CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

https://zenodo.org/records/10352398

https://www.iajps.com/volumes/volume10-november-2023/48-issue-11-november-23/

Available online at: http://www.iajps.com Research Article

SHAKEN BABY SYNDROME

Pallavi Atalkar [1*], Dipti Damodar[1], Sejal Sahu[1], Aniket Sawsakade[1], Dhiraj Thaddani[1], Vivek Rathod [2]

[1]Student, Vidyabharti College of Pharmacy, Amravati.

[2]Assistant Professor, Vidyabharti College of Pharmacy, Amravati.

Abstract:

Infants who experience Shaken Baby Syndrome have their brains pushed up against their skulls as a result of very strong acceleration-deceleration forces. Hemorrhages in the subarachnoid, and retina are signs of the Shaken Baby Syndrome. The degree of mental and visual impairment is assessed using MRI and ocular exams, and axonal lesions are discovered using immunohistochemistry staining for the -amyloid precursor protein. Shaken Baby Syndrome is treated with surgeries like the Burr hole craniotomy and the Subdural hemorrhage (SDH) evacuation procedure, however the prognosis is frequently dismal. Shaken Baby Syndrome is a serious condition with traumatic and occasionally fatal repercussions, so it is crucial to inform new parents, nurses, and medical professionals about the condition in order to prevent instances.

Keywords: *Shaken Baby Syndrome infants retinal hemorrhage , subdural hemorrhage evacuation subdural hemorrhage subarachnoid hemorrhage.*

Corresponding author:

Pallavi Atalkar,

Student, Vidyabharti College of Pharmacy, Amravati.

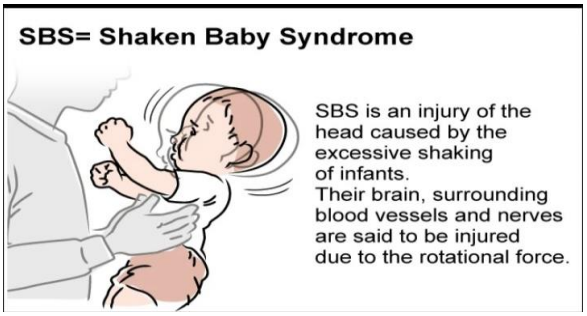
..

QR code

Please cite this article in press Pallavi Atalkar et al ***Shaken Baby Syndrome .,*** *Indo Am. J. P. Sci, 2023; 10 (11).*

INTRODUCTION:

The hypothesis of violently shaking newborns causing subdural hemorrhages was proposed by pediatric neurosurgeon Norman Guthkelch in 1971. This led to the concept of shaken baby syndrome (SBS), now referred to as abusive head trauma (AHT).[1] The triad of symptoms, including retinal hemorrhages, was considered indicative of severe shaking.[2] Pediatricians and Child Protection Teams have maintained that Thea is a scientific robot and there is evidence to support this claim.[3,4] Pediatricians endorsed this, and criminal proceedings often relied on these standards.[5] In 2009, the American Association of Pediatrics recommended replacing SBS with AHT due to its broader scope.[6,7] The incidence of non-accidental head injuries is higher in infants, with a decline as age increases.[8] AHT can lead to fatalities and substantial neurological damage in survivors, contributing to a significant percentage of infant deaths.[9] The associated costs for diagnosis and management are substantial, and the syndrome's diagnosis requires the presence of three key discoveries: retinal hemorrhage, subdural hematoma, and encephalopathy.[10] While AHT can be fatal, it also results in cognitive, visual, and motor impairments.[7,11] Such signs, with or without evidence of an impact to the head or bone structures and without a history of severe trauma, are not infrequently the clinical presentation of the illness.[12] However, when these indications do not idiopathic. [13] There are a large number of differential diagnoses that must be ruled out before confirmation. In addition to being thorough and detailed, this research also addresses legal issues. makes this syndrome highly debatable.[14]



(**Fig.1.** Introduce to Shaken Baby Syndrome)

Objective:

The main goal of this systematic review was to evaluate the diagnostic efficacy of the triad in identifying infants who had been shaken severely.

