases is often compared to forces that are equal to a fall from a height as high as thirty feet onto a hard surface or from high speed motor vehicle crashes. *Id.* at 76; Duhaime et al., *supra* note 89, at 179–85. These assertions of Shaken Baby Syndrome have not been substantiated biomechanically with some reports refuting their validity at all. *Id.*; Duhaime et al., *supra* note 16, at 409–15; Michael Prange et al., *Anthropomorphic Simulations of Falls, Shakes and Inflicted Impacts in Infants*, 99 J. NEUROSURGERY 143–50 (2003).

<sup>157</sup> Bandak, *supra* note 16, at 78.



[injury] but without cervical spine or brain stem injury is questionable and other causes of the intracerebral injury must be considered.

....

Cervical spine and/or brain stem injury should be included amongst the factors considered in the determination of consistency of reported history in cases where infant shaking is suspected. It should be kept in mind that such injury is not exclusive to shaking as the sole mechanical cause. Traumatic shaking is just one of the causes.<sup>158</sup>

Dr. Bandak's study highlighted the important fact that the amount of force necessary to cause the injuries for a shaken baby diagnosis would cause serious injury to an infant's neck before it would cause retinal hemorrhaging or subdural brain bleeding.<sup>159</sup> Yet, neck injuries are never mentioned as part of the triad of symptoms of SBS.<sup>160</sup> Ultimately, Dr. Bandak concluded that in light of his findings, the diagnostic criteria for SBS should be re-evaluated.<sup>161</sup> The inference that can be drawn from Dr. Bandak's study is that before a medical professional renders a shaken baby diagnosis, a neck injury should be made part of the diagnostic criteria.

One significant biomechanical study demonstrated that the classic triad of SBS symptoms occurred in cases of accidental trauma.<sup>162</sup> The study involved a twenty-one month old boy brought to an emergency room and diagnosed with bilateral retinal hemorrhages with retinal folds and subdural hemorrhages.<sup>163</sup> A computed tomography (CT) scan of the cervical spine, conducted prior to death, showed no injuries to the spine.<sup>164</sup> The caretaker's history that the young child fell onto a tiled floor from a standing position on a kitchen chair while eating was believed to be inconsistent with the physical injuries; the child died

---

<sup>158</sup> *Id.*

<sup>159</sup> *Id.* at 73. Ommaya et al., *supra* note 86, at 76.

<sup>160</sup> *Id.*

<sup>161</sup> *Id.* at 79.

<sup>162</sup> Barnes et al., *supra* note 17, at 178.

<sup>163</sup> *Id.* There was no other evidence of traumatic injury upon physical examination. *Id.*

<sup>164</sup> *Id.* at 179.

forty-four hours after the fall.<sup>165</sup> Treating physicians diagnosed the young boy as having suffered non-accidental injury and SBS.<sup>166</sup> The researchers considered the medical examiner's report in conjunction with a court-approved biomechanical evaluation. A post-mortem CT scan of the neck and spine revealed multilevel compression fractures of varying degrees.<sup>167</sup> The researchers noted, "[i]t is problematic, biomechanically, to conclude that such an injury can result from 'SBS', particularly in a child of this age and size."<sup>168</sup> The autopsy also revealed soft-tissue hemorrhages in the neck and shoulder regions and disruption of the central spinal cord near the medulla area of the brain.<sup>169</sup> The biomechanical examination included an investigation of the home where the injury occurred.<sup>170</sup>

The biomechanics specialist analyzed a number of potential accidental scenarios to address the thoracic spinal injuries and the cervical cord injury.<sup>171</sup> The biomechanical analysis assumed the caretaker's history was accurate and applied the principle of mechanics to determine whether such a history was consistent with the child's injuries.<sup>172</sup> A biomechanical analysis determined that "[t]he gross and histological findings, as well as the imaging findings, [were] entirely consistent with the caretaker history of a household fall as corroborated by the biomechanical evaluation."<sup>173</sup> Unfortunately, the initiation of criminal proceedings occurred prior to the completion of a thorough medical evaluation.<sup>174</sup> The treating physicians attributed the injuries to SBS before the brain and spinal cord injuries were thoroughly evaluated.<sup>175</sup> Fortunately, upon consideration of all of the forensic

---

<sup>165</sup> *Id.* at 178.

<sup>166</sup> *Id.*

<sup>167</sup> *Id.* at 180. "Multiple anterior compression fractures of the thoracic spine, as reported in this case, are uncommon. The mechanism most consistent with this type of injury, however, would be severe flexion and/or axial compression of the spine." *Id.* at 181.

<sup>168</sup> *Id.*

<sup>169</sup> *Id.*

<sup>170</sup> *Id.*

<sup>171</sup> *Id.*

<sup>172</sup> *Id.* The caretaker reported that his back was turned at the time of the incident but that the boy had been standing up on the seat of a chair. *Id.* The caretaker then heard a noise and turned to find the boy and the chair on the floor, with the chair lying on its back. *Id.* It was assumed that the boy struck the floor first with his head and then his neck and shoulder, based on the autopsy findings. *Id.*

<sup>173</sup> *Id.* at 182.

<sup>174</sup> *Id.* at 181.

<sup>175</sup> *Id.*

evidence at trial, the jury acquitted the child's father.<sup>176</sup>

Clinical studies of children suspected to be victims of non-accidental head injuries also found that a significant number of the children exhibited neck injuries and other physical signs of abuse. One study examined the occurrence of spinal injuries, through magnetic resonance imaging (MRI), of infants with non-accidental head injuries.<sup>177</sup> The study included eighteen infants with non-accidental head injuries between 2000 and 2007 using images of the brain and the spine.<sup>178</sup> The researchers found that eight (44%) of the infants had spinal injuries coupled with subdural hematomas.<sup>179</sup> Additionally, three out of the eight children with spinal injuries also had skull fractures.<sup>180</sup> Five of the ten children without spinal injuries also suffered skull fractures.<sup>181</sup> This clinical study demonstrates that spinal fractures/injuries are a well-recognized feature of children who are suspected to be victims of non-accidental head injury. However, it is not considered common manifestation and is not included within the triad of injuries presumed to be “diagnostic” of SBS.<sup>182</sup> Spinal pathology in a brain-injured child is often difficult to recognize clinically since it is not detectable in a normal x-ray.<sup>183</sup> Typically, these types of injuries are only detectable through a complete spinal MRI or an autopsy. Spinal injuries may be more common than is currently believed by many in the medical community. A study in 1989 found that five of six children diagnosed with subdural hematomas, caused by non-accidental head injury, had cervical spinal hematomas; four had spinal contusions.<sup>184</sup> In another study, the post-mortem

---

<sup>176</sup> *Id.* at 180.

<sup>177</sup> Koumellis et al., *supra* note 19, at 216–19. The study included eleven males and seven females ranging in age from one to twelve months with a mean age of three months. All infants were referred to the local child protection services and proceeded through criminal legal proceedings. The diagnosis of all infants was confirmed as non-accidental head injury. *Id.*

<sup>178</sup> *Id.* at 216.

<sup>179</sup> *Id.*

<sup>180</sup> *Id.* at 217.

<sup>181</sup> *Id.*

<sup>182</sup> *Id.* at 218.

<sup>183</sup> *Id.*; Eilish Twomey et al., *Multiple Thoracic Vertebral Compression Fractures Caused by Non-accidental Injury: Case Report with Radiological Pathological Correlation*, 34 PEDIATRIC RADIOLOGY 665–68 (2005); R.C. Sneed, S.L. Stover, *Undiagnosed Spinal Cord Injuries in Brain-Injured Children*, 142 AM. J. DISEASES CHILDREN 965–67 (1988).

