

# Evidence-based or Evidence-biased? How Science is (Mis)applied to Medical Evaluations of Child Abuse

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## Objectives

- 1) Understand recent arguments against the existence of abusive head trauma
- 2) Understand to origins of the concepts of "shaken baby syndrome"
- 3) Understand how evidence-based medicine strengthens the diagnoses of abusive head trauma



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## AHT Quick History

- 1860 Ambrose Tardieu – physical, sexual injuries including meningeal hemorrhage, brain injury in fatally abused children
- 1946 John Caffey – association of long bone fractures and chronic SDH
- 1962 Kempe – Battered Child Syndrome
- 1971 Guthkelch – infants with SDH due to caregiver shaking
- 1972 Caffey described radiology and clinical features attributed to shaking
- 1974 Caffey – Whiplash Shaken Infant Syndrome
- 1984 Ludwig, Warman – Shaken Baby Syndrome term, 20 infants – toddlers shaking injury without signs impact
- 1987 – Duhaime – victims of fatal shaking and survivors showed evidence of blunt impact at diagnosis, stressed the importance of acceleration/deceleration injury supported by basic biomechanical models



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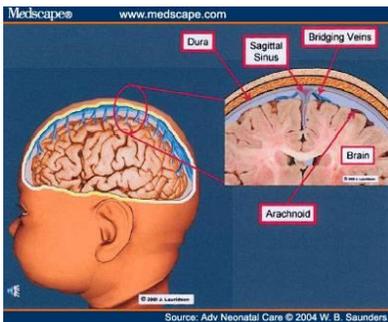
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## SBS vs. SIS vs. AHT

- Why do some people call it Shaken Baby Syndrome, others Shaken Impact Syndrome, and still others Abusive Head Trauma?




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## SBS vs. SIS vs. AHT

- Classically, SBS refers to SDH, Rh, and edema
- Shaken Baby Syndrome implies no impact occurs
- Shaken Impact Syndrome implies impact definitely occurred
- Abusive Head Trauma implies someone willfully caused trauma to the child's head




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## SBS vs. SIS vs. AHT

- Specific mechanism difficult to study scientifically (need specific perpetrator descriptions, eyewitness accounts, videotaped episodes)
- Some cite biomechanics studies as “proof” impact must occur, but these studies are full of confounding issues (the most famous study involves adult rhesus monkeys)




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POLICY STATEMENT

### Abusive Head Trauma in Infants and Children

Cindy W. Christian, MD, Robert Black, MD, and the Committee on Child Abuse and Neglect

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

- The term Abusive Head Trauma avoids this controversy
- Making the diagnosis of Shaken Baby Syndrome implies a very specific mechanism of injury
- Using “Abusive Head Trauma” negates these issues




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## Has a Flawed Diagnosis Put Innocent People in Prison?

A Re-examination of Shaken Baby Syndrome  
 Emily Bazelon  
 The New Your Times Magazine  
 2/6/2011




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### Issues Raised by the Article

- Triad of: brain bleeding (SDH), brain swelling, bleeding in the eye (RH)
- Shaking alone
- No external signs on head/body
- Timing of symptom onset
- Birth trauma
- Rebleeding (Uscinski)




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### Issues Raised by the Article

- 1970's animal experiments:
- Ommaya – 50 rhesus monkeys on sleds
  - Strapped on chair, head unsupported
  - Slammed into a wall
  - Injuries that resulted in 15
  - Experiments didn't involve infants, shaking




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### Issues Raised by the Article

- 1970's Caffey, Guthkelch papers describing SDH and injuries, attributed to shaking of infants without impact, with or without visible neck injury
  - 1980's SBS term, national awareness and prevention campaign
- Forces
- 1987 Duhaime 13 deceased infants, trauma associated impact
  - - shaking alone did not generate forces of previous experiments
  - - impact when thrown did, even soft impact




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### Issues Raised by the Article

- Co- occurrence of SDH and RH = more likely to have had AHT
- RH severity
- Causes of RH
- Confession studies 2004 Starling, 2010 Vinchon, problems with confessions

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### Issues Raised by the Articles

- Controversy, disagreement among doctors, experts about the dx
- Scientific uncertainty
- Alternate explanations for clinical picture
- DNA evidence for exoneration?
- “Defense experts”, payment, alternate theories
- Tuerkheimer, Innocence project