Definition:

When a baby or young child suffers a violent head injury, it is commonly referred to as shaken baby syndrome (SBS). [15] A young child who is violently shaken can suffer from SBS, which is described as "a devastating form of inflicted traumatic brain injury." accelerated quickly, decelerated quickly, and rotated quickly, either with or without effects." [16] When Ludwig and Warman examined 20 infants in 1984, the condition was first described. and small children who had been shaken, none of whom displayed symptoms of a head impact. [17]

Sign and symptoms :

Significant symptoms of SBS include:

vomiting, irritability, breathing problem, lethargy, seizures, pale or bluish skin, Difficulty staying awake, Poor eating, Paralysis & Coma.[17] shaking-related injuries can cause death or severe neurological problems such as cerebral palsy, cortical blindness, static encephalopathy, mental retardation, and learning disabilities. In younger children under the age of one, subdural hemorrhages are more common. [18]

(Fig2. Signs of Shaken Baby Syndrome)

(**Fig3** Symptoms of Shaken Baby Syndrome)

Causes:

Babies' neck muscles are weak, so they are unable to support their heads. A baby's delicate brain oscillates inside the skull if they are violently shaken. This results in bleeding, swelling, and bruises. When a parent or other adult violently shakes a baby or toddler out of frustration or rage, usually because the child won't stop crying, it's known as "shaken baby syndrome." Not many small falls or bouncing a baby on your knee result in "shook baby syndrome."

(Table 1. Best history in 48 cases of Shaken Baby Syndrome)

Best history in 48 cases of shaken baby syndrome

Etiology	Cases	
	No.	Percent
shaking only	1	2
fall or accidental blunt trauma	15	31
strike or fall plus shaking	10	21
strike only	3	6
trauma or shaking denied, caretakers in attendance	8	17
history unknown, caretakers not in attendance	10	21
cardiopulmonary resuscitation	1	2

Diagnosis :

Shaken Baby Syndrome (AHT) diagnosis relies on the triad of subdural hematoma, retinal hemorrhage, and encephalopathy, with additional symptoms.[19] Since the final indications weren't they can't attract the attention of the less specific seasoned medical professionals, postponing the management and diagnosis.[20] CT or MRI detects encephalopathy and SDH, while fundoscopy identifies retinal hemorrhage. [21] Ophthalmic USG may reveal post-traumatic eye disease.[22] Careful consideration is vital, as not all hemorrhages are diagnostic [23].

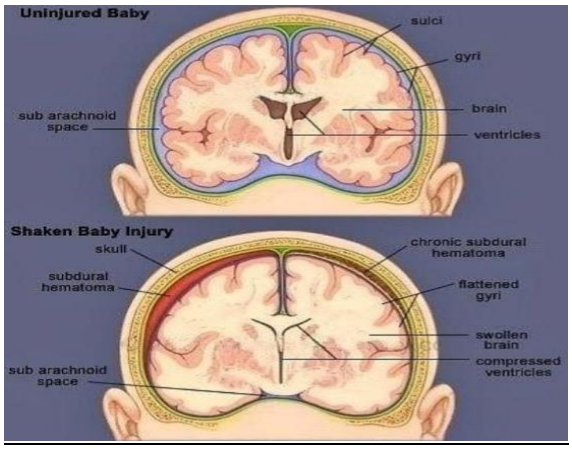
The authors claim that it is feasible to demonstrate this hypothesis. Theneed to raise these ethical questions about Diagnosis of the syndrome.[20] Dating the abuse's occurrence is a very difficult and crucial factor in legal investigations that aids the main suspects' boundaries and characteristics. [14] This process is carried out based on the histopathology of the subdural hematom.[24] On the other hand, the presence of siderophages in both types of hemorrhage is a strong dating indicator if it is discovered three days after the hemorrhage Traumata happen.[24] The existence of the siderophages allows for the detection of hemosiderin in victims'

retina only until, on average, 16.8 months after aggression. [25]

Clinical features :

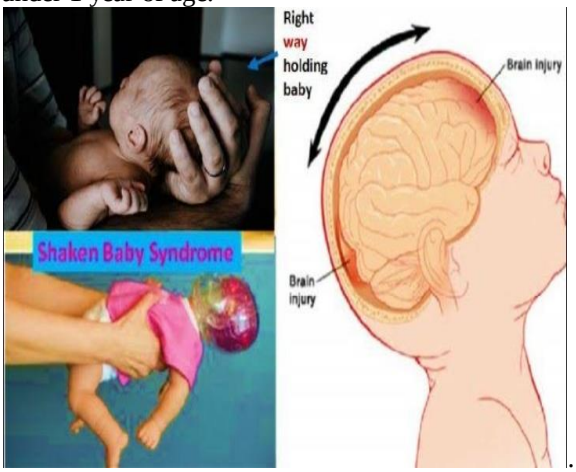
The diagnosis of AHT can be challenging. Young children and infants who have experienced trauma may show signs like unspecific symptoms that only need supportive treatment acute life-threatening complications requiring urgent care. [(26)] Medical professionals might initially misdiagnose or pediatric AHT diagnosis was delayed until later, which was the first offense that may be made more difficult by persistent trauma episodes. [27]

Subdural haematoma:



(**Fig. 4.** Comparison between normal uninjured baby and injured brain of shaken baby syndrome).