<sup>184</sup> Kenneth Feldman et al., *Cervical Spine MRI in Abused Infants*, 21 CHILD ABUSE NEGLECT 199–205 (1997). These findings were discovered during a post mortem examination of the children. *Id.*

examination of the spine was conducted on eight children.<sup>185</sup> Two of the children were suspected to be victims of non-accidental head injury and six of the children exhibited no signs of trauma.<sup>186</sup> Spinal injuries were found in the two children suspected of being victims of abuse and none were observed in the other six children.<sup>187</sup> The significance of these studies is that they demonstrate the correlation between head injuries and spinal injuries in cases of abuse. In other words, there is other physical evidence of shaking, impact, or abuse to support the diagnosis of non-accidental head injury.

The criticisms aimed at SBS question not only the underlying basis for the hypothesis, but also the scientific methodology used in the “research” which created the SBS diagnosis.<sup>188</sup> A recent article published in the *American Journal of Forensic Medicine Pathology* carefully scrutinized the quality of the evidence used in shaken baby research from 1966 through 1998, and determined that the research failed to meet accepted standards for scientific validity.<sup>189</sup> After conducting an exhaustive review of the research, the author noted the lack of quality involved in most of the research, which for years, had been used as “evidence” to support the SBS hypothesis.<sup>190</sup> Ultimately, there is a

---

<sup>185</sup> G.N. Ruttly et al., *Epidural Haemorrhage of the Cervical Spinal Cord: A Post-mortem Artifact?*, 31 NEUROPATHOLOGY APPLIED NEUROBIOLOGY 247–57 (2005).

<sup>186</sup> *Id.*

<sup>187</sup> *Id.*

<sup>188</sup> Mark Donohoe, *Evidence-Based Medicine and the Shaken-Baby Syndrome, Part 1: Literature Review, 1966 Biomechanics & Neuropathology of Head Injury, 1998*, 24 AM. J. FORENSIC MED. & PATHOLOGY 239 (2003).

<sup>189</sup> *Id.*

<sup>190</sup> Donohoe concluded:

There exists major data gaps in the medical literature about SBS. There is a very obvious lack of clear definition of cases. For valid studies, some method of determining cases of actual proven shaking must be found, and appropriate control groups (trauma without shaking, other illness, health controls) must be defined and assessed blindly. This gold standard has yet to be achieved in even a single study in the field of SBS. There is a lack of useful and specific laboratory or other markers proven to identify SBS. There is poor definition and quantification of the social and family risk factors to provide guidance on the likelihood of abuse for a given set of circumstances. Last, there is a strong need for a check list or other diagnostic or management tool to assess cases and to quantify index of suspicion of shaking.

*Id.* at 241.

significant group of researchers who have conducted clinical and biomechanical studies on the assumptions of SBS. These studies reveal the lack of scientific basis and flawed methodology in SBS. They also expose the invalidity and unreliability of the SBS diagnosis. Those accused of SBS must struggle with the legal community's misunderstanding and ignorance of the utter lack of validity of the diagnosis. Unfortunately, the burden often falls to those accused of SBS to prove their innocence and educate the system about the unreliability of an SBS diagnosis.

### III. Admissibility of Expert Testimony

#### A. Evolution of the Current Federal Admissibility Standard

Until the 1990s, the standard for the admissibility of scientific and other expert testimony stemmed from the case of *Frye v. United States*.<sup>191</sup> Under the *Frye* standard, courts could admit expert testimony only if it was based on scientific principles "generally accepted" in the applicable scientific community.<sup>192</sup> In *Frye*, the trial court needed to determine whether to admit evidence of a systolic blood pressure test, a novel scientific development in 1923.<sup>193</sup> The Court articulated the admissibility standard by stating,

Just when a scientific principle or discovery crosses the line between the experiential and demonstrable stage is difficult to define. Somewhere in this twilight zone, the evidential force of the principle must be recognized and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.<sup>194</sup>

Since the systolic blood pressure test had not gained general acceptance

---

<sup>191</sup> 293 F. 1013 (D.C. Cir. 1923).

<sup>192</sup> *Id.* at 1014.

<sup>193</sup> Elaine Sutherland, *Undue Deference to Experts Syndrome?*, 16 *IND. INT'L & COMP. L. REV.* 375, 410 (2006).

<sup>194</sup> *Frye*, 293 F.1013 at 1014.

within the physiological and psychological communities, the court ruled evidence of its results inadmissible.<sup>195</sup>

Decades later, the Supreme Court shifted the standard of admissibility of expert testimony in the case of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*<sup>196</sup> The case centered around two minor children who alleged that their birth defects were the result of their mothers ingesting an anti-nausea drug known as Bendectin during pregnancy.<sup>197</sup> The issue in *Daubert* was whether the children could prove that a link existed between Bendectin, a drug manufactured by Merrell Dow, and their birth defects. The district court granted summary judgment for Merrell Dow and held that the children failed to demonstrate the generally acceptability of the expert's opinion as a reliable technique as required by the *Frye* test.<sup>198</sup> The appeals court affirmed.<sup>199</sup> The children appealed to the Supreme Court and argued that the Federal Rules of Evidence (FRE) now controlled the standard of admissibility of expert testimony.<sup>200</sup> The Supreme Court agreed with the plaintiffs and held that FRE 702 superseded *Frye*.<sup>201</sup> In reaching this decision, the Court found that the *Frye* standard was absent from the Federal Rules of Evidence and should not be applied in federal trials.<sup>202</sup> The Court further held that FRE 702 placed sufficient limits on the admissibility of scientific evidence, and that trial judges must ensure that an expert's testimony is both relevant and reliable.<sup>203</sup> The Court placed upon a trial judge the role of "gatekeeper" to ensure that expert scientific testimony satisfied the standards set out in FRE 702.<sup>204</sup>

---

<sup>195</sup> *Id.*

<sup>196</sup> 509 U.S. 579 (1993).

<sup>197</sup> *Id.* at 582.

<sup>198</sup> *Id.* at 584.

<sup>199</sup> *Id.*

<sup>200</sup> *Id.* at 587. *Frye* predated the Federal Rules of Evidence by half a century. The *Daubert* Court noted that "[i]n *United States v. Abel*, 469 U.S. 45 (1984), we considered the pertinence of background common law in interpreting the Rules of Evidence. We noted that the Rules occupy the field." *Id.*

<sup>201</sup> *Id.* at 582. FED. R. EVID. 702 ("If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education, may testify thereto in the form of an opinion or otherwise.").

<sup>202</sup> *Daubert*, 509 U.S. at 589.

<sup>203</sup> *Id.*

<sup>204</sup> *Id.*

The *Daubert* court went on to set forth various guidelines to assist the trial court in determining whether the evidence is based on “scientific knowledge.” The Supreme Court listed six factors a trial judge should consider, as the gatekeeper, in determining whether scientific evidence satisfies the requirements for reliability and relevance: (1) whether the theory or technique can be tested, (2) whether the theory or technique has been subject to peer review and publication, (3) the “known or potential” error rate, (4) the existence and maintenance of standards controlling the technique’s operation, (5) the degree of acceptance within the relevant scientific community, and (6) whether the probative value of the evidence is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury.<sup>205</sup> The Court specifically emphasized that the inquiry envisioned by FRE 702 is a “flexible one.”<sup>206</sup> Federal Rule of Evidence 702 ensures the relevance, reliability, and scientific validity of proffered evidence by focusing on the methodology of the science.<sup>207</sup>

Subsequent federal court decisions seemed to construe the *Daubert* decision as having lowered the standard of admissibility for scientific evidence.<sup>208</sup> In *Borawick v. Shay*,<sup>209</sup> the Second Circuit wrote, “[B]y loosening the strictures on scientific evidence set by *Frye*, *Daubert* reinforces the idea that there should be a presumption of admissibility of evidence.”<sup>210</sup> In *United States v. Bonds*,<sup>211</sup> the Sixth Circuit explained “that the DNA testimony easily meets the more liberal test set out by the Supreme Court in *Daubert*.”<sup>212</sup> Surprisingly, in *United States v. Posado*,<sup>213</sup> the Fifth Circuit stated, “[T]he rationale underlying this circuit’s per se rule against admitting polygraph evidence did not survive *Daubert*.”<sup>214</sup> The *Daubert* decision established a liberal and flexible

---

<sup>205</sup> *Id.* at 593–95.

