A DIFFERENT VIEW

Re-evaluation of abusive head trauma in Norway appears flawed

Arne Stray-Pedersen1,2 | Mary Jo Vollmer-Sandholm1,2,3 | Stein M. Aukland4,5 | Bernt J. Due-Tønnessen6 | Jens B. Grøgaard7 | Olav H. Haugen5,8 | Arne K. Myhre9,10 | Claus Møller11 | Silje Osberg1 | Torleiv O. Rognum2

1Department of Forensic Sciences, Oslo University Hospital, Oslo, Norway
2Institute of Clinical Medicine, University of Oslo, Oslo, Norway
3Department of Paediatrics, Oslo University Hospital, Oslo, Norway
4Department of Radiology, Haukeland University Hospital, Bergen, Norway
5Department of Clinical Medicine, University of Bergen, Bergen, Norway
6Section of Paediatric Surgery, Department of Neurosurgery, Oslo University Hospital, Oslo, Norway
7Oslo, Norway
8Department of Ophthalmology, Haukeland University Hospital, Bergen, Norway
9Department of Paediatrics, St. Olavs University Hospital, Trondheim, Norway
10Department of Clinical and Molecular Medicine, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
11Bergen, Norway

Correspondence
Arne Stray-Pedersen, Department of Forensic Sciences, Oslo University Hospital, Postbox 4950 Nydalen, 0424 Oslo, Norway.
Email: arne.stray-pedersen@medisin.uio.no

A review by Wester et al in Acta Paediatrica presented 17 adjudicated cases of Norwegian infants with abusive head trauma (AHT).1 Their interpretation of the medical findings identified alternative diagnoses for 16 of the 17 children and suggested that the injuries were not inflicted and may have been the result of spontaneously occurring events. The authors stated that eight children had clinical and radiological characteristics consistent with external hydrocephalus, complicated by chronic subdural haematoma, and that six had findings compatible with hypoxic-ischaemic insults. Fractures were attributed to prematurity and sequelae from birth trauma. If their interpretations are correct, this study calls for a thorough review of how the medical community, forensic experts and the courts manage AHT cases. However, there are several elements of concern in the Wester et al study that we believe need clarification before a conclusion can be reached.

We have seen renewed legal challenges to diagnoses of AHT in Sweden and Norway, particularly following the 2016 report on traumatic shaking by the Swedish Health Technology Assessment Agency.2 The report generated controversy and debate, with many authors criticising it3,4 and others welcoming it.5 As physicians we know that that each year many infants present to Norwegian emergency rooms with intracranial injuries, such as subdural haematoma, brain injuries and retinal haemorrhages. Some have associated osseous and cutaneous injuries.6 In most cases, there is no history that is consistent with the injuries and no witnesses. An AHT diagnosis may have major medical and legal implications for the infant and caretakers and a broad multidisciplinary investigation and careful diagnostic evaluation are necessary.6 Medical diseases that mimic components of AHT must be excluded before diagnosing physical abuse. In some instances, there is a realistic natural cause for the injuries and no grounds for legal action.3,7 In other cases, there is little doubt that the injuries have been inflicted on the child.

There is still much to learn about AHT, including the exact mechanisms and forces required to induce the typical injuries

Abbreviations: AHT, abusive head trauma; CT, computed tomography; MRI, magnetic resonance imaging.
| Pat # | Age (corrected) | Sex | Symptoms & findings | Onset | HC | RH | Signs of impact to the skull | Fractures | Radiological findings | Outcome |
|-------|----------------|-----|---------------------|-------|----|----|-----------------------------|-----------|----------------------|---------|
| 2     | 1.5 (0.5)      | M   | Tender swelling right thigh | Gradual | >97% | Unilat | Small blue mark forehead | Femur fracture, Rib fractures with callus | BEH-like Bilat. CSDH/SDHy | Good    |
| 2     | 2.5 (1.5)      | M   | Failure to thrive – concerns for abuse | Repeated incidents raising concern; 1mo: oral mucosal tearing, 1.5m: femur fracture, 2.5 mo breathing difficulties. Inconsistent story of reason for fractures | Bilateral; Multiple right, scattered left. Conjunctival bleeding left eye | Bruise left eyelid, red parallel linear bruising on the back | 17 rib fx: 9 new rib fx at age 1.5 mo, 8 new rib fx at age 2.5 mo | Bilat subdural effusions with elements of fresh blood | Unknown |
| 4     | 1              | F   | Unilateral pupillary dilatation, severe hypopotassaemia and acidosis | Sudden | no records | Unilat | None | Small linear | Intracerebral haematoma, suture diastasis, HII | Died    |
| 4     | 1              | F   | Minor head trauma, irritability, seizures, gaze deviation | Sudden | 32 cm at birth – <3% | Bilat | Blue marks on face and body | Clavicle, old rib fractures with callus | Large left hemisphere infarction, HII | Severe brain damage |
| 6     | 1              | F   | Alleged minor trauma. Later confession of vigorous shaking | Father confessed having shaken the infant 4–5 seconds. The girl became quiet, was put to bed, mother found the girl unconscious hrs later | Multiple, multilayered bilateral haemorrhages | Bruises both sides of face, and both thighs | Clavicle, scapular and two posterior rib fractures -all new | Bilateral ASDH, Oedema. Global hypoxic-ischaemic changes | Multicystic encephalopathy |