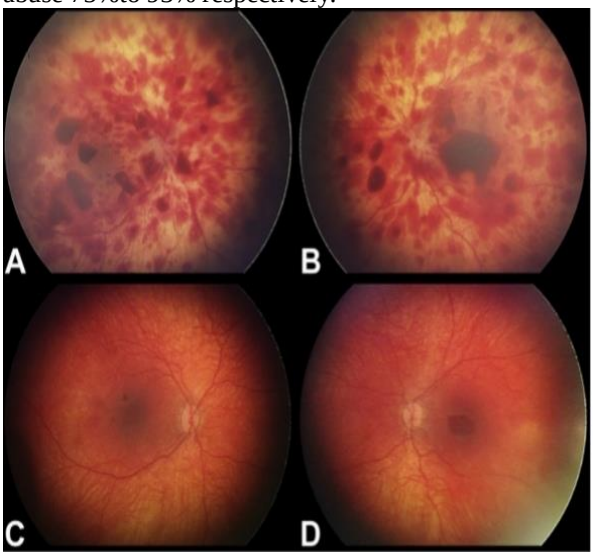
AHT is thought to be an acceleration-deceleration force that causes the brain to move within the fixed venous vessels and skull, resulting in subdural and subarachnoid hemorrhages if there is tearing of the superficial cortical veins, and subdural hematomas are a common finding in AHT. [28, 29] While AHT is the most common cause of subdural bleeding in infants under 1 year of age. [30]



(**Fig. 5.** Method used to holding a baby)

Retinal hemorrhage :

Ophthalmology consultation within the first 24 hours is important since small or superficial hemorrhages often resolve quickly. Retinal hemorrhage has the sensitivity and specificity for the diagnosis of chi abuse 75%to 93% respectively. [31]



(**Fig. 6.** Colour fundus photographs at admission (**A**,Right eye and **B**, left eye) and follow examination six weeks later **(C**, Right eye & **D**, left eye))

Retinal hemorrhages, not exclusive to shaken baby syndrome, result from various conditions. Dating them is uncertain; intraretinal resolves in weeks, while preretinal may last months. Cerebral decompression and ventilation were performed. Electroencephalography and MRI showed brain damage. The child moved to rehabilitation and foster care.

Skull fracture:

Any of the following types of skull fractures may suggest the potential existence of AHT. Skull fractures are caused by a direct force being applied to the head. AHT is frequently taken into consideration when the fracture is complex, diastatic (width greater than 3 mm), multiple, and non-parietal. [32]

Imagine exams :

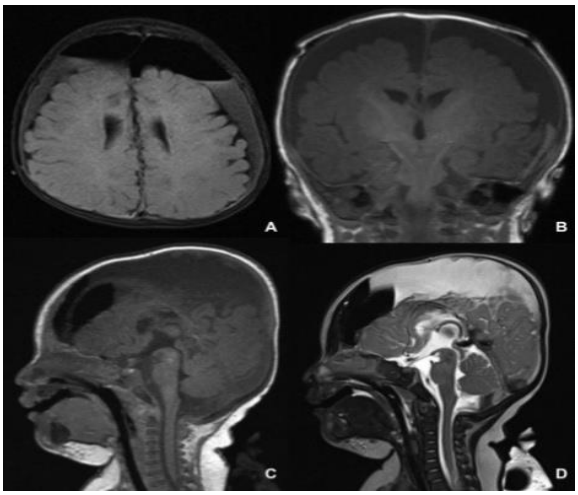
Early analysis combines CT scan for hemorrhages and fractures with MRI for better delineation, especially in cerebral infarction and edema cases.[6] The key Shaken Baby Syndrome indicator is subdural hematoma, but distinguishing causes is challenging. Alternative diagnoses include birth injuries and medical conditions. [6-33]

Imaging:

The most crucial tests to confirm AHT are imaging studies. A head CT scan and skeletal survey should be ordered by the doctor. [34]