<sup>206</sup> *Id.* at 597.

<sup>207</sup> *Id.* at 595. Subsequent federal court decisions seemed to construe the *Daubert* decision as having lowered the standard of admissibility for scientific evidence. See Paul C. Giannelli, *Daubert Revisited*, 41 CRIM. L. BULL. 5 (2005). In *Borawick v. Shay*, the Second Circuit wrote, “by loosening the strictures on scientific evidence set by *Frye*, *Daubert* reinforces the idea that there should be a presumption of admissibility of evidence.” 68 F.3d 597, 610 (2d Cir. 1995).

<sup>208</sup> Giannelli, *supra* note 207, at 5.

<sup>209</sup> 68 F.3d 597 (2d Cir. 1995).

<sup>210</sup> *Id.* at 610.

<sup>211</sup> 12 F.3d 540 (6th Cir. 1993).

<sup>212</sup> *Id.* at 568.

<sup>213</sup> 57 F.3d 428 (5th Cir. 1995).

<sup>214</sup> *Id.* at 429.

standard of admissibility for expert scientific evidence.

A few years later, the Supreme Court expanded the *Daubert* test to non-scientific evidence in the case of *Kuhmo Tire Co. v. Carmichael*.<sup>215</sup> The Court concluded that “*Daubert’s* general holding setting forth the trial judge’s general ‘gatekeeping’ obligation applied not only to testimony based on ‘scientific’ knowledge, but also to testimony based on ‘technical’ and ‘other specialized’ knowledge.”<sup>216</sup> The Court further held that the *Daubert* factors were not an exclusive checklist, and should be applied in a flexible manner.<sup>217</sup> The Court also explained that the factors a court should consider in determining whether to apply the *Daubert* factors are the nature of the case, the expert’s particular expertise, and the subject of his testimony.<sup>218</sup> The Court found that the problem in this case was not the reliability of the expert witness’s methodology, but whether he used that methodology in a way that enabled him to reliably determine why the tire failed.<sup>219</sup> As a result of this decision, the Court made clear that expert opinion testimony from a non-scientist should receive the same reliability scrutiny as opinion testimony from a “scientific” expert.

#### B. Admissibility of Expert Testimony in Military Courts-Martial

In military courts-martial, MRE 702 dictates the factors upon which military judges must rely in determining that admissibility of expert testimony.<sup>220</sup> Military Rule of Evidence 702, like its federal counterpart,

---

<sup>215</sup> 526 U.S. 137 (1999). A car driven by Carmichael blew a tire and the vehicle overturned, killing one passenger and injuring others. The survivors and the decedent’s representative filed a suit against the tire’s maker and distributor, claiming that the failed tire was defective. The issue in the case was the reliability of the plaintiff’s expert witness who intended to testify that a defect in the tire’s manufacture or design caused the blowout. *Id.*

<sup>216</sup> *Id.* at 138.

<sup>217</sup> *Id.*

<sup>218</sup> *Id.*

<sup>219</sup> *Id.* at 139.

<sup>220</sup> MANUAL FOR COURTS-MARTIAL, UNITED STATES, MIL. R. EVID. 702 (2008) [hereinafter MCM]. Military Rule of Evidence 702 replaced paragraph 138(e). MANUAL FOR COURTS-MARTIAL, UNITED STATES ¶138(e) (rev. 1969). Paragraph 138(e) defined an expert witness as “one who was skilled in some art, trade, profession or science or who had specialized training or experience in relation to matters which are not generally within the knowledge of men of common education and experience.” *Id.* Before being allowed to express his opinion, the proponent would have to demonstrate that the witness



was amended in response to the Supreme Court's opinions in *Daubert v. Merrell Dow Pharmaceuticals Inc.* and *Kuhmo Tire Co. v. Carmichael*. The current MRE 702 has been interpreted as permitting greater admissibility of expert testimony than was the case under previous court-martial practice and the 1969 Manual.<sup>221</sup> The 2004 amendment to the Rule codifies the approach of *Daubert* and *Kumho*; it does not codify the *Daubert* factors. The drafters intentionally excluded the *Daubert* factors because the Court itself does not see the factors as exclusive or dispositive.<sup>222</sup> The Drafters' Analysis indicates that they did not intend for the Rule to eliminate all previous *Manual* constraints, and should not be interpreted as an indication that previously inadmissible expert or opinion testimony is now automatically admissible.<sup>223</sup> Rule 702's language provides that military judges must scrutinize the principles and methods used by the expert; they must also determine whether those principles and methods were applied properly to the facts of the case.<sup>224</sup>

The Court of Appeals for the Armed Forces established that MRE 702 dictates the admissibility of expert testimony while also recognizing the "gatekeeping" role of military judges as established by the Supreme

---

was an expert in the specialty. The expert may be required to specify the data upon which he based his opinion and to relate the details of his observation, examination or study.

<sup>221</sup> *United States v. Kyles*, 20 M.J. 571 (N.M.C.M.R. 1985). The Navy-Marine Court of Military Review recognized that these rules were designed to broaden the admissibility of expert testimony but only when they will assist the finder of fact in understanding an important trial issue. *See also* MCM, *supra* note 220, MIL. R. EVID. 702 analysis, at A22–50 (noting that the current rule may be "broader and may supercede *Frye v. United States*").

<sup>222</sup> STEPHEN A. SALTZBURG ET AL., *MILITARY RULES OF EVIDENCE MANUAL* § 702.4 (6th ed. 2009).

<sup>223</sup> *Id.*

<sup>224</sup> *Kuhmo Tire Co. v. Carmichael*, 526 U.S. 137, 139 (1999). Military Rule of Evidence 702 states:

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

MCM, *supra* note 220, MIL. R. EVID. 702.

Court in *Daubert*.<sup>225</sup> Military judges are authorized to use the four factors outlined in *Daubert* in determining the reliability of expert testimony.<sup>226</sup> In determining if an expert is qualified to testify, military judges are encouraged to use the factors outlined in *United States v. Houser*<sup>227</sup>: (1) the qualifications of the expert, (2) the subject matter of the expert testimony, (3) the basis for the expert testimony, (4) the legal relevance of the evidence, (5) the reliability of the evidence, and (6) that the probative value of the expert's testimony outweighs the other considerations outlined in MRE 403.<sup>228</sup> While *Houser* slightly predates *Daubert* and *Kuhmo Tire Co.*, it is "consistent with later cases, and this Court has continued to use the *Houser* factors in analyzing the admissibility of expert testimony."<sup>229</sup> While satisfying every *Daubert* or *Houser* factor is sufficient, it is not necessary for establishing the admissibility of expert testimony.<sup>230</sup> As the *Daubert* court stated, the test of reliability is "flexible," and the factors are not a definitive list.<sup>231</sup>

The focus for military judges is on the objective of the gate-keeping requirement to ensure that the expert "employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field."<sup>232</sup> The military judge is required to determine whether his conclusions could follow from the facts known to the expert and the methodology used by the expert.<sup>233</sup>

---

<sup>225</sup> See *United States v. Sanchez*, 65 M.J. 145, 149 (C.A.A.F. 2007); *United States v. Billings*, 61 M.J. 163, 167 (C.A.A.F. 2005).

<sup>226</sup> See *Sanchez*, 65 M.J. at 149. The Court of Appeals for the Armed Forces (CAAF) cited the four *Daubert* factors, outlined by the Supreme Court, which a trial judge "may" use to determine the reliability of expert testimony. The CAAF also stated, "This Court has often cited the *Daubert* factors, along with those in *Houser* as firm ground upon which a military judge may base a decision." *Id.* (citation omitted).