Abbreviations: ASDH, acute subdural haematoma; BEH, benign external hydrocephalus; CSDH, chronic subdural haematoma; F, female; HII, hypoxic-ischaemic injury; M, male; SDH, subdural haematoma; SDHy, subdural hygroma.
involved. We also need to examine predisposing and biogenetic factors and the progression of the injuries. Therefore, it is important that these complex medical issues are resolved by high-quality research and not based on hypotheses that are based on incomplete, or misinterpreted, crucial, patient information.

We do not yet have full access to all the cases presented by Wester et al., but have recognized three as two of our authors (ASP, TOR) were clinically and legally involved in these cases. Our main concern is that the authors’ case reports are missing significant clinical information that is pertinent and pivotal to the diagnosis. This includes the differential diagnoses that were considered. We provide a short summary of the three cases (Table 1, Figures 1-5), using the numerical designations in Wester et al’s paper.

**CASE TWO**

The authors state that this infant had chronic subdural haematoma, which was asymptomatic and only diagnosed because the limb fracture raised suspicion of shaken baby syndrome/AHT. They further state that he had asymptomatic rib fractures with callus and a femur fracture. In reality, the femur fracture was detected after he was admitted to hospital due to failure to thrive, which was when the police and social services first became involved. An oral injury had been documented two weeks earlier during an outpatient visit. Four days after discharge the child was re-admitted to the intensive care unit for respiratory distress. Neuroradiological examination with computed tomography (CT) and magnetic resonance imaging (MRI) scans revealed bilateral subdural effusions with fresh haemorrhagic components. Eye examination identified retinal haemorrhages widespread in the right eye and scattered in the left eye which also had conjunctival bleeding. There were fractures diagnosed in 17 ribs. All were new when first observed, but nine had been initially missed by the radiologist who evaluated the radiographs. The fractures caused a flail chest, which was evident upon clinical examination. Wester et al describe a small blue mark on the forehead, which is correct, but they do not mention the bruising and swelling of the left eyelids and the parallel linearly patterned bruising on the back.
There were numerous features in the child’s history and clinical presentation that raised the examining clinicians’ concerns about abuse. The missing details indicate an inaccuracy in the clinical picture presented by Wester et al. The authors suggest alternative diagnoses such as bone fragility; however extensive clinical, radiological and laboratory tests excluded this as a possibility.

2 | CASE FOUR

We believe that significant details were missing from this case review, including the clinical presentation and several pertinent injuries. The authors describe an intracerebral haematoma. However, the baby presented with an acute subdural haematoma that required surgical evacuation. In addition, CT and MRI scans revealed multiple contusion injuries in the brain parenchyma. The infant ultimately died of haemorrhagic infarctions due to hypoxic-ischaemic brain injuries. Multiple bruises were present, as well as a posterior rib fracture. Metaphyseal and corner fractures were identified in both femurs and both tibiae during the radiological evaluation.

