CHILD ABUSE EVIDENCE: Perspectives from Law, Medicine, Psychology + Statistics

Friday, November 6 from 8:30 a.m. to 4:30 p.m.
University of Michigan Law School Honigman Auditorium, 100 Hutchins Hall
Can a “sign or occult finding" predict a causal relationship?
"How to Reason about Possible Child Abuse"

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Professor

Symposium Ann Arbor 6th of November 2015
F. Scott Fitzgerald –
American writer 1896-1940

- "No grand idea was ever born in a conference, but a lot of foolish ideas have died there"
Disclosure

I have a son that has been accused of shaking his son Johan (further referred to as “Johan’s case”).

After more than 3 years, the charges were dismissed.
Personal declaration

I believe that violent shaking seriously may injure a child

It is of outmost importance that paediatricians are well acquainted with this fact and that they look for signs that may be caused by child abuse
My background

Vice President of Karolinska Institutet 1995-2001
Chairman, the Swedish Society of Medicine 2009-2010
Vice Dean at Karolinska Institutet and Head of the MD program 1993-1995
Chairman of the Scientific Advisory Board, the Swedish Board of Health Technology 2000-2005
Head of Research and Education at Huddinge University Hospital 2002-2004
Chairman, the Swedish Society of Radiology
My background

I am not a specialist in diagnosing SBS/AHT
But I am well educated in evaluating research and especially in Evidence Based Medicine
Can a “sign or occult finding" predict a causal relationship ?

"How to Reason about Possible Child Abuse“

If so – then with what (pathognomonic) evidence and positive predictive value?
Is there a controversy?

In Shaking Baby syndrom (SBS) and Abusive Head trauma (AHT),
1. Concerning the cause of the Triad (signs)
2. Whether the signs are predictive of a causal relationship

YES
The background of SBS

1. A vague hypothesis (Gutchech) 1971
2. Becomes a new theory (Caffey) 1974
3. That develops into a child abuse paradigm (Battered Child syndrome, originally suggested by Kempe 1962)
The background of SBS

4. That over time develops to a pathognomonic causal relationship

5. Which based on empirical findings becomes the "truth" (and sometimes nothing but the truth)
Is there new evidence?

To question the theory behind the concept? And thus the causal relationship

YES - according to me
The concept - THE TRIAD

Retinal bleeding (RH)
Subdural hematoma (SDH)
Brain swelling (BS)
The concept - THE TRIAD

If the triad (RH, SDH and BS) occurs then a shaking must be suspected. And if no alternative explanation is given –

Then the triad is pathognomonic for a child abuse. (?)
THE TRIAD

Is the triad always and only caused by a violent shaking

1 If YES- what is the evidence for that
2 If NO what is the new evidence to question that
3 If NO what other causes may explain the triad
THE TRIAD

Is the triad always and only caused by a violent shaking

I will in the end relate this discussion to my son’s “Johans case”
Retinal bleeding (RH)

A. Was first described as due to a “mechanical cause” with rupturing of the vessels in (into) the eye due to shaking shearing forces tearing and rupturing the vessels to the eye.

B. Question; Are there autopsy findings showing “torn vessels” to support that?

American Academy of Ophthalmology,
Retinal bleeding (RH)

Today we know that a RH can occur whenever the venous pressure in the brain (eye veins) exceeds the arterial pressure (eye artery).

This may happen for several reasons whenever there is an *increased intra - cranial pressure* (ICP)

(Can be caused by trauma, postoperatively, venous thrombosis in the brain, high PCO2 - high altitude disease, hypertensive crisis and hypoxia) irrespective of cause)

- B, Honigman, High Altitude Medicine & Biology Volume 2, Number 4, 2001
Retinal bleeding (RH)

It is proven to appear spontaneously post partum
It is proven to exist as a result of high ICP and if trauma
( mechanical explanation) is claimed, then RH must be diagnosed before brain swelling occurs.
So, evidence is in favour for that RH is a capillary bleeding that is the consequence of pressure differences with no pathognomonic causal relationship to shaking

Retinal bleeding (RH)

New evidence is IN

And the American Society of Ophthalmologist does not consider RH pathognomonic for SBS or AHT (any longer)
Subdural hematoma/effusion (SDH)

At the start of SBS it was suggested to have a mechanical cause, caused by tearing of the bridging veins, and that only high energy trauma could cause it (especially with the triad)

Subdural hematoma (SDH)

We now know that SDH may appear in connection to birth.