MRI

MRI can help to identify subacute and chronic subdural hemorrhages, distinguish chronic subdural from subarachnoid collections, and specify the severity of the parenchymal injuries. [35] The suggested MRI procedures are spin echo (T1- sequencing (weighted and T2-weighted), diffusion-weighted FLAIR is a fluid-attenuated inversion recovery technique for imaging. ordering. [36] The diffusion-weighted MRI may be especially useful for commonly considered for an accurate parenchymal diagnosis acute ischemic change that are associated with prog-nosis. [37,38] In the recent past, the importance of susceptibility-the use of weighted imaging (SWI) to identify cerebral micro- Early-stage hemorrhage has been linked to a predictor the outlook. [39,40] Furthermore, magnetic resonance spectra Additionally, troscopy (MRS) may be useful in predicting results in AHT. [41] CT and MRI can both be utilized for Skeletal analysis. [42]



(**Fig. 7.** Initial MRI after insertion of bilateral subdural drainage without further signs of intracranial injuries (FLAIR (A), T1 (B, C), and T2 (D))

Skeletal survey :

Children under 18 with an unidentified traumatic event should undergo a skeletal survey, including radiographs of the head, spine, ribs, and long bones. This aids in detecting child abuse. Follow-up, 2-3 weeks later, may include rib films to assess healing fractures not visible initially [37,43]

CT scan:
The detection of intracranial damage brought on by AHT is greatly aided by the head CT. Usually, non-contrast head CT is used as radiologic assessment of possible head trauma. CT is sensitive in identifying intracranial bleeding and skull fracture, brain edema, ischemic changes, and hemorrhage are all presented. [44]

Risk factors:
Regarding SBS/AH, a variety of risk factors, including those related to parents, the environment, and infants, have been identified. In addition to parents who aren't expecting children, single caregivers, and parental depression, very low levels of education, substance and alcohol abuse, young mothers, and unemployment are among the parental high-risk variables. [45,46] Postpartum depression was identified as another risk factor and was found to be a separate risk regardless of the apparent intensity of the crying, a factor for shaking and smothering. [47,48]

During times of stress, mothers may be less tolerant of their children's cries. [47,49] Partner abuse,Poverty and social instability are risk factors for child abuse in the home or community. [50]
Despite recognizing the relevance of birth trauma timing, it was acknowledged that incorporating this information would only slightly enhance predictive models for such trauma in routine medical assessments. [51]

In-lab examinations:
Complete blood count with platelet count, chemistry panel, prothrombin time, and parathyroid hormone levels should be included in laboratory studies.tial thromboplastin time, lipase, aspartate aminotransferase, and urinalysis, transferase, and alanine aminotransferase. The AHT may be indicated by a laboratory evaluation's discovery of additional wounds that add to the evidence of child maltreatment.

Consultations:
A qualified ophthalmologist ought to be contacted. The most popular technique is fundoscopy with dilated pupils. [52] When MRI and ophthalmoscopy were compared, it was discovered The ability to detect retinal hemorrhage in 83% of cases of abuse MRI. [53] A pediatric neurologist's assessment is essential for a thorough examination. A female infant aged one suffering from AHT Images of the bilateral eyegrounds demonstrate variable degrees of papilledema, cotton-wool spots, and diffuse intraretinal and preretinal hemorrhage. The preliminary CT images show chronic acute left subdural and bilateral subdural effusion hematoma, suggesting that there may have been several traumas. 2 weeks after bilateral subdural drainage, the MRI was taken. demonstrates asymmetric collections of subdural fluid, as well as ischemic changes to the parenchyma.

Prognosis:
Abusive Head Trauma (AHT) brings severe morbidity and mortality risks, including blindness, motor issues, and learning challenges.[54, 55]A multicenter study comparing AHT to accidental head injuries reveals worse outcomes for AHT.[56] Over 50% of affected children may become partially or totally blind, and more than 20% require feeding tubes.[57] AHT carries a higher mortality rate than accidental head trauma, with long-term consequences impacting life quality. Studies link Glasgow Coma Scale and intracranial pressure to poor outcomes in AHT cases. [58]

Prevention
Patient education and prevention:
Society holds a substantial responsibility to prevent Abusive Head Trauma (AHT) in children, given its potential harm. Annual AHT-related medical costs surpass $70 million in the US.[57] Emphasizing prevention, educating parents on managing infant crying is vital, supported by public service announcements and family resource programs.[59] The National Center on Shaken Baby Syndrome leads efforts to empower parents, enhance infant health, and implement policies, targeting the estimated 1200 to 1400 AHT cases annually in the US, with a mortality rate of up to 30%. [60]