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### Defense Theories

- Short falls
- Rebleeds
- Lucid Intervals
- Biomechanics
- Bleeding disorders
- BEAF
- Vitamin C/Immunizations
- Choking/Coughing

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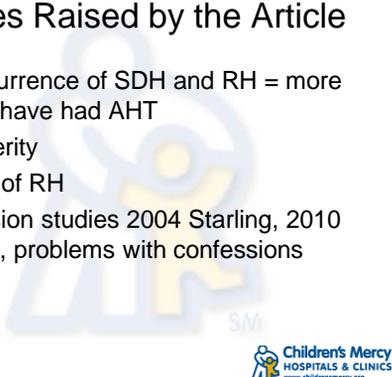
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## Short Falls

- 12/18 contact/translational injury
- The lowest height of the fall was used
- May expect lucid intervals in this group
- Data gathered from a large database with minimal specific information
- Death rate 1.3/100,000 falls




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## Short Falls

- 368 cases of pediatric short falls
- None with SDH
- None died
- 6 with skull fx

Lyons and Oats (1993), Helfer et al. (1977), Williams (1991), Nimityongskul and Anderson (1987)




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## Short Falls: Further Data

REVIEW ARTICLE

### Annual Risk of Death Resulting From Short Falls Among Young Children: Less Than 1 in 1 Million

David L. Chodwick, MD<sup>1,2\*</sup>; Gita Barfood, PhD<sup>1</sup>; Edward Cutillo, PhD, MPH<sup>1</sup>; Lori Frasier, MD<sup>2</sup>; Elisabeth Guenther, MD, MPH<sup>2</sup>; Karim Razaee, MD<sup>2</sup>; Bruce Herman, MD<sup>2</sup>; Henry F. Krous, MD<sup>2,3\*</sup>

- Short fall defined as < 1.5 meters
- Multiple large databases reviewed and journals/books searched
- <0.48 deaths *per 1 million children per year*




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### Short Falls: Experiential Info

- Kids fall **ALL THE TIME**
- Toddlers fall even more
- Kids don't die very often when they fall
- Most people (jurors) know this
- So, Plunkett has (somewhat) abandoned this (clinical/epidemiological) approach and has moved on to *Biomechanics*




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### Short Falls: Conclusions

- Short falls may rarely cause death or severe injury
- These cases generally have typical medical findings:
  - 1) Mass effect bleeds
  - 2) Infarcts of brain parenchyma
  - 3) Crush injury
  - 4) Other serious injury (not head)




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### Rebleeds

- Rebleed: a previous intracranial injury begins bleeding once again due to
  - 1) Re-injury
  - 2) The natural history of the first injury




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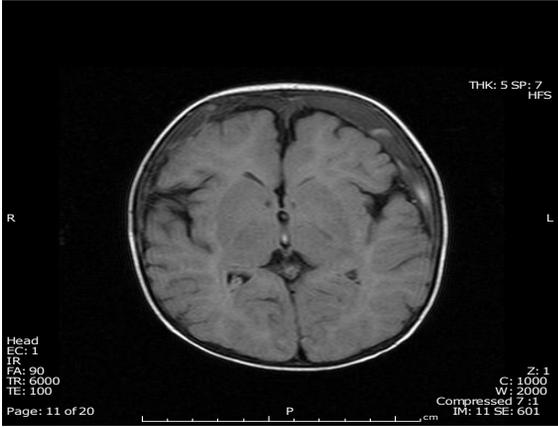
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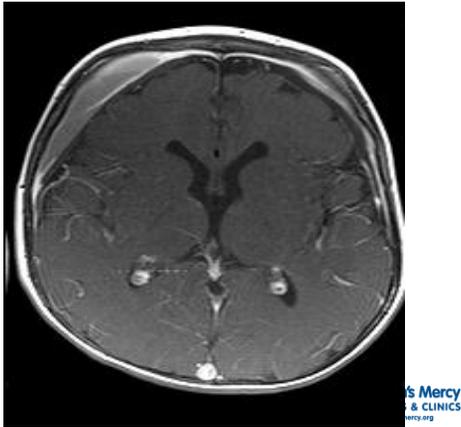
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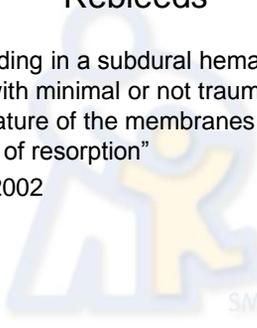
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## Rebleeds