<sup>227</sup> 35 M.J. 392, 397 (C.M.A. 1993).

<sup>228</sup> *Id.*

<sup>229</sup> *Billings*, 61 M.J. at 166; see, e.g., *United States v. Dimberio*, 56 M.J. 20, 26 (C.A.A.F. 2001); *United States v. Griffin*, 50 M.J. 278, 284 (C.A.A.F. 1999).

<sup>230</sup> *Sanchez*, 65 M.J. at 149.

<sup>231</sup> *Id.*; see also *Daubert v. Merrell Dow Pharms., Inc.* 509 U.S. 579, 593-94 (1993).

<sup>232</sup> *Sanchez*, 65 M.J. at 149 (citing *Kuhmo Tire Co. v. Carmichael*, 526 U.S. 137, 152 (1999)).

<sup>233</sup> *Id.*

IV. Application of *Daubert* and MRE 702 to Shaken Baby Syndrome Testimony

A medical doctor's diagnosis of a particular ailment does not, by itself, make the diagnosis reliable for purposes of admissibility under MRE 702. Such a conclusion is especially true in the area of child abuse medicine where no medical tests exist to determine the actual cause of injuries or whether those injuries are intentional, accidental, or caused by a mechanism other than accidental injury or trauma. The fundamental purpose of medicine is treatment; this purpose does not necessarily translate to the purpose of the legal process. The judicial process attempts to get to the truth for the underlying purpose of resolving societal disagreements, whether civil or criminal. Criminal law imposes upon the government the additional burden of proving guilt beyond a reasonable doubt to ensure that someone's liberty is not taken by mistake, accident, or negligence.

Medicine, on the other hand, seeks treatment of physical ailments. Medical professionals accomplish this by diagnosing an illness and applying scientific principles to treat the illness. Often, scientific approximations are accepted because it allows the doctor to try to understand the medical condition, assess a prognosis, and plan treatment. If the diagnosis is incorrect, the doctor reexamines the situation, makes a new diagnosis, and creates a treatment plan based upon the altered diagnosis. Medicine uses a scientific process of elimination to evaluate patient data in order to differentiate disorders that may have similar manifestations.<sup>234</sup> The medical world of probabilities, and trial and error in diagnosing a patient, contradicts the burden of proof required in the legal arena. Thus, allowing expert medical testimony into a courtroom can be dangerous, especially in the area of SBS. The shaken baby diagnosis *assumes* a conclusion about a caregiver based on the lack of an explanation for an infant's injuries. Non-neutral, corroborating medical findings must exist to ensure this testimony is reliable and unambiguous to the fact-finder.

---

<sup>234</sup> This process is referred to as a differential diagnosis. A differential diagnosis is the "determination of which two or more diseases with similar symptoms is one from which the patient's suffering, by a systematic comparison and contrasting of the clinical findings." *STEDMAN'S MEDICAL DICTIONARY* 428 (William R. Hensyl ed., Williams & Wilkins 25th ed. 1990) (1911). This process often involves a systematic process of exclusion in which is done by "excluding those diseases to which some of the patient's symptoms belong, leaving only one disease to which all symptoms point." *Id.*

The application of the *Daubert* factors to a triad-only case of suspected SBS exposes the unreliability of an SBS diagnosis and its lack of admissibility under MRE 702.<sup>235</sup> A hypothetical case of a triad-only SBS case is one in which an infant presents to a hospital or emergency medical services (EMS) and is unresponsive and not breathing. Upon evaluation, the infant is diagnosed as having retinal hemorrhaging, subdural hemorrhaging, and brain edema (swelling). The infant does not exhibit any external signs of physical trauma/abuse, such as bruising, nor will the infant have any skin redness due to head impact or from being gripped around the torso and shaken. A CT scan will reveal that there are no skull fractures; x-rays will be negative for rib fractures and long bone fractures. The last known caretaker will report a history which doctors will determine is inconsistent with the injuries observed. The treating pediatrician will render a diagnosis of SBS; a criminal investigation will proceed.

Application of the *Daubert* factors to the above hypothetical SBS case demonstrates that shaken baby testimony fails to satisfy the *Daubert* factors for admissibility of expert testimony.<sup>236</sup> The relevant factors are as follows:

- (1) Whether the theory or technique can be and has been tested;
- (2) Whether it has been subjected to peer review and publication;
- (3) Whether, in respect to a particular technique, there is even a known or potential rate of error;
- (4) The existence and maintenance of standards controlling the technique's operation;

---

<sup>235</sup> While military defense counsel may challenge the admissibility of an SBS diagnosis under *Daubert*, there are no reported military cases on this issue. There are several reported cases involving a SBS diagnosis but the appellate issues in those cases do not involve a *Daubert* challenge to the admissibility of SBS expert testimony. See *infra* note 277.

<sup>236</sup> Other authors have examined SBS in light of *Daubert* but, in doing so, relied upon different studies than this article and did not propose the creation of a new rule of evidence as a remedy to rectify the failure to SBS to satisfy the standards set out in *Daubert*. See Genie Lyons, *Shaken Baby Syndrome: A Questionable Scientific Syndrome and a Dangerous Legal Concept*, 2003 UTAH L. REV. 1109, 1126–30.

(5) Whether the theory or technique enjoys general acceptance within a relevant scientific community; and,

(6) Whether the probative value of the evidence is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury.<sup>237</sup>

The first of the *Daubert* factors is whether the theory can be tested and if so, whether the results corroborate or rebut the theory.<sup>238</sup> While clinical studies have been conducted which support the theory of SBS, they are scientifically flawed.<sup>239</sup> In many clinical studies, researchers chose subjects based upon the presence of subdural hematomas and retinal hemorrhages with little investigation into other possible causes of these injuries. Researchers “selected cases by the presence of the very clinical findings and test results they [sought] to validate as diagnostic.”<sup>240</sup> In other words, the researchers studied cases of children with the very “triad” of injuries they sought to verify and then simply concluded that the infants were shaken.

A scientific theory may be disproved by a single correctly run experiment, no matter how many prior experiments tend to corroborate the original theory.<sup>241</sup> Several studies, not just one, have tested the validity of the shaken baby diagnosis and have proven it to be an incorrect theory.<sup>242</sup> The nature of SBS prevents it from being literally tested. It would be illegal and unethical for a medical professional to shake infants or young children to determine the resulting injuries. Rather, medical professionals have used clinical studies of head-injured children and whip-lashed monkeys in an attempt to study the shaken baby diagnosis.<sup>243</sup> Recent clinical and biomechanical testing and studies

---

<sup>237</sup> *Daubert*, 509 U.S. at 595.

<sup>238</sup> According to *Daubert*, “[s]cientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry.” *Id.* at 593.

<sup>239</sup> Tuerkheimer, *supra* note 1, at 6 (recognizing the work of Patrick Barnes and Mark Donohoe in applying the “evidence-based medicine” standards to SBS methodology and exposing the flaws of the diagnosis). *See also* Donohoe, *supra* note 186.

<sup>240</sup> *Id.* (quoting Donohoe, *supra* note 188, at 239).

<sup>241</sup> J.F. Geddes has shown that retinal hemorrhaging is not a marker of shaking a baby. J.F. Geddes et al., *Neuropathy of Inflicted Head Injury in Children I: Patterns of Brain Damage*, 124 *BRAIN* 1290 (2001); *see also* Plunkett, *supra* note 91, at 1.

<sup>242</sup> *See supra* Part III.