Technology-based prevention:
Simulation-based pediatric research has two categories: one focuses on parents' and professionals' education, assessing technical and practical knowledge, while the other evaluates the quality of patient services, aiming to enhance performance. Bechtel et al. emphasize the success potential of this method in reducing the incidence and severity of Abusive Head Trauma (AHT) after effects.[9] Additionally, Lopes et al.'s review of prevention strategies between 2005 and 2015, categorized into managing infant crying, emotional control of caregivers, and AHT risk factor alerts, allows for the analysis of prevention methods evolution. [61]

Treatment
Treatment/management:

Main AHT treatment involves supportive care. Monitor vital signs closely. Respiratory failure may require intubation and ventilation. Attend to increased intracranial pressure (IICP) if present. Take action for significant subdural hematoma. Maintain normal intracranial pressure for healthy blood pressure and cerebral perfusion pressure (CPP).[62]

First tier treatment:
Starting steps to take for managing children with AHT involves addressing traumatic brain injury (TBI). Seizures, particularly early post-traumatic seizures (EPTS), affect a significant percentage.[63] Continuous EEG monitoring, recommended early after admission, helps detect nonconvulsive electrographic seizures. Status epilepticus control follows a common directive.[64] Although studies vary on prophylaxis benefits, antiepileptic medication administration, especially for younger infants with severe injuries, may reduce EPTS risk by 80%.[65,66]

Second-tier treatment:
Caution is crucial to avoid intracranial hypertension during IICP control in AHT. Therapeutic procedures, including strong suction, require careful execution. Consider ICP monitor installation.[67] Maintain ICP below 20 mmHg and ensure cerebral perfusion pressure (CPP) stays between 40-60 mmHg. [68]

Third tier treatment:
Third-tier therapies (pentobarbital, thiopental) sedate IICP patients, reducing blood flow. Gradual hypothermia over 48 hours mitigates seizures.[69] Decompressive craniectomy prevents secondary damage. International studies stress intensive ICP monitoring.[70, 71] Irish study underscores parental education for proper treatment, advocating clear messages by nurses.[72] Nurses play a crucial role in disseminating information about the risks of shaking, normalizing infant crying, and providing support services for parents and caregivers.[73]

Limitation:
Study findings face limitations: ascertainment bias in recruitment, self-selection bias in online surveys, social desirability bias, recall bias in self-reports, and methodological biases in retrospective case-control studies.[74] Age differences, especially in falls, and limited blinding in radiological and ophthalmological exams challenge study validity. [75]

Case report:
Case:
A three-month-old female infant was shaken in May 2017, suffering severe brain damage. The video displays her connected to medical devices, struggling with diagnoses like blindness, gastroparesis, tube feeding dependency, cerebral palsy, seizures, and limited voluntary movements. The mother, open about the perpetrator's lack of understanding, advocates for Shaken Baby Syndrome awareness. Tragically, the infant passed away in 2020.

(**Fig.8.** Three-month -old female infant before and after health changes.)

Christa tragically passed away due to Shaken Baby Syndrome (SBS), revealing a lack of awareness and financial challenges for proper treatment. It becomes our mission to raise awareness about SBS and educate on the correct way to hold babies. Recognizing abnormal signs and symptoms is crucial; early detection, as seen in Christa's case, can be lifesaving. Knowledge about SBS and prompt diagnosis is essential for safeguarding the well-being of infants.

CONCLUSION:
"Shaken baby syndrome," now part of "abusive head trauma," faces controversies in concepts, diagnoses, and legalities. Prevention relies on public awareness, emphasizing proper child comfort and understanding syndrome risks. Despite debates, research is crucial due to its role as a primary cause of child brain injury. A study reveals 30.7% awareness, primarily through social media. Sociodemographic details impact knowledge levels. Future research should avoid circular reasoning in infant classification, requiring valid knowledge to ascertain if an infant has been violently shaken.

ACKNOWLEDGEMENT:
I am very thankful to Mr.Vivek Rathod, Assistant Professor of Vidyabharti College of Pharmacy, Amravati for encouraging and providing the necessary facility for completion of this work.

Disclosure of conflict of interest
The authors have no conflict of interest to declare.