- “Rebleeding in a subdural hematoma may occur, with minimal or not trauma, owing to the nature of the membranes and the process of resorption”

Uscinski 2002




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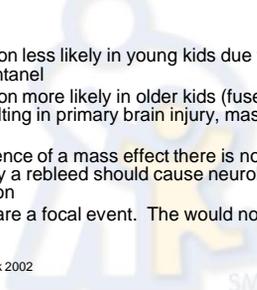
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## Rebleeding: Problem

- Deterioration less likely in young kids due to open sutures/fontanel
- Deterioration more likely in older kids (fused sutures), event resulting in primary brain injury, mass effect from SDH
- In the absence of a mass effect there is no physiologic reason why a rebleed should cause neurological deterioration
- Rebleeds are a focal event. They would not cause *diffuse bleeding*

Hymel, Jenny, Block 2002




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## Thin film SDH




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Delayed Sudden Death in an Infant Following an  
Accidental Fall  
A Case Report With Review of the Literature

Scott Denton, MD, and Darinka Mileusnic, MD, PhD

- Problems:
  - 1) This case report is at odds with the rest of published literature
  - 2) No method/mechanism of physiologic brain injury is proposed
  - 3) The legal investigation is used as a form of scientific proof/validation



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### Lucid Intervals

- Known causes:
  - 1) Mass effect bleeds
  - 2) Gradual cerebral edema
  - 3) Post-traumatic seizures
  - 4) Infarcts (strokes)



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### Lucid Intervals

- Other documented "lucid intervals" in the literature are poorly documented at best
- Most last in the "minutes" range
- In the absence of a known cause of a lucid interval, **most cases** of severe head trauma result in **immediate symptoms of some kind**
- **Every case needs to be approached carefully!**



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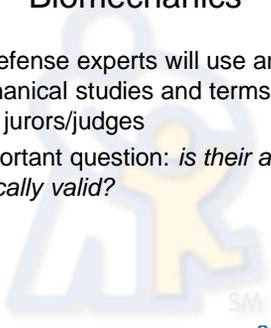
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# Biomechanics

- Some defense experts will use an array of biomechanical studies and terms to confuse jurors/judges
- The important question: *is their approach scientifically valid?*




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## The shaken baby syndrome

A clinical, pathological, and biomechanical study

ANN-CRISTINE DEBIAME, M.D., THOMAS A. GONNARELLI, M.D., LAWRENCE E. THIBAUT, SC.D., DERRA A. BRUCE, M.D., SUSAN S. MARGULES, M.S.E., AND RANDALL WISSE, M.S.E.  
 Division of Neurosurgery and Department of Biomechanics, University of Pennsylvania, Philadelphia, Pennsylvania

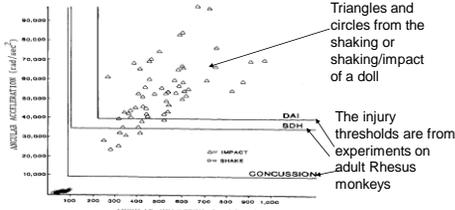


FIG. 2. Angular acceleration versus angular velocity for shakes and impacts, with injury thresholds from primate experiments scaled to 300-gm brain weight. DAI = diffuse axonal injury; SDH = subdural hematoma.




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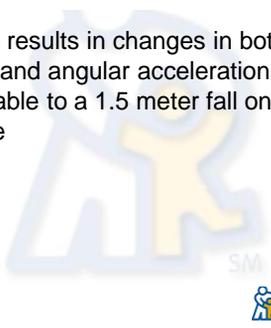
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## Anthropomorphic simulations of falls, shakes, and inflicted impacts in infants

MICHAEL T. PRANGE, PH.D., BRITTANY COATS, B.S., ANN-CRISTINE DEBIAME, M.D., AND SUSAN S. MARGULES, PH.D.  
 Department of Biomechanics, University of Pennsylvania, Philadelphia, and Division of Neurosurgery, Children's Hospital of Philadelphia, Pennsylvania

- Shaking results in changes in both angular velocity and angular acceleration comparable to a 1.5 meter fall onto concrete




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### Problems with the Biomechanical Literature

- **Core question for scientific validity:**  
Can injury thresholds derived from adult non-human primates undergoing a single acceleration on a sled be reliably extrapolated, using only mass scaling, to a human infant undergoing repetitive shaking?