May be caused by a re-bleed from, an earlier effusion/bleeding.

That it can be caused by short falls.

Can be caused by hypoxia.

Subdural hematoma (SDH)

So no pathognomic evidence that either a shaking or especially not a violent shaking is needed to create a SDH/effusion
Brain Swelling (BS)

First believed to have a mechanical cause where the nerve fibers were torn apart by a violent shaking (shear forces)

There is no evidence supporting that “theory”
May have other explanations than trauma (as change in PCO2 and PO2 and may have a hypoxic explanation)

The Triad

First was believed to be mechanical and hence could only be caused by high energy forces - violent shaking.

New evidence has shown that also low energy trauma e.g. Short falls may give the triad

Multiple other conditions can create both the individual components of the triad as well as the triad itself.
“One case” that contradicts that something is pathognomonic (by definition) rules out that it is!
Johan´s case

Father reported low energy trauma - short fall
Ambulance and hospital (GSC 11)
Intubation
CT shows small SDH (2-3 mm) otherwise “normal”
Diagnosis (of trauma/emergency doctor)- accident, fall

Prognosis-good

con´t
Johan’s case

Control CT After 6 h shows severe brain ischemia
Control CT After 12 h shows massive brain swelling

After 13 h
Child abuse Dr finds RH -takes 30 minutes to diagnose the Triad
Claims , history of short fall does not match “findings”
Makes diagnosis; SBS. (No other explanation at hand)
The Father is arrested and put in custody
Johan`s case

- The brain swelling continues and Johan is later declared brain dead and dies after less than a week.

- The autopsy takes more than 8 months to be completed and has to be “re-checked” after our experts testimony.
Johan’s case

It took us 3 months to gather all medical information
Another 3 months to find all medical “questionable finding about the care and the diagnosis”
Took 3 years to gather and get “testimonies” of multiple national and international experts
In order to “find”

- con’t
11/8 Monday

- KA Picks up Lukas and Johan at daycare
- Accident, Paramedics Arrive
- Johan Arrives at hospital

**CT 1**
1. Only Shows a small left SDH (Subdural Hematoma)
2. No Swelling or mass effect

**Faulty Intubation**
1. Left Lung completely collapsed, right lung partially collapsed.
2. Was intubated 8 minutes after arrival, and it was not detected until at X-ray 8:37, and we are not sure when it was corrected “on the floor” (1 hour added here)
3. increases the ischemia to the brain -poor oxygenation for at least 1 hour. Need to understand how this impacts an infant with brain injury.

**CT 2**
- Severe hypoxia-ischemia (Swelling)
- Proof of impact seen (Not reported)

**Eye Examination**
- Estimated time on memory
- diffuse intraretinal hemorrhage; subhyaloid hemorrhage; discs obscured by hem OU. Limited peripheral exam.

11/9 Tuesday

**High pCO2 (4:15)**
Even after the Brain Swelling in CT2 the pCO2 value is recorded high

**High pCO2 (21:20)**
1. The pCO2 is indirectly steering the blood flow to the brain
2. Normally one should try to over ventilate to get a low pCO2 that constricts the carotid arteries so the brain should get less blood to reduce the swelling
3. Johan is heavily under ventilated (respiratory acidosis) which “opens up the blood flow to the brain” which in a brain damaged child increases the brain edema.
4. May not have caused the brain edema but could surely aggravate it.
Johan Medical Timeline
Enlarged critical timeframe

19:26
Johan Arrives at hospital

20:00
CT 1

20:05
2nd Intubation

20:05
X-Ray 1

20:20
Intubated & Medicated

19:35
Ven pO2 = 82
pCO2 = 88
PH = 7.05

21:20
21:20
Cap pO2 = 304
pCO2 = 40
PH = 7.42

21:20
Cap pO2 = 63
pCO2 = 33
PH = 7.35

21:20
Ven pO2 = 84
pCO2 = 66
PH = 7.14

23:38
Cap pO2 = 63
pCO2 = 40
PH = 7.35

02:15
Cap pO2 = 85
pCO2 = 52
PH = 7.22

02:58
CT 2

02:00
X-Ray 2

04:05
Ven pO2 = 11
pCO2 = 66
PH = 7.14

02:15
Ven pO2 = 11
pCO2 = 66
PH = 7.14

23:38
Cap pO2 = 63
pCO2 = 40
PH = 7.35

02:58
CT 2

04:05
Ven pO2 = 11
pCO2 = 66
PH = 7.14

04:35
Ven pO2 = 11
pCO2 = 66
PH = 7.14

Bradydardia ° 2/2 Hypoxia
over-dosing (Max 0.7 of Versed/8 mg Roc)
IV Infiltrated 3 mm versed, 10 mg rocuronium
Repeated 3 mm versed, 10 mg rocuronium

*Respiratory event (22:43)
noted in nursing notes

Real possibility that intubation was always loose and that the cuffed/uncuffed tube may periodically have become disconnected or loose.