REFERENCES:

1. Guthkelch AN. (1971). " Infantile Subdural haematoma and its relationship to whiplash injuries". Br Med J 2: 430.
2. Elinder G, Eriksson A, et al (2016). "Traumatic shaking. The role of the triad in medical investigations of suspected traumatic shaking" – A systematic review. Swedish Agency for Health Technology Assessment and Assessment of Social Services, Stockholm SBU Assessment. Report 255E/2016. ISBN 978-91-85413-98-0.
3. Ludvigsson J, Steinwall Larsen S, (2015). (In Swedish). "The presence of shaken baby syndrome is scientifically robust". Lakartidningen; 112: DE6U.
4. Strouse PJ.(2016). " Child abuse: we have problems". Pediatr Radiol 46: 587–90.
5. Reece RM, Sege R.(2000)." Childhood head injuries: accidental or inflicted?" *Acta Pediatr Adolesc Med*. 154: 11–5.
6. Shekdar K.(2016 Jun). " Imaging of Abusive Trauma". *Indian J Pediatr.* 83(6):578-88.
7. Hinds T, Shalaby-Rana E et al (2015 Mar). "Aspects of abuse: abusive head trauma". *Curr Probl Pediatr Adolesc Health Care.* 45(3):71-9.
8. Van Zandwijk JP, Vester MEM et al (2019 Sept). "Modeling of inflicted head injury by shaking trauma in children: what can we learn?" : Part II: "A systematic review of mathematical and physical models". *Forensic Sci Med Pathol*. 15(3):423-436.
9. Bechtel K, Bhatnagar A et al (2019 Aug). "Simulation- based research to improve infant health outcomes: Using the infant simulator to prevent infant shaking". *Infant Behav Dev.* 56:101263.
10. Fujiwara T. (2015 May). "Effectiveness of public health practices against shaken baby syndrome/abusive head trauma in Japan". *Public Health.* 129(5):475-82.
11. Elinder G, Eriksson A, Hallberg B, et al. (2018 Sep). "Traumatic shaking: The role of the triad in medical investigations of suspected traumatic shaking". *Acta Paediatr*. 107 Suppl 472:3-23.
12. Coats B, Binenbaum G, Smith C, et al. (2017 Jan). "Cyclic Head Rotations Produce Modest Brain Injury in infants". *Piglets J Neurotrauma.* 1;34(1):235-247.
13. Mian M, Shah J, Dalpiaz A, et al. (2015 June). "Shaken Baby Syndrome: a review". *Fetal Pediatr Pathol.* 34(3):169-75.
14. Vinchon M. (2017 Oct). " Shaken baby syndrome: what certainty do we have?" *Childs Nerv Syst.* 33(10):1727- 1733.
15. Christian CW. Block R. (2009). "Abusive head trauma in infants and children". *Pediatrics*. 123, 1409–1411.
16. Stewart TC, Polgar D et al.(2011). "Shaken baby syndrome and a triple dose strategy for its prevention". *J Trauma.* 71:1801–1807.
17. Ludwig S, Warman M (1984). " Shaken baby syndrome: A review of 20 cases". *Ann. Emerg. Med.* 13:104–107.
18. Gilbert R, Kemp A (2009). "Recognizing and responding to child maltreatment". *Lancet.* 373:167–180.
19. Högberg U, Lampa E et al. (2018 Aug). "Infant abuse diagnosis associated with abusive head trauma criteria: incidence increase due to overdiagnosis?". *Eur J Public Health.* 1;28(4):641-646.
20. Fraser JA, Flemington T et al. (2017 Oct). " Prevention and recognition of abusive head trauma: training for healthcare professionals in Vietnam". *Acta Paediatr.* 106(10):1608-1616.
21. Debelle GD, Maguire S et al. (2018 Jun). " Child Protection Standing Committee, Royal College of Paediatrics and Child Health. 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.* 103(6):606-610.
22. Riggs BJ, Trimboli-Heidler C et al. (2016 May). "The Use of Ophthalmic Ultrasonography to Identify Retinal Injuries Associated With Abusive Head Trauma". *Ann Emerg Med.* 67(5):620-4.
23. Shuman MJ, Hutchins KD (2017 May). "Severe Retinal Hemorrhages with Retinoschisis in Infants are Not Pathognomonic for Abusive Head Trauma". *J Forensic Sci.* 62(3):807-811.
24. Delteil C, Kolopp M, Capuani C, et al. (2019 Oct). "Histological dating of subarachnoid hemorrhage and retinal hemorrhage in infants". *Forensic Sci Int.* 303:109952.
25. Bais B, Karst WA et al. (2016 Nov). "Persistent Retinal Iron in Abusive Head Trauma". *J Forensic Sci.* 61(6):1693-1696.
26. Duhaime AC, Christian CW (1998). "Nonaccidental head injury in infants – the shaken-baby syndrome". *N Engl J Med* 338:1822-9.
27. Deans KJ, Thackeray J et al. (2013). "Mortality increases with recurrent episodes of nonaccidental trauma in children". *J Trauma Acute Care Surg.* 75:161-5.