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### Problems with the Biomechanical Literature

- Injury thresholds based on extrapolation from *adult primates*
  - *Infant's head is relatively larger*
  - *Weaker neck muscles*
  - *Less myelination*
  - *Relative absence of nodes of Ranvier (locus of traumatic AI)*
- Single cycle rotations used
  - Infant head injury is often repetitive
- No consideration of biochemical response to trauma
- Biofidelity of models (especially the neck)




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### Animal Studies

- Injury Severity depends on:
  - 1) Developmental stage
  - 2) Rotational direction/impact location
  - 3) Time after the injury
  - 4) # of insults to the brain
  - 5) Time between insults




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## Biochemical Response to Brain Injury

• TBI results in secondary injury:

- 1) Excitotoxicity: glutamate
- 2) Ischemia
- 3) Inflammation
- 4) Oxidative stress
- 5) Apoptosis

The metabolic response of immature brain to TBI is different than adults. Thresholds have never been determined for either




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## HIC

- Head Injury Criterion
- Linear head injury model designed for use in the automotive industry
- Widely used in determining head injury tolerance
- Derived from impact experiments on adult cadavers
- Does not differentiate b/t rotational (whiplash) and translational (falling off a bed) loads
- Not sensitive to the direction of head movement




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The potential and limitations of utilising head impact injury models to assess the likelihood of significant head injury in infants after a fall

C.Z. Cory<sup>a,\*</sup>, M.D. Jones<sup>a</sup>, D.S. James<sup>b</sup>, S. Leadbeater<sup>b</sup>, L.D.M. Nokes<sup>a</sup>

<sup>a</sup>Medical Engineering Research Unit, ENGIN, University of Wales Cardiff, #13, Box 485, Cardiff, Wales, UK  
<sup>b</sup>Wales Institute of Forensic Medicine, Cardiff Royal Infirmary, Newport Road, Cardiff, Wales, UK

Received 20 February 1999; received in revised form 21 December 2000; accepted 14 May 2001

- Applying the HIC to pediatric abusive head injury cases may under-represent the head injury potential




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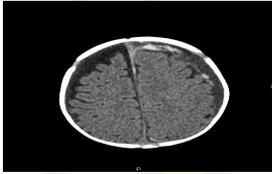
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## Bleeding Disorders



An array of bleeding disorders may result in spontaneous intracranial hemorrhage



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## Bleeding Disorders

Short report

Delta-storage pool disease as a mimic of abusive head trauma in a 7-month-old baby: A case report

Marc De Leeuw MD<sup>a</sup>, Emile Beuls MD<sup>a</sup>, Philippe Jorens MD, PhD<sup>b</sup>, Paul Parizel MD, PhD<sup>c</sup>, Werner Jacobs MD, PhD, Prof., Head of Department of Forensic Medicine and Pathology<sup>a,c</sup>

Journal of Forensic and Legal Medicine 26 (2013) 116–119

Contents lists available at ScienceDirect



Journal of Forensic and Legal Medicine

journal homepage: www.elsevier.com/locate/jflm



Letter to the Editor

A single case report lacking details does not equal a mimic of abusive head trauma



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## Data!

Challenges in the evaluation for possible abuse: Presentations of congenital bleeding disorders in childhood

Jami Jackson<sup>a</sup>, Shannon Carpenter<sup>b</sup>, Jim Anderst<sup>c,\*</sup>

<sup>a</sup> Children's Mercy Hospital, Department of Emergency Medicine, Kansas City, MO, USA

<sup>b</sup> Children's Mercy Hospital, 2401 Gillham Road, Department of Pediatric Hematology/Oncology, University of Missouri/Kansas City School of Medicine, Kansas City, MO, USA

<sup>c</sup> Children's Mercy Hospital, 2401 Gillham Road, Section on Child Abuse and Neglect, University of Missouri/Kansas City School of Medicine, Kansas City, MO 64108, USA