3 | CASE SIX

The authors state that the injuries to this child are due to a hypoxic-ischaemic insult and that the infant had old rib fractures and a clavicle fracture. Again, critical details are missing. This infant presented with new, not old, fractures to the clavicle, scapula and two ribs. Multiple bruises were documented. CT and MRI scans showed bilateral acute subdural haematoma, as well as a rapidly evolving brain oedema with hypoxic-ischaemic changes, which resulted in end-stage cystic global encephalopathy. The Wester et al paper does not report that, critically, the defendant confessed to having repeatedly shaken the child back and forth. He demonstrated this act on camera during the criminal investigation and his early confession was substantiated during the court hearings. Although this information can be interpreted in various ways...
ways, it is vital for a fair and accurate assessment and understanding of the case.

We are puzzled by how many injuries, symptoms and details are missing from the paper by Wester et al. As medical professionals and researchers, we have a responsibility to scrutinise all the facts of a case, including the entire clinical picture. If critical elements and findings are missing or omitted from that evaluation, a sound and thorough diagnostic, clinical and forensic medical assessment is precluded. Wester et al presented the judicial aspects of the cases in a Norwegian law journal prior to their paper in *Acta Paediatrica*, and a law scholar and former prosecutor discussed significant methodological shortcomings of the study.10

4 | CONCLUSION

We do not have access to all cases in the Wester et al’s paper, but this preliminary review raises concerns about why significant facts are missing. While we welcome challenges to the diagnosis and legal proceedings surrounding these cases, we believe that this should involve high-quality research that is fully transparent. This should include all of the clinical information and be presented in a manner that is objective and avoids circular reasoning. We are also concerned about the impact that the incomplete representation of the three cases; we specifically comment on may have on clinical judgement and medical expert testimony in the future. This can make it even more difficult to protect those infants who are most at risk and ensure justice for them and their parents.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

ORCID

Arne Stray-Pedersen DOI: https://orcid.org/0000-0002-7238-0327

Mary Jo Vollmer-Sandholm DOI: https://orcid.org/0000-0002-2348-0065

REFERENCES

1. Wester K, Stridbeck U, Syse A, Wikstrom J. Re-evaluation of medical findings in alleged shaken baby syndrome and abusive head trauma in Norwegian courts fails to support abuse diagnoses. *Acta Paediatr*. 2022;111(4):779–792.
2. Lynoe N, Elinder G, Hallberg B, Rosen M, Sundgren P, Eriksson A. Insufficient evidence for ‘shaken baby syndrome’ - a systematic review. *Acta Paediatr*. 2017;106(7):1021-1027.
3. Bilo RAC, Banaschak S, Herrmann B, et al. Using the table in the Swedish review on shaken baby syndrome will not help courts deliver justice. *Acta Paediatr*. 2017;106(7):1043-1045.
4. Debelle GD, Maguire S, Watts P, et al. Abusive head trauma and the triad: a critique on behalf of RCPCH of ‘Traumatic shaking: the role of the triad in medical investigations of suspected traumatic shaking’. *Arch Dis Child*. 2018;103(6):606-610.
5. Cohen MC. The Swedish shaken baby syndrome report and review: what does the latest knowledge tell us? *Acta Paediatr*. 2019;108(2):198-199.
6. Stray-Pedersen A, Moller C, de Lange C, et al. The doctors’ role in cases of suspected child abuse. *Tidsskr Nor Laegeforen*. 2019;1382.
7. Duhaime AC, Christian CW. Abusive head trauma: evidence, obfuscation, and informed management. *J Neurosurg Pediatr*. 2019;24(5):481-488.
8. Stray-Pedersen A, Strisland F, Rognum TO, Schiks LAH, Loeve AJ. Violent infant surrogate shaking: continuous high-magnitude centripetal force and abrupt shift in tangential acceleration may explain high risk of subdural hemorrhage. *Neurotrauma Rep*. 2021;2(1):224-231.
9. Lindberg DM, Dubowitz H, Alexander RC, Reece RM. The "New Science" of Abusive Head Trauma. *Int J Child Maltreat*. 2019;2(1–2):1-16.
10. Holst Ø. Shaken baby: en kommentar til Syse og Stridbeck. *Tidsskrift for Rettsvitenskap*. 2021;124(2–03):333-348.

How to cite this article: Stray-Pedersen A, Vollmer-Sandholm MJ, Aukland SM, et al. Re-evaluation of abusive head trauma in Norway appears flawed. *Acta Paediatr*. 2022;111:793–797. [https://doi.org/10.1111/apa.16069](https://doi.org/10.1111/apa.16069)