<sup>243</sup> *Id.*

in this area have revealed that the basic assumptions and symptoms of SBS are scientifically flawed.<sup>244</sup> Biomechanical studies established other medical explanations for subdural hematomas and retinal hemorrhages.<sup>245</sup> In fact, retinal hemorrhages have been shown not to be diagnostic of SBS.<sup>246</sup> Additionally, biomechanical studies in this area demonstrate that violent shaking cannot cause the triad of injuries.<sup>247</sup> These studies also revealed that shaking alone does not produce enough force to cause subdural hemorrhaging.<sup>248</sup> The shaking forces required to cause subdural hematomas do not result in brain injury without first causing spinal or neck injuries.<sup>249</sup> Studies show that violent shaking would cause neck and spinal cord injuries in infants before resulting in subdural hematomas and retinal hemorrhages.<sup>250</sup> At a minimum, an SBS diagnosis should be based upon a finding of neck and/or spinal injuries. Diagnostic criteria for SBS do not include neck and spinal cord injuries, an exclusion that demonstrates that the SBS diagnostic criteria are flawed. Testing conducted by non-pediatricians contradicts the assertion that subdural hematomas and retinal hemorrhages are diagnostic of shaking and establish this “diagnosis” is not only scientifically unverified, it is simply false. All of the biomechanical studies produced results in direct contrast to the assertions of pediatricians in this area. Biomechanical testing refutes, rather than supports, SBS theory. Since the triad of symptoms can be caused by a number of contributing factors and biomechanical studies expose the lack of scientific validity of SBS, the diagnosis fails the first factor of the *Daubert* analysis.

The second *Daubert* factor is whether the theory has been published in peer-reviewed journals. According to the *Daubert* court, “submission

---

<sup>244</sup> See *supra* Part II.B.

<sup>245</sup> There are many other explanations for the symptoms associated with SBS, including apnea, bleeding disorders, meningitis, septicemia, leukemia, galactosaemia, and hypertension. J.F. Geddes et al., *supra* note 241, at 1304–05; see also Barnes et al., *supra* note 17, at 180–83; Mark Donohoe, *Shaken Baby Syndrome (SBS) and Non-Accidental Injuries (NAI)*, § 1.2.1, Aug. 20, 2001, available at <http://www.whale.to/v/sbs.html> (listing ailments that contribute to “spontaneous subdural hemorrhage”).

<sup>246</sup> Tongue, *supra* note 101, at 1009; Ommaya et al., *supra* note 86, at 227; Plunkett, *supra* note 91, at 9; Barnes et al., *supra* note 17, at 182; Duhaime et al., *supra* note 16, at 414.

<sup>247</sup> Smith et al., *supra* note 17, at 693–705; Ommaya, *supra* note 86, at 223; Duhaime et al., *supra* note 16, at 412–14.

<sup>248</sup> Duhaime et al., *supra* note 16, at 414; Ommaya et al., *supra* note 86, at 220; Bandak, *supra* note 16, at 78.

<sup>249</sup> Bandak, *supra* note 16, at 78.

<sup>250</sup> *Id.*; Koumellis et al., *supra* note 19, at 216–19.

to the scrutiny of the scientific community is a component of ‘good science,’ in part because it increases the likelihood that substantive flaws in the methodology will be detected.”<sup>251</sup> While studies about SBS have been published in many highly reputable journals, studies published prior to 1999 were seriously flawed.<sup>252</sup> Approximately half of all indexed medical publications on the topic of SBS were published prior to 1999.<sup>253</sup> In recent years, the medical community has advocated for basing medical practice and opinions on the best available medical and scientific evidence,<sup>254</sup> noting, “This process has been termed evidence-based medicine (EBM) and involves a review of the quality of evidence that is available in various diseases and fields of inquiry within medicine.”<sup>255</sup> The turning point in acceptance of the practice of EBM was approximately 1999.<sup>256</sup> Mark Donohoe, M.D., conducted a comprehensive review of the medical literature in the area of SBS published prior to 1999.<sup>257</sup> He concluded “there was inadequate scientific evidence to come to a firm conclusion on most aspects of causation, diagnosis, treatment, or any other matters pertaining to SBS” based on the literature published prior to 1999.<sup>258</sup> He further concluded:

Before 1999, there existed serious data gaps, flaws of logic, inconsistency of case definition, and a serious lack of tests capable of discriminating non-accidental injury cases from natural injuries. By 1999, there was an urgent

---

<sup>251</sup> *Daubert v. Merrell Dow Pharms., Inc.* 509 U.S. 579, 593 (1993).

<sup>252</sup> Donohoe, *supra* note 188, at 241 (asserting that that “1998/1999 is regarded as the turning point in acceptance of the tenets and practice of evidence-based medicine”). *Id.* at 239.

<sup>253</sup> *Id.* at 239.

<sup>254</sup> *Id.*

<sup>255</sup> *Id.*

<sup>256</sup> *Id.*

<sup>257</sup> *Id.* Donohoe stressed that the aim of his review was to be neutral on the subject of SBS. *Id.* He recognized that “[n]eutrality is difficult to define in this field, in part because of the polarization of opinions on the highly emotional subject of infant injury and death and in part because of clear data deficiencies arising from difficulty in performing experiments.” *Id.* He went on to explain that [n]eutrality in this review simply means that there is no selective quotation of the available literature, and literature is not chosen to support any particular view.” *Id.*

<sup>258</sup> *Id.* Donohoe searched the entire Biomednet Medline database and Internet Explorer by using the search term “shaken baby syndrome” in November 1998. *Id.* at 240. Other published articles that had not yet been indexed on MEDLINE were also included. *Id.* The following articles were excluded: articles in which SBS was only peripherally mentioned, letters and brief correspondence, and articles in non-English journals that lacked an English abstract. *Id.*

need for properly controlled, prospective trials into SBS, using a variety of controls. Without published replicated studies of that type, the commonly held opinion that the finding of subdural hematoma and retinal hemorrhages in an infant was strong evidence of SBS was unsustainable, at least from the medical literature.<sup>259</sup>

Clinical and biomechanical studies since 1999 disprove the assumptions upon which SBS is based. Those studies cast doubt upon the entire theory of SBS, making this a perfect example of the Supreme Court's suggestion that more recent studies may expose flaws in earlier ones. While each side of the SBS debate has published articles in peer-reviewed journals, the more recent clinical and biomechanical studies expose the flawed nature of the shaken baby diagnosis, weighing against the admissibility of shaken baby testimony.

The third factor is the "known or potential rate of error" of the scientific theory. Scientific authors of studies related to SBS acknowledge that the caretaker rarely admits to any child abuse. Even if a caretaker explains that a minor fall caused the baby's injuries, it is assumed the caretaker is lying.<sup>260</sup> Medical professionals merely assume that if the triad of injuries is present with no known explanation, then shaking is the cause of the infant's injuries. This assumption that shaking occurred means that the precise error rate is not known or testable. Donohoe recognized that there were major data gaps in the medical literature published prior to 1999.<sup>261</sup> He recognized that there was no method for determining actual proven shaking, nor were appropriate control groups (trauma without shaking, other illnesses, healthy controls) defined and assessed blindly.<sup>262</sup> Many authors of articles published prior to 1999 failed to select an appropriate population sample and instead "repeated the logical flaw that if retinal hemorrhages and subdural hematomas are nearly always seen in SBS, the presence of retinal hemorrhages and subdural hematomas 'prove' that a baby was shaken intentionally."<sup>263</sup> Such circular reasoning in selecting a population group

---

<sup>259</sup> *Id.* at 241.

<sup>260</sup> G. Lyons, *supra* note 236, 1120.

<sup>261</sup> Donohoe, *supra* note 188, at 241.

<sup>262</sup> *Id.* Dr. Donohoe reviewed fifty-four articles or abstracts. In total, his study assessed 307 shaken baby cases in the twenty-three articles in which the number of SBS patients was provided. He found that a mere two studies had appropriate control groups, three had inappropriate control groups, and twenty-one cases had no control group whatsoever. *Id.*

<sup>263</sup> *Id.*



prevents the measurement of an error rate. On the other hand, the clinical and biomechanical studies actually highlight the fact that the potential error rate for *misdiagnosis* of SBS, if it were measurable, would be quite high since those studies have demonstrated the flawed methodology and reasoning of the shaken baby diagnosis. Thus, since there is no known error rate, and any potential error rate would be significant, SBS fails this factor of the *Daubert* analysis.