- 15% of children with bleeding disorders present in a manner that may be confused with abuse



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CLINICAL REPORT

Evaluation for Bleeding Disorders in Suspected Child Abuse

abstract

James D. Anderson, MD, MS, Shannon L. Carpenter, MD, MS, Thomas C. Aschman, MD, and the SECTION ON HEMATOLOGY/ONCOLOGY AND COMMITTEE ON CHILD ABUSE AND NEGLECT

TECHNICAL REPORT

Evaluating for Suspected Child Abuse: Conditions That Predispose to Bleeding

Shannon L. Carpenter, MD, MS, Thomas C. Aschman, MD, James D. Anderson, MD, MS and the SECTION ON HEMATOLOGY/ONCOLOGY AND COMMITTEE ON CHILD ABUSE AND NEGLECT

abstract

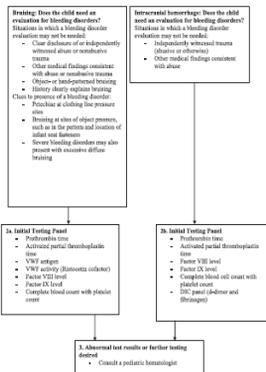


FIGURE 1 Recommended pathway for evaluation of possible bleeding disorders when child abuse is suspected. VWD, von Willebrand factor.



Probabilities for ICH in congenital coagulopathies

Condition	Prevalence of Condition (upper limits)	Prevalence of ICH (upper limits)	Pre-test Probability
VWD	1/1000	Extremely rare	Low
Factor II deficiency	1 in 1 million	11%	1 in 10 million
Factor V deficiency	1 in 1 million	8% of homozygotes	1 in 10 million homozygotes
Combined Factors V and VIII deficiencies	1 in 1 million	2%	1 in 50 million
Factor VII deficiency	1/300,000	4-6.5%	1 in 5 million
Factor VIII deficiency	1/5000 males	5-12%	1/50,000 males
Factor IX deficiency	1/20,000 males	5-12%	1/200,000 males
Factor X deficiency	1 in 1 million	21%	1 in 5 million
Factor XI deficiency	1/100,000	Extremely rare	Low
Factor XIII deficiency	1 in 2 million	1/3	1 in 6 million
Alpha-2 antiplasmin deficiency	40 cases reported	Not reported	Low
PAI-1 deficiency	Extremely rare	Unknown, has been reported	Low
Afibrinogenemia	1/500,000	10%	Low
Dysfibrinogenemia	1 in 1 million	Not reported	Low







## BEAF: Problems

- No standard definitions exist for measurements of subarachnoid spaces
- No prospective studies exist to **prove** that BEAF predisposes to easy bleeding
- Even if BEAF causes easy bleeding, it does not explain thin film SDH bilaterally and global effects on the brain




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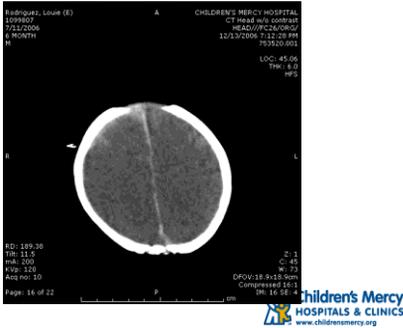
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## Thin film SDH




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## BEAF

- Even if we assume the “BEAF theory” to be true, it would generally result in:
  - 1) Localized SDH
  - 2) Lack of global decompensation
  - 3) Lack of persistent deficits




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## Vitamin C/Immunizations

- Clemetson, CAB, *Medical Hypotheses* (2002) 59(1), 52-56  
**BARLOW'S DISEASE (Abstract/Summary)**
- "The classical form of Barlow's disease, or infantile scurvy, with bruises, broken bones and sores that will not heal, is rarely seen today, but it seems to be reappearing under a different guise, when infants with borderline vitamin C depletion are assaulted with too many inoculations at one time. Moreover, it is now sometimes mistakenly diagnosed as child abuse."