28. Feldman KW, Bethel R (2001). "The cause of infant and toddler subdural hemorrhage: a prospective study". *Pediatrics.* 108:636-46.
29. Howard MA, Bell BA, Uttley D et al. (1993). "The pathophysiology of infant subdural haematomas". *Br J Neurosurg*. 7:355-65.
30. Matschke J, Voss J et al. (2009). " Nonaccidental head injury is the most common cause of subdural bleeding in infants <1 year of age". *Pediatrics.* 124:1587-94.
31. Vinchon M, Defoort-Dhellemmes S et al. (2005). " Accidental and nonaccidental head injuries in infants: a prospective study". *J Neurosurg.* 102:380-4.
32. Section on Radiology, American Academy of Pediatrics (2009). "Diagnostic imaging of child abuse". *Pediatrics.* 123:1430-5.
33. Yilmaz U, Körner H et al. (2015 Jun). " Multifocal Signal Loss at Bridging Veins on Susceptibility-Weighted Imaging in Abusive Head Trauma". *Clin Neuroradiol*. 25(2):181-5.
34. Foerster BR, Petrou M, et al. (2009). "Neuroimaging evaluation of non-accidental head trauma with correlation to clinical outcomes: a review of 57 cases". *J Pediatr*. 154:573-7.
35. Barlow KM, Gibson RJ, et al. (1999). "Magnetic resonance imaging in acute non-accidental head injury". *Acta Paediatr.* 88:734-40.
36. Nishimoto H (2015). "Recent progress and future issues in the management of abusive head trauma". *Neurol Med Chir (Tokyo).* 55:296-304.
37. Bradford R, Choudhary AK, Dias MS (2013). "Serial neuroimaging in infants with abusive head trauma: timing abusive injuries". *J Neurosurg Pediatr.* 12:110-9.
38. Ashwal S, Wycliffe ND, Holshouser BA (2010). "Advanced neuroimaging in children with nonaccidental trauma". *Dev Neurosci.* 32:343-60.
39. Tong KA, Ashwal S. (2008). "Susceptibility-weighted MR imaging: a review of clinical applications in children". *AJNR Am J Neuroradiol.* 29:9-17.
40. Colbert CA, Holshouser BA, et al. "Value of cerebral microhemorrhages detected with susceptibility-weighted MR imaging for prediction of long-term outcome in children with nonaccidental trauma". *Radiology.* 256:898-905.
41. Aaen GS, Holshouser BA, et al. (2010). "Magnetic resonance spectroscopy predicts outcomes for children with nonaccidental trauma". *Pediatrics.* 125:295-303.
42. Vezina G (2009). "Assessment of the nature and age of subdural collections in nonaccidental head injury with CT and MRI". *Pediatr Radiol.* 39:586-90.
43. Keenan HT, Runyan DK et al. (2004). "A population-based comparison of clinical and outcome characteristics of young children with serious inflicted and non inflicted traumatic brain injury". *Pediatrics.* 114:633-9.
44. Tung GA, Kumar M, et al. (2006). "Comparison of accidental and non accidental traumatic head injury in children on noncontrast computed tomography". *Pediatrics.* 118:626-33.
45. Minns RA, Jones PA (2008). "Incidence and demography of non-accidental head injury in southeast Scotland from a national database". *Am. J. Prev. Med.* 34:S126–S133.
46. Kelly P, Farrant B (2008). "Shaken baby syndrome in New Zealand, 2000–2002". *J. Paediatr. Child Health.* 44:99–107.
47. Fujiwara T, Yamaoka, et al. (2016). "Self-Reported Prevalence and Risk Factors for Shaking and Smothering Among Mothers of 4-Month-Old Infants in Japan". *J. Epidemiol.* 26:4–13.
48. Adamsbaum, C.; Grabar S (2010). "Abusive head trauma: Judicial admissions highlight violent and repetitive shaking". *Pediatrics*. 126:546–555.
49. Radesky JS, Zuckerman B, et al. " Inconsolable infant crying and maternal postpartum depressive symptoms". *Pediatrics.* 131:1857–1864.
50. Miehl NJ (2005). "Shaken baby syndrome". *J. Forensic Nurse.* 1:111–117.
51. Kelly P, Thompson JMD, Rungan S, et al. (2019 Mar). " Do data from child protective services and the police enhance modelling of perinatal risk for paediatric abusive head trauma? A retrospective case-control study". *BMJ Open.* 1;9(3)-024199.
52. Levin AV (2010). "Retinal hemorrhage in abusive head trauma".*Pediatrics*. 126:961-70
53. Zuccoli G, Panigrahy A, et al. (2013). "Susceptibility weighted imaging depicts retinal hemorrhages in abusive head trauma". *Neuroradiology*. 55:889e93.
54. Tilak GS, Pollock AN (2013). "Missed opportunities in fatal child abuse". *Pediatr Emerg Care*. 29:685-7.
55. Lind K, Toure H, et al. (2016). "Extended follow-up of neurological, cognitive, behavioral and academic outcomes after severe abusive head trauma". *Child Abuse Negl.* 51:358-67.
56. Hymel KP,Makoroff KL, et al. (2007). "Mechanisms, clinical presentations, injuries, and outcomes from inflicted versus non inflicted head trauma during infancy: results of a prospective,