The next factor in determining the reliability of expert testimony on SBS is the existence and maintenance of standards controlling the technique's operation. There is no known set of standards to control a diagnosis of SBS other than the triad of symptoms. If those injuries are present and that last known caretaker fails to provide a reasonable explanation for the injuries, then the diagnosis of shaken baby results. The methodology of diagnosing a child with SBS is left to each treating physician with no set guidelines or techniques in reaching such a diagnosis other than the medical training and experience of the treating physician. While some may argue that the "triad" of injuries provides standards for controlling the diagnosis of SBS, such an assertion is incorrect. In Donohoe's 2003 article in which he reviewed the shaken baby literature from 1966 thru 1998, he concluded, "there is a strong need for a checklist or other diagnostic or management tool to assess cases and to quantify index of suspicion of shaking."<sup>264</sup> It is very likely that some physicians may render a shaken baby diagnosis by the mere presence of one of the triad of symptoms while others may only render such a diagnosis if all of the triad injuries are present. Donohoe found that of the fifty-four articles he reviewed, selection criteria for shaken baby cases were unstated in twelve (22%) articles, and based on mere presumption or suspicion (not the triad injuries) in ten (19%) articles.<sup>265</sup> Of the fifty-four articles Donohoe reviewed, there were no selection criteria given for the sample groups in 41% of the articles. In fact, some of the articles even based a shaken baby diagnosis on nothing more than mere suspicion. It is obvious that there is no set of standards to control the methodology of diagnosis of Shaken Baby Syndrome. The triad of injuries "guidelines" does not qualify as a standard when physicians fail to apply it consistently.

The fifth factor is whether the theory is "generally accepted" within the scientific community (which was the only relevant factor in the

---

<sup>264</sup> *Id.*

<sup>265</sup> *Id.*

superseded *Frye* test). *Daubert* stresses that general acceptance in the scientific community is no longer a necessary condition for admissibility, but merely a factor that a court should consider in deciding whether to admit evidence.<sup>266</sup> Therefore, while SBS has been used in numerous cases, this is not the proper measure of general acceptance to use under *Daubert*. This is especially true in cases (such as the triad only cases) where no other indicia of abuse exist to support the diagnosis. The scientific studies discussed exemplify that acceptance of the theory of SBS within the medical and scientific communities is faltering, and is not nearly as strong as it was a decade ago. These studies have led a segment of the scientific community to perceive the diagnosis as illegitimate.<sup>267</sup> Other medical professionals have responded to the new research by defending SBS against attack, including the American Academy of Pediatrics (AAP). Interestingly, after the publishing of studies which showed that shaking alone does not produce enough force to cause the triad of SBS symptoms, the American Academy of Pediatrics issued the following 2009 policy statement:

Shaken baby syndrome is a term often used by doctors and the public to describe abusive head trauma inflicted on infants and young children. While shaking an infant can cause neurologic injury, blunt impact or a combination of shaking and blunt impact can also cause injury. In recognition of the need for broad medical terminology that includes all mechanisms of injury, the new AAP policy statement, "Abusive Head Trauma In Infants and Children," recommends pediatricians embrace the term "abusive head trauma" to describe an inflicted injury to the head and its contents.<sup>268</sup>

Despite its presence in society at large, the scientific basis for SBS has deteriorated over the past decade as the medical community has deliberately discarded the diagnosis as defined by shaking and has moved to a diagnosis based on shaking and/or blunt impact.<sup>269</sup> Shaken baby syndrome is no longer a generally accepted term or methodology in

---

<sup>266</sup> *Daubert v. Merrell Dow Pharms., Inc.* 509 U.S. 579, 587 (1993).

<sup>267</sup> See Bandak, *supra* note 16, at 79; Duhaime et al., *supra* note 16, at 414; Barnes et al., *supra* note 17, at 181; Uscinski, *supra* note 91, at 217-18; Donohoe, *supra* note 188, at 239-40.

<sup>268</sup> AM. ACAD. OF PEDIATRICS, <http://www.aap.org/advocacy/releases/may09headtrauma.htm> (last visited May 2, 2012).

<sup>269</sup> Tuerkheimer, *supra* note 1, at 11.

the general scientific community: “Doctors are now in widespread agreement that SBS is an unhelpful characterization, and that the presence of retinal hemorrhages and subdural hematoma cannot conclusively prove that injury was inflicted.”<sup>270</sup> The research demonstrating that shaking alone cannot cause brain trauma has caused the medical community to change the diagnosis to Abusive Head Trauma, a diagnosis that encompasses shaking and/or impact as a cause of an infant’s head injuries.

The last *Daubert* factor is determining whether the probative value of the evidence is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury. This factor plays an important role with respect to expert witness testimony; panel members are often mesmerized by experts and may lend special reliability and trustworthiness to an expert simply based on an expert’s credentials.<sup>271</sup> “Science is perceived as solid, knowable, measurable: in short, science offers certainty.”<sup>272</sup> An average person who knows nothing of a particular scientific subject will naturally give deference to an individual with training and education on that topic, but “[t]he danger for the legal system is that this empowerment of the expert witness will result in undue deference to his or her opinion.”<sup>273</sup> In the case of shaken baby testimony, deference to the expert proves dangerous and unfairly prejudicial to the defense. A shaken baby diagnosis assumes not only mechanism of injury (shaking) but it assumes the act was intentional. The fact-finder is charged with the responsibility of deciding whether an act was intentional and the cause of the infant’s injuries, not medical experts. Such testimony also comments on the accused’s veracity. Shaken baby testimony assumes the caretaker is lying about the cause of an infant’s injuries. If an accused denies shaking a baby or causing the injuries, then the shaken baby testimony essentially renders an opinion that the accused is a liar. Ultimately, this is an attempt to clothe human lie detector testimony under the guise of science. Government witnesses will try to build a case looking at sociological factors while ignoring the

---

<sup>270</sup> *Id.* SBS has been replaced by several different terms: shaken impact syndrome, abusive head trauma, inflicted traumatic brain injury, and non-accidental head injury. Robert Reece, *What Are We Trying to Measure: The Problems of Case Ascertainment*, 34 AM. J. PREVENTATIVE MED. 116 (2008); see also Cindy Christian et al., *Abusive Head Trauma in Infants and Children*, 123 PEDIATRICS 1409, 1411 (2009).

<sup>271</sup> See generally *Daubert*, 509 U.S. at 595 (“[E]xpert evidence can be both powerful and quite misleading because of the difficulty of evaluating it.”).

<sup>272</sup> Sutherland, *supra* note 193, at 382.

<sup>273</sup> *Id.*

hard scientific studies that do not support their conclusion. They reinforce their conclusion by using the accused's own story against him; they proffer he must be lying concerning his version of events since the injuries could not occur in the absence of shaking. This is especially problematic in cases with no additional indicia of abuse and no additional clinical findings to support the scientific conclusion of SBS. The military rules of evidence prevent a witness from commenting as to the truthfulness of another witness's statements.<sup>274</sup> Shaken baby testimony violates the rules of evidence and is unduly prejudicial to the defense. Scientific developments in the past decade have created a strong polarization and debate within the medical community on this topic. Allowing that controversy inside the courtroom would lead to a confusion of the issues. It would create a "mini-trial" on the validity of a shaken baby diagnosis and confuse the real issues at trial. *Daubert* is meant to answer this issue. Asking a panel to decipher the validity of a diagnosis, upon which scientists and doctors vehemently disagree, is akin to asking the panel to perform heart surgery. More to the point, how can such a controversy equate to proof beyond a reasonable doubt? Where in the criminal justice system should speculation, guess, and conjecture be espoused as evidence? Hopefully, it should not be.