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## Vitamin C/Immunizations: the theory

- Too many simultaneous vaccinations raise the body's histamine level
- This, in turn, is related to low Vitamin C levels
- This causes scurvy and we are confusing it with child abuse
- There is no legitimate data to support this hypothesis




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## The Journal: Medical Hypothesis

- Not actually peer reviewed
- Seeks to publish hypothetical conclusions
- Example: has published articles suggesting that masturbation in males is an effective treatment for sinusitis
- Message: just because it is published doesn't mean it is legitimate science




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## Apparent Life Threatening Event

- Something happened that made the parents scared
- Child may not breath for a few seconds
- Lips may turn blue
- Common
- Usually no underlying problems




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### Infant Acute Life-Threatening Event—Dysphagic Choking Versus Nonaccidental Injury

Patrick D. Barnes, MD,<sup>1</sup> John Galaznik, MD,<sup>1</sup> Horacio Gardner, MD,<sup>1</sup> and Mark Shuman, MD<sup>2</sup>

- A 4 month old reportedly choked while bottle feeding
- Found on autopsy to have subdural and subarachnoid hemorrhages, retinal hemorrhages, brain edema, and two rib fractures
- Authors hypothesize that blood back flow from choking/coughing caused SDH/SAH/RH/Edema
- No scientific evidence to support this hypothesis
- How come this has never been witnessed in public?
- Lots of kids in hospitals cough.
- This has never happened.




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## Cerebral Sinovenous Thrombus

### Cerebral Venous Thrombosis: A Potential Mimic of Primary Traumatic Brain Injury in Infants

Michael V. Krasnokutsky<sup>1</sup>

### Does Intracranial Venous Thrombosis Cause Subdural Hemorrhage in the Pediatric Population?

#### CLINICAL REPORT

L.A. McLean  
L.D. Frasier  
G.L. Hedlund




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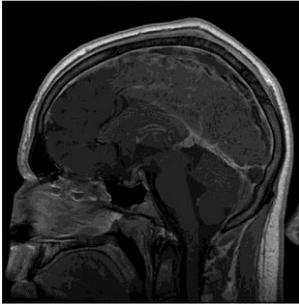
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CVST



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HOSPITALS & CLINICS  
www.childrensmc.org

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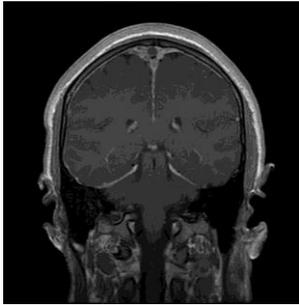
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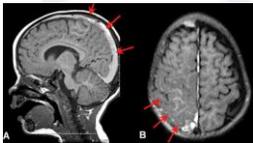
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MRI with SDH (A) and SAH (B)



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## CVST

- Incidence in the first year of life: <1/100,000
- Most children are neonates with known risk factors
- MacLean et al: 36 cases of CVST, none had SDH
- Even cases that do have SDH don't look like AHT




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## Levels of Evidence

Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence

Question	Step 1 (Level 1*)	Step 2 (Level 2*)	Step 3 (Level 3*)	Step 4 (Level 4*)	Step 5 (Level 5)
How common is the problem?	Local and current random sample surveys (or censuses)	Systematic review of surveys that allow matching to local circumstances**	Local non-random sample**	Case-series**	n/a
Is this diagnostic or monitoring test accurate? (Diagnosis)	Systematic review of cross sectional studies with consistently applied reference standard and blinding	Individual cross sectional studies with consistently applied reference standard and blinding	Non-consecutive studies, or studies without consistently applied reference standards**	Case-control studies, or "poor or non-independent" reference standard**	Mechanism-based reasoning




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## Differential Diagnosis for SDH

- Bleeding disorders
- Infection
- Metabolic disorder – GAI
- Accidental trauma
- Pre-natal, peri-natal trauma
- Iatrogenic – procedures
- Autoimmune/Vasculitis
- Cancers
- Abnormal Blood Vessels




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## Study on Confessions

- Starling 2004:
- 171 children with AHT
- 81 confessions
- 68% admitted to shaking
- 54% admitted shaking without impact
- Some with shaking only confessed had evidence of impact
- Not all infants with impact had visible signs




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## Studies on Confessions

- Vinchon 2010:
- 45 confessed histories
- 39 accidental histories, public place, corroborated by independent witness
  - MVA, fall out window, fall while carried, fall from shopping cart, fall off objects, walker fall on stairs, fall on sidewalk
- Avoid the bias of circularity




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## Vinchon 2010

**Table 4** Diagnostic value of brain ischemia, subdural hematoma, retinal hemorrhage, and absence of signs of impact, for the diagnosis of child abuse

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Chi-square (p)
Brain ischemia	0.267	0.971	0.921	0.505	<0.01
SDH	0.822	0.552	0.685	0.724	<0.001
Severe RH	0.556	0.974	0.961	0.655	<0.001
Absence of scalp swelling	0.978	0.769	0.830	0.968	<0.001
SDH and diffuse RH and no scalp swelling	0.244	1	1	0.534	<0.001




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# Data!