multicentered, comparative study". *Pediatrics*. 119:922-9.
57. Joyce T, Huecker MR (2019 Feb 11). "Pediatric abusive head trauma (shaken baby syndrome)". StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Feb 11. https://www.ncbi.nlm.nih.gov/books/NBK499836/#_article-28960_s8. [accessed 23 November 2019].
58. Ferguson NM, Shein SL, et al. (2016). "Intracranial hypertension and cerebral hypoperfusion in children with severe traumatic brain injury: thresholds and burden in accidental and abusive insults". *Pediatr Crit Care Med.* 17:444-50.
59. Catherine NL, Ko JJ, Barr RG (2008). " Getting the word out: advice on crying and colic in popular parenting magazines". *J Dev Behav Pediatr*. 29:508-11.
60.Paul AR, Adamo MA (2014). " Non-accidental trauma in pediatric patients: a review of epidemiology, pathophysiology, diagnosis and treatment". *Transl Pediatr*. 3:195-207.
61. Lopes NRL, Williams LCA (2018. Dec). "Pediatric Abusive Head Trauma Prevention Initiatives: A Literature Review". *Trauma Violence Abuse.* 19(5):555-566.
62. Kochanek PM, Carney N, et al. (2012). "Guidelines for the acute medical management of severe traumatic brain injury in infants,children, and adolescents–second edition". *Pediatr Crit Care Med.* 13:S1-82.
63.. Barlow KM, Spowart JJ, Minns RA (2000). " Early posttraumaticseizures in non-accidental head injury: relation to outcome". *Dev Med Child Neurol* 42:591-4.
64. Brophy GM, Bell R, et al. (2012). " Guideline for the evaluation and management of status epilepticus". *Neurocrit Care.* 17:3-23.
65. Young KD, Okada PJ, et al. (2004). "A randomized, double-blinded, placebo controlled trial of phenytoin for the prevention of early posttraumatic seizures in children with moderate to severe blunt head injury". *Ann Emerg Med.* 43:435-46.
66. Liesemer K, Bratton SL, et al. (2011). "Early post-traumatic seizures in moderate to severe pediatric traumatic brain injury: rates, risk factors, and clinical features". *J Neurotrauma*. 28:755-62.
67. Bennett TD, Riva-Cambrin J, et al. (2012). " Variation in intracranial pressure monitoring and outcomes in pediatric traumatic brain injury". *Arch Pediatr Adolesc Med.* 166:641-7.
68. Chesnut RM, Temkin N, et al. (2012). " A trial of intracranial-pressure monitoring in traumatic brain injury". *N Engl J Med*. 367:2471-81.
69. Adelson PD (2009). "Hypothermia following pediatric traumatic brain injury". *J Neurotrauma.* 26:429-36.
70. Cho DY, Wang YC, Chi CS (1995). "Decompressive craniectomy for acute shaken/impact baby syndrome". *Pediatr Neurosurg.* 23:192-8.
71.Ferguson NM, Sarnaik A, et al. (2017). " Abusive head trauma and mortality e an analysis from an international comparative effectiveness study of children with severe traumatic brain injury". *Crit Care Med.* 45:1398-407.
72. Mann AK, Rai B, et al." Assessment of parental awareness of the shaken baby syndrome in Ireland". *Eur. J. Pediatr.* 174:1339–1345
73. Ta¸sar, M.A.; ¸Sahin, et al. (2014). "Long-term outcomes of the shaken baby syndrome prevention program: Turkey's experience". *Turk. Arch. Pediatr.* 4 9: 203–209. 94. Minns RA, Jones PA, et al. (2012). "Prediction of inflicted brain injury in infants and children using retinal imaging". *Pediatrics*. 130: 1227–34.
75. Mulvihill AO, Jones P, et al. (2011). "An inter-observer and intra-observer study of a classification of RetCam images of retinal haemorrhages in children". *Br J Ophthalmol*. 95: 99–104.