The theory of SBS in triad-only cases performs poorly on each of the factors identified in *Daubert*; any courtroom should exclude such testimony as unreliable scientific speculation instead of scientific knowledge as required by *Daubert*. Presentation of such evidence to a fact-finder leads to speculation about the nature and cause of an infant's injuries. Any decision a fact-finder reached, after hearing evidence of SBS, is a decision based on mere conjecture and speculation about matters in which even experts have not been able to agree. It is not the defense's burden to prove a negative, that is, that shaken baby evidence is unreliable. The government must affirmatively demonstrate its expert evidence is reliable; failure to do so mandates exclusion of the evidence. Every objective measure of reliability regarding SBS evidence fails in the "triad-only" cases.

---

<sup>274</sup> See MCM, *supra* note 220, MIL. R. EVID. 608(a). Military Rule of Evidence 608(a) authorizes testimony about the credibility of a witness, but only "in the form of opinion or reputation" and "the evidence may only refer to character for truthfulness or untruthfulness." *Id.* It would be the rare occasion in which a medical expert would be able to render a personal opinion as to the accused's reputation or character for truthfulness or untruthfulness.

## V. Proposed Military Rule of Evidence to Address Shaken Baby Evidence

Biomechanical and clinical studies over the past several years have seriously undermined the foundation of SBS as a diagnosis. These studies have crippled an SBS diagnosis to the point that judges should rule such testimony as inadmissible. The rules of evidence are premised on an adversarial system.<sup>275</sup> Even the *Daubert* court believed “[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.”<sup>276</sup> The flexibility and discretion given to a judge allows the presumption of admissibility of expert testimony to be standard practice in courts-martial. In fact, there are no reported military cases in which the judge excluded SBS testimony.<sup>277</sup> Every reported case in which a military court admitted shaken baby testimony resulted in convictions ranging from assault and battery to premeditated murder.<sup>278</sup> In every reported case, medical professionals testified for the government that the infant suffered from SBS demonstrating that, even as of 2009, doctors are continuing to use

---

<sup>275</sup> Tuerkheimer, *supra* note 1, at 13.

<sup>276</sup> *Daubert*, 509 U.S. at 596.

<sup>277</sup> Several reported cases present facts where the court admitted SBS evidence. These triad-only cases are: *United States v. Delarosa*, 67 M.J. 318 (C.A.A.F. 2009); *United States v. Bresnahan*, 62 M.J. 137 (C.A.A.F. 2005); *United States v. Dimberio*, 56 M.J. 20 (C.A.A.F. 2001); *United States v. Davis*, 53 M.J. 202 (C.A.A.F. 2000); *United States v. Van Syoc*, 36 M.J. 461 (C.M.A. 1993). These additional reported cases contained corroboration evidence of bruising, blunt force trauma, and rib fractures: *United States v. Harrow*, 65 M.J. 190 (C.A.A.F. 2007), *cert. denied*, *Harrow v. United States*, 552 U.S. 992 (Oct. 29, 2007); *United States v. Warner*, 62 M.J. 114 (C.A.A.F. 2005); *United States v. Allen*, 59 M.J. 478 (C.A.A.F. 2004), *cert. denied*, *Allen v. United States*, 543 U.S. 877 (Oct. 4, 2004); *United States v. Winter*, 35 M.J. 93 (C.M.A. 1992); *United States v. Curry*, 31 M.J. 359 (C.M.A. 1990); *United States v. Valois*, 2009 WL 1507981 (A.F. Ct. Crim. App. 2009); *United States v. Stanley*, 60 M.J. 622 (A.F. Ct. Crim. App. 2004).

<sup>278</sup> *Delarosa*, 67 M.J. at 319 (accused convicted of aggravated assault); *Harrow*, 65 M.J. at 192 (accused convicted of unpremeditated murder); *Bresnahan*, 62 M.J. at 138 (accused convicted of involuntary manslaughter); *Warner*, 62 M.J. at 115 (accused convicted of assault and battery); *Allen*, 59 M.J. at 479 (accused convicted of maiming and assault with intent to commit grievous bodily injury); *Dimberio*, 56 M.J. at 21 (accused convicted of assault with means likely to cause death or grievous bodily injury); *Davis*, 53 M.J. at 203 (accused convicted of involuntary manslaughter); *Van Syoc*, 36 M.J. at 461 (accused convicted of unpremeditated murder); *Winter*, 35 MJ at 94 (accused convicted of unpremeditated murder); *Curry*, 31 M.J. at 360 (accused convicted of premeditated murder); *Valois*, 2009 WL at 1507981 (accused convicted of murder); *Stanley*, 60 M.J. at 622 (accused convicted of involuntary manslaughter).

this faulty diagnosis.<sup>279</sup> Even more concerning is the fact that military judges are continuing to allow government experts to testify about this “diagnosis.”

In order to address this problem, the military should adopt a new rule of evidence to prevent the admission of SBS testimony in triad-only cases. Opponents of such a change may argue that the debate about the validity of the SBS diagnosis is really an issue of the weight to be given the evidence by the fact-finder, and not an issue of admissibility. However, such a new rule of evidence can be closely analogized to the rule prohibiting polygraph evidence. Military Rule of Evidence 707 “serves several legitimate interests in the criminal trial”: “ensuring that only reliable evidence is introduced at trial, preserving the court members’ role in determining credibility, and avoiding litigation that is collateral to the primary purpose of the trial.”<sup>280</sup> Polygraph evidence was not left to the fact-finder to determine the reliability and weight to give such evidence; SBS should be treated similarly. A new rule of evidence is needed which requires either corroborating physical evidence that the alleged SBS injuries resulted from an impact, evidence that the mechanism of injury was more than just shaking, or a voluntary confession that admits to intentional physical assault.

The current system’s permissive practice of allowing military judges to apply the *Daubert* factors when analyzing whether to admit evidence fails to prevent the admission of unreliable SBS testimony at courts-martial. One basis for this conclusion is the difficulty judges may face in understanding scientific evidence and in applying the *Daubert* factors. Such potential misunderstandings may result in the judiciary’s undue

---

<sup>279</sup> See *Delarosa*, 67 M.J. at 321.

<sup>280</sup> *United States v. Scheffer*, 523 U.S. 303, 309 (1998). The *Scheffer* Court went on to state:

These interests, among others, were recognized by the drafters of Rule 707, who justified the Rule on the following grounds: the risk that court members would be misled by polygraph evidence; the risk that the traditional responsibility of court members to ascertain the facts and adjudge guilt or innocence would be usurped; the danger that confusion of the issues “could result in the court-martial degenerating into a trial of the polygraph machine;” the likely waste of time on collateral issues; and the fact that the “reliability of polygraph evidence has not been sufficiently established.”

*Id.* at 309 n.5 (citations omitted).

deference to expert witnesses.<sup>281</sup> The synergistic effect of these elements creates an almost impossible situation for an accused to exclude SBS testimony under an MRE 702 or *Daubert* challenge. It is understandable that lawyers and judges would accept scientific expert testimony at face value since the experts are much more knowledgeable in the area. An expert's credentials and training alone can cause a judge to accept the expert's testimony as reliable without question. In the legal system, it is this empowerment of an expert witness that results "in undue deference to his or her opinion."<sup>282</sup> An expert who testifies regarding a "generally accepted" medical diagnosis can have a powerful effect on the outcome of a trial. Simply allowing the defense to challenge a SBS diagnosis with its own experts does not address the problem of admitting faulty scientific testimony at trial. The proper way to address this situation is to create a rule of evidence that would require corroboration evidence of child abuse in triad-only cases.