ARTICLES

Estimating the Probability of Abusive Head Trauma: A Pooled Analysis Maguire et al. 2010

• Can calculate the probability of AHT based on the presence/absence of six factors (in addition to intracranial injury):

- 1) Retinal hemorrhage
- 2) Long Bone Fractures
- 3) Rib Fractures
- 4) Apnea
- 5) Seizures
- 6) Bruising




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# Data!

ARTICLES

Estimating the Probability of Abusive Head Trauma: A Pooled Analysis



**WHAT'S KNOWN ON THIS SUBJECT:** In recent debate in medicolegal circles, clinical basis for a diagnosis of abusive head trauma (AHT) has been questioned. Studies have been underpowered to address the key clinical questions. Estimates of the association of single clinical variables with AHT are recognized.



**WHAT THIS STUDY ADDS:** This study provides an estimate of probability of AHT based on 6 clinical features. In a child younger than 3 who has an intracranial injury and  $\geq 3$  of these features, the positive predictive value of AHT is  $>85\%$  (odds ratio:  $>100$ ).



www.childrensmc.org

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# Data!

Neuroimaging: what neuroradiological features distinguish abusive from non-abusive head trauma? A systematic review

A M Kemp,<sup>1</sup> T Jaspán,<sup>2</sup> J Griffiths,<sup>3</sup> N Stoodley,<sup>4</sup> M K Mann,<sup>5</sup> V Tempest,<sup>6</sup> S A Maguire<sup>2</sup>

The following are significantly associated with AHT:

- 1) SDH (OR 8.2)
- 2) Multiple hemorrhages (OR 6)
- 3) Interhemispheric hemorrhage (OR 7.9)
- 4) Convexity hemorrhage (OR 4.9)
- 5) Hypoxic ischemic injury (OR 3.7)




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## Data!

Neuroimaging: what neuroradiological features distinguish abusive from non-abusive head trauma? A systematic review

A M Kemp,<sup>1</sup> T Jaspán,<sup>2</sup> J Griffiths,<sup>3</sup> N Stoodley,<sup>4</sup> M K Mann,<sup>5</sup> V Tempest,<sup>6</sup> S A Maguire<sup>2</sup>

**What this study adds**

- ▶ This is the first meta-analysis of neuroradiological features of AHT describing the evidence-base behind these features.
- ▶ Multiple SDH over the convexity, interhemispheric haemorrhages, posterior fossa SDH, hypoxic-ischaemic injury and cerebral oedema are significantly associated with AHT.
- ▶ Data to inform decisions about the likelihood of AHT in the clinical and legal child protection arenas are presented.



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## Data!

Which clinical features distinguish inflicted from non-inflicted brain injury? A systematic review

S Maguire,<sup>1</sup> N Pickerd,<sup>1</sup> D Farewell,<sup>2</sup> M Mann,<sup>3</sup> V Tempest,<sup>1</sup> A M Kemp<sup>1</sup>

The following are statistically predictive of AHT:

- 1) Apnea (PPV 93%)
- 2) Retinal hemorrhage (71%)



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## Data!

Which clinical features distinguish inflicted from non-inflicted brain injury? A systematic review

S Maguire,<sup>1</sup> N Pickerd,<sup>1</sup> D Farewell,<sup>2</sup> M Mann,<sup>3</sup> V Tempest,<sup>1</sup> A M Kemp<sup>1</sup>

**What this study adds**

- ▶ The finding of apnoea and/or retinal haemorrhage in a child with a brain injury is more strongly associated with iBI than niBI.
- ▶ Children where iBI may be a differential diagnosis should undergo fundoscopy by an ophthalmologist and if <2 years old should have a skeletal survey.
- ▶ Infants less than 6 months of age with a brain injury are more likely to have sustained an iBI than older infants.