Fontanel Flat

Blown Pupil

Ventilation disconnect
?-long time?

Lung [left upper lobe] remarks: noted asymmetric chest rise/fall and diminished sounds on the left; readjusting ETT

Baby was physically restrained at 11 pm. This could have contributed to or masked agitation.

The question is whether he was agitated because he wasn't being ventilated adequately and was attempting to breathe.
Johan Medical Timeline
Enlarged critical timeframe

19:26 Johan Arrives at hospital
19:35 Intubated & Medicated
19:30 Botched Intubation
20:05 CT 1
20:37 X-Ray 1
21:20 Ven pO2 = 82 pCO2 = 88 PH = 7.05
21:40 Intubation Adj 50% Lung Cap?
23:38 Cap pO2 = 304 pCO2 = 33 PH = 7.42
02:00 X-Ray 2
02:58 CT 2
04:05 Ven pO2 = 11 pCO2 = 66 PH = 7.35
04:35 Cap pO2 = 85 pCO2 = 82 PH = 7.22

Botched Intubation 30% Lung Capacity
Intubation Adj 50% Lung Cap?
Ventilator controlled by Pressure:
With Reduced Lung volume lungs can not remove carbon dioxide resulting in high pCO2 (hypoventilation --> hypercapnia)
Paralyzed
Bradyardia
over-dosing (Max 0.7 of Versed/8 mg Roc)
IV Infiltated 3 mm versed, 10 mg rocuronium
Repeated 3 mm versed, 10 mg rocuronium
9 times Max for Versed / 2.5 times Max for Roc

[Sara Harris] lung [left upper lobe] remarks: noted asymmetric chest rise/fall and diminished sounds on the left; readjusting ETT (10:43)

Now the Lung volume is back and initially the Hypercapnia induces hyperventilation. The HIE is already in a vicious cycle from the insult to the brain in the first 3 hours? Hyperventilation and high Oxygen levels continue → hyperventilation at 4.05 again

Fixed Pupil! Uncal Herniation?
baby was physically restrained at 11 pm. This could have contributed to or masked agitation
The question is whether he was agitated because he wasn’t being ventilated adequately and was attempting to breathe

Fontanel Flat [All the signs for ICP are there (Slow Heart Rate/BradyCardia/pupil Dilation/CE) except bulging Fontanel?] Possibility that intubation was always loose/leakage and that the tube may periodically have become disconnected. Leakage noted at 5 am by Nurse

From relatively small SDH to brain death in 7 hours? Seems like a fast development? Considering first CT.
Johan`s case

(in brief)
There was a “botched intubation” for 2-6h
During this botched intubation, high and low PO2 and high PCO2 was registered
Poor ventilation was present the whole time.

All this may cause increased intracranial pressure causing the brain swelling and secondary to that the found RH

con´t
Johans first Chest X ray (20.32, 8th)
CXR 11-8-12 taken after first CT exam at approximately 2032 hrs
Johans second Chest X ray 01.58 (9th)
Johan`s case

Retrospective analysis of initial CT shows undisputable soft tissue swelling well in accordance with father history of fall- mild trauma.
Later also autopsy was prejudice and had to be reanalyzed after “our expert critics” and later cause of death was changed after our corrections
And after multiple turbulence and cost the case was dismissed 3.5 years after the accident.
Johans first CT
Johans second CT scout view
Posterior to parasagittal blood/thrombosis
Johans first CT
Johans second CT
Johan`s case – (my) lesson learned?

1. The diagnosis was made too fast (30 min)
2. No evident team conference or retrospective analysis
3. To retrieve data is difficult – time consuming
4. To understand data requires high level of medical knowledge (expensive)
5. Too many are prejudice – and wants to support the prosecutor (police, social workers, coroner etc)
5. We don´t know “for sure” – is used too seldom
THE TRIAD

Is the triad always and only caused by a violent shaking

1 If YES - what is the evidence for that – the theory behind the causal relationship is not evidence based and not pathognomonic

2 If NO what is the new evidence to question that – yes there is new evidence to question that
THE TRIAD

Is the triad always and only caused by a violent shaking

NO
THE TRIAD

Thus the proof of concept (triad and high energy trauma) is not valid as an explanatory reason.