Another factor that renders unreliable SBS testimony admissible at trial under the current system is the lack of understanding by judges in properly applying the *Daubert* factors. A survey conducted of state judges revealed the importance judges place on *Daubert* in making expert admissibility decisions.<sup>283</sup> The study demonstrated the importance of *Daubert* in decisions to admit expert testimony and demonstrated the lack of understanding of the error rates and falsifiability factors.<sup>284</sup> The first portion of the study surveyed four hundred state judges and ninety-four percent of those who responded found *Daubert* valuable in their decisions regarding admissibility of expert testimony.<sup>285</sup> Ninety-one percent of the judges said they found error rates to be helpful in assessing the quality of evidence offered.<sup>286</sup> However, only four percent of the judges held an accurate understanding of error rates.<sup>287</sup> Although eighty-

---

<sup>281</sup> See Sutherland, *supra* note 193, at 382.

<sup>282</sup> *Id.*

<sup>283</sup> Sophia I. Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post-Daubert World*, 25 LAW AND HUM. BEHAV. 433, 441 (2001). A total of four hundred judges were surveyed with a seventy-one percent response rate. The surveys were conducted by use of a structured telephone interview. *Id.* There is no known survey of military judges on this issue and the study of state judges is used for illustrative purposes.

<sup>284</sup> *Id.* While this study involved surveying state judges and not military judges, these judges apply the same *Daubert* factors as military judges, allowing for one to analogize the results to the military.

<sup>285</sup> *Id.* at 443.

<sup>286</sup> *Id.* at 445-47.

<sup>287</sup> *Id.*

eight percent reported they believed “falsifiability” to be useful in determining the reliability of scientific evidence, a mere six percent revealed a proper understanding of the concept.<sup>288</sup> The second part of the study surveyed over three hundred judges and questioned them about a variety of psychological syndromes.<sup>289</sup> The judges were asked to identify the aspects of each syndrome that they found most problematic in determining admissibility. Few of the judges even mentioned *Daubert* criteria.<sup>290</sup> Rather, the judges most often referred to the qualification of the expert, subjectivity of the diagnostic process, and relevance as being of greater concern.<sup>291</sup> This part of the survey highlights the deference given to experts in trials. If judges misunderstand, misapply, or simply fail to apply the *Daubert* factors altogether, then unreliable SBS testimony will continue to permeate courtrooms.

Requiring corroborating physical evidence as the cause of the subdural hemorrhaging, retinal hemorrhaging, and brain swelling in suspected SBS cases will ensure that such testimony is reliable and satisfies the *Daubert* factors. The most reliable way to ensure that corroborating evidence is required is to create a rule of evidence. The proposed rule of evidence should read as follows:

Rule 708. Abusive Head Trauma

(a) Notwithstanding any other provision of law, the opinion by a medical professional or social worker, or any reference to, or diagnosis of, abusive head trauma/shaken baby syndrome shall not be admitted into evidence without: corroborating physical evidence that the injuries resulted from an impact or blunt force trauma, the mechanism of injury included something

---

<sup>288</sup> *Id.* at 444.

<sup>289</sup> *Id.* at 440. Part II of the study was conducted using telephone interviews or written questionnaires with an eighty-one percent response rate. Veronica Dahir et al., *Judicial Application of Daubert to Psychological Syndrome and Profile Evidence*, 11 PSYCHOL. PUB. POL'Y & L. 62, 68 (2005). Of the 325 judges who participated in part II of the study, 318 provided answers to the questions dealing with syndromes. *Id.* at 68. The syndromes on which the study focused were: battered women's syndrome; rape trauma syndrome; child sex abuse accommodation syndrome; repressed memory syndrome; and post-traumatic stress disorder. *Id.*

<sup>290</sup> Dahir, *supra* note 289, at 72.

<sup>291</sup> *Id.*



more than shaking alone, or a voluntary confession<sup>292</sup> by the accused that he/she intentionally physically assaulted the child. Such corroborating evidence may include evidence of a neck injury, spinal cord injury, rib fractures, skull fractures, or bruising (such list is not intended to be exclusive or exhaustive).<sup>293</sup>

(b) Nothing in this section is intended to exclude from evidence medical observations or statements made during a medical examination which are otherwise admissible, except that no reference to an abusive diagnosis is permitted unless the evidence complies with section (a) above.

This rule would require corroborating physical evidence of impact, or some other mechanism of head injury other than shaking, as a threshold matter before allowing testimony regarding Shaken Baby Syndrome/Abusive Head Trauma. The corroboration requirement could also be satisfied with a voluntary confession, not a mere admission,<sup>294</sup> by the accused that he or she intentionally physically assaulted the child. The corroboration required would parallel the corroboration requirement for voluntary confessions.<sup>295</sup> Just like corroboration required for confessions, the SBS independent corroborating evidence itself need not be sufficient to establish proof beyond a reasonable doubt. The corroborating evidence need only raise an inference of truth as to the essential facts admitted and the proposed shaken baby diagnosis. Corroboration evidence of abuse would ensure that there is some other

---

<sup>292</sup> A voluntary confession is a statement rendered admissible in accordance with the Military Rules of Evidence. *See* MCM, *supra* note 220, MIL. R. EVID. 304–305.

<sup>293</sup> Lyons, *supra* note 236, 1120 (recognizing that “child abuse should only be assumed as a last resort: if other indicia of abuse are present such as long-bone injuries, a fractured skull, bruising, or other indications that abuse has actually occurred” but does not recommend requiring such evidence as a prerequisite to admission of SBS testimony at trial). *Id.* at 1132.

<sup>294</sup> A voluntary confession is a statement rendered admissible in accordance with the MRE. *See* MCM, *supra* note 220, MIL. R. EVID. 304–305.

<sup>295</sup> A confession is an acknowledgement of guilt. *Id.* MIL. R. EVID. 305(c)(1). An admission is a self-incriminating statement falling short of an acknowledgement of guilt, even if its maker intended it to be exculpatory. *Id.* MIL. R. EVID. 305(c)(2). Because caretakers often admit to shaking the child for responsiveness after the child is unresponsive, such admission is often improperly viewed as an admission of guilt. Thus, a confession should be required as opposed to a mere admission that may be improperly viewed as an inculpatory statement.

evidence of assault other than just an assumption by physicians that abuse occurred. This proposed rule also specifically requires evidence of impact or a mechanism other than shaken baby diagnosis. This rule would address the weaknesses of the SBS theory, and ensure that there is independent evidence of a mechanism of injury other than just alleged shaking.

## VI. Conclusion

Shaken Baby Syndrome is a “diagnosis” which developed over several decades from the 1940s to the 1970s. The SBS diagnosis consisted of a “triad” of symptoms that the caretaker could not explain to the satisfaction of medical providers. These symptoms included subdural hemorrhaging, retinal hemorrhaging, and brain swelling. If an infant presented to a hospital with these three symptoms and no known explanation, medical personnel might diagnose shaking as the cause of the injuries. In recent years, biomechanical studies and clinical studies have challenged the assumptions, science, and methodology behind the shaken baby diagnosis. In essence, the “science” has continued to develop in this area. Studies have shown that a human being cannot create enough force, by shaking alone, to cause brain injuries in young infants and children. Other studies concluded that the amount of shaking force necessary to cause brain injuries would result in neck and spinal injuries before brain injuries would occur. Still other studies demonstrated that shaking alone would not cause retinal hemorrhaging.<sup>296</sup> In essence, biomechanical studies exposed the unreliability of shaken baby diagnosis.

Military Rule of Evidence 702 and *Daubert* contain such liberal standards of admissibility of expert testimony that judges almost always admit SBS testimony despite its frequent unreliability. A close analysis of SBS evidence reveals that it does not satisfy the *Daubert* factors. SBS evidence is a troubling example of the *Daubert* factors’ and MRE 702’s failure to exclude unreliable scientific expert testimony in court. Reform is necessary. A military rule of evidence is needed which would require corroborating physical evidence of abuse, irrespective of the triad of injuries of subdural hemorrhaging, retinal hemorrhaging, and brain swelling in order for SBS testimony to be admissible at courts-martial.

---

<sup>296</sup> Ommaya et al., *supra* note 20, at 285.