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## Data!

TABLE 1 Abuse Ranking

Ranking	Criteria Used to Define Abuse
1	Abuse confirmed at case conference or civil, family, or criminal court proceedings or admitted by perpetrator or independently witnessed
2	Abuse confirmed by stated criteria, including multidisciplinary assessment
3	Diagnosis of abuse defined by stated criteria
4	Abuse stated as occurring, but no supporting detail given as to how it was determined
5	Abuse stated simply as "suspected"; no details on whether it was confirmed




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## Data!

Is the diagnosis of physical abuse changed when Child Protective Services consults a Child Abuse Pediatrics subspecialty group as a second opinion?

James Anderst<sup>a,\*</sup>, Nancy Kellogg<sup>b</sup>, Inkyung Jung<sup>c</sup>

<sup>a</sup> Division of Emergency Medical Services, Section for Children at Risk, Children's Mercy Hospitals and Clinics, University of Missouri at Kansas City, 2401 Gillham Road, Kansas City, MO 64108, USA  
<sup>b</sup> Division of Child Abuse Pediatrics, UT Health Science Center San Antonio, USA  
<sup>c</sup> Department of Epidemiology and Biostatistics, UT Health Science Center San Antonio, USA

- Child Abuse Pediatricians are less likely to diagnose abuse than other physicians
- One of the most important factors in arriving at a diagnosis that is different from a non-CAP physician is information gathered by investigative services!




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## Circular Reasoning?

- Elimination of investigative component
  - May reduce circular reasoning
  - May eliminate a critical component in coming to an accurate diagnosis
- One way to address:
  - Design studies that completely eliminate the investigative component
  - Classify abuse based on physical findings/presentation
  - DON'T include the finding in question in the classification scheme




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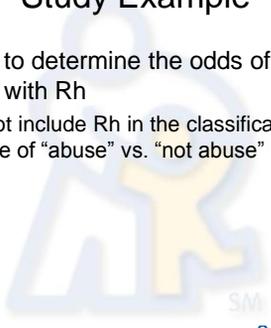
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## Study Example

- If I want to determine the odds of abuse in children with Rh
  - I cannot include Rh in the classification scheme of “abuse” vs. “not abuse” in my study




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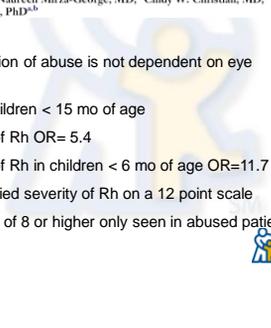
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## Data!

### Odds of abuse associated with retinal hemorrhages in children suspected of child abuse

Gil Binenbaum, MD,<sup>1,2</sup> Naureen Mirza-George, MD,<sup>1</sup> Cindy W. Christian, MD,<sup>2</sup> and Brian J. Forbes, MD, PhD<sup>1,2</sup>

- Categorization of abuse is not dependent on eye findings
- Study of children < 15 mo of age
- Presence of Rh OR= 5.4
- Presence of Rh in children < 6 mo of age OR=11.7
- Also classified severity of Rh on a 12 point scale
- Rh severity of 8 or higher only seen in abused patients




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## Data!

### Prevalence of the Classic Metaphyseal Lesion in Infants at Low Versus High Risk for Abuse

Paul K. Kleinman<sup>1</sup>  
 Jeannette M. Perez-Rossello<sup>1</sup>  
 Alice W. Newton<sup>2</sup>  
 Henry A. Feldman<sup>3</sup>  
 Patricia L. Kleinman<sup>1</sup>

- 50% of “high risk” infants had a CML
- 0 of “low risk” infants had a CML




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## Conclusions

- The origins of “shaken baby syndrome” were non-scientific
- There are now *scientific, positive* criteria for the diagnosis of Abusive Head Trauma
- The differential diagnosis of head bleeds/brain swelling/eye bleeds must be considered in each case
- Defense arguments are largely based on hypothesis, with no underlying scientific basis
- Most “defense experts” often distort fact and misrepresent data



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## Conclusions

- A good prosecutor will gain understanding of the defense theories ahead of time
- Each defense theory can be deconstructed and refuted with good preparation and understanding
- Consider asking your prosecution expert for a list a questions to ask the defense expert



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