Are there - case based correlations/associations from an epidemiologic viewpoint?
Epidemiology

1. Are there correlations between the Triad and a “gold standard”

If Gold standard is defined as - independently witnessed shaking - leading to the triad

There are NO such cases

Maguire A. Pediatrics 2011 128,550-564
2. There are independently witnessed violent shakings – with no Triad as a result

3. There are independently witnessed short falls leading to the triad

Epidemiology

4. The only causal relationships between the triad and violent shaking are based on
   a. Confessions
   b. Conclusions from child abuse teams.
Epidemiology

Since there is no “gold standard”
Most efforts to predict the value of the symptoms are based on “circular reasoning”
Since it is scientifically incorrect to use the “test” (the triad symptoms), when it is part of (mostly the major component) of the final diagnosis.

This must also be questioned
Circular reasoning

1. Hypothesis: The triad is highly specific for SBS.
2. Educate hypothesis as a fact.
3. Doctors believe that The Triad is highly specific for SBS:
   If the Triad, then SBS
4. Study: What findings are predictive for SBS in diagnosed SBS?
   Result: The Triad!
Epidemiology

Also there is in the medical reports published an almost total lack of “false positive cases”.
Cases with the triad that was not regarded as SBS (as in Johan’s case – there are numerous). Never gone to court or dismissed in court, never becomes published.

So without a gold standard and no false positive cases the epidemiology approach is quite questionable as a “proof.”
Epidemiology

Thus the predivitive value of the Triad to claim that a violent shaking has taken place is very doubtful.

The mechanical theory is not proven (evidence based).
The epidemiology outcome is not proven (evidence based).
Other explanations

When looking for other explanations
There are many but

Even if you don’t find any-
Be humble for the possibility for
“We don’t know”

(Sudden infant death syndrome-SID)
Analysis of the perpetrator

Almost always missing
No psychiatrist or psychologist involved
Analysis of the perpetrator – is there also an unproven Triad?

1. Anyone can do it
2. No one has ever seen it
3. Denial is a "proof"

How do you defend yourself against this (compare- witch hunt)
Never forget "second impact syndrom"
The terminology is prejudice

Shaken Baby syndrom/Abusive head trauma

Implies
1. Intention to harm (Abusive)
2. Etiology (shaking-trauma)

From clinical signs- is that evidence based – from both a medical and legal aspect??
Evidence Based Medicine - what is it?
"the higher up a methodology is ranked, the more robust and closer to objective truth it is assumed to be"
Evidence Based Medicine – what is it not?

Everything you do in medicine does NOT have to be evidence based
Some diagnosis/treatments things will never be evidence based (unethical to perform the study)

BUT, the doctor then has to KNOW, that it is NOT EBM

(to know, to strongly believe, to suspect, to not know)
Evidence Based Medicine - what is it?

The difference between

EVIDENCE based
and
EMINENCE based
SBU – Swedish Agency for Health Technology Assessment and Assessment of Social Services

- Is presently investigating, systematically, the “evidence” for shaking Baby Syndrome and will probably have finished a report in 2016
The final answer is not in

“ In god we trust, all others must bring data”

W Edwards Deming
Summary

New evidence is IN

The mechanical original theory is not evidence based

That only high energy trauma can give the Triad is not evidence based (low energy trauma can cause the triad)

The predictive value of the triad is questionable as no objective “gold standard” exists and almost no false positive cases.

Conclusion: Nothing is “pathognomonic” for SBS
Reflection

Tolerance is defined as “to pay attention to views that lies outside your own internal opinion”

Don’t stipulate dogmas but stimulate argumentation
Reflection

"In all political systems – those who are loved by the general public can obtain justice. Legal rights for the individual, means justice for the repugnant."

Horace Engdahl, secretary of the Swedish Nobel Committee in Literature
Who are the survivors?
- Not the strongest
- Not the smartest

Charles Darwin (1809-1882)
Who are the survivors?
- Not the strongest
- Not the smartest
But
- those who can adapt to change

Charles Darwin (1809-1882)
ALL-DAY CONFERENCE

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