



# Abusive head trauma: current practice of investigation and management in Taiwan

Frank Leigh Lu<sup>1,2</sup> · Yen-Ju Chu<sup>2,3,4</sup> · Meng-Fai Kuo<sup>5</sup>

Received: 6 October 2022 / Accepted: 19 October 2022 / Published online: 26 October 2022  
© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2022

## Abstract

**Introduction** Abusive head trauma (AHT) is a worldwide leading cause of fatal head injuries in children under 2 years. This study aims to present the development of child protection medical service in Taiwan in the past decade.

**Materials and methods** This study reviews the evolution of the pediatric protection network and the cross-system professional training in Taiwan from 2013 to 2022. The recommendations of Taiwan Pediatric Association on the prevention and management of AHT and the Medical Professionals Manual of Child Abuse and Neglect proposed by the Ministry of Health and Welfare were reviewed.

**Results** Considering the impact of the high incidence of severe sequelae and the mortality caused by of AHT, 10 regional centers for child protection medical service were founded in Taiwan to identify, recognize, and properly manage cases of AHT, which is easily overlooked by the healthcare providers. The child protection network across the healthcare, social welfare administration, and judicial systems facilitate the early detection, management, and proper disposition of the children with AHT.

**Conclusion** An increasing of the incidence of AHT is expected after the setting up of the child protection network and the continuing cross-system professional trainings. There is more consensus of the diagnosis and management of AHT than before in Taiwan. However, there is no end to protecting children from AHT.

**Keywords** Abusive head trauma · Taiwan

## Introduction

Abusive head trauma (AHT) is a one of the leading causes of fatal head injury in infants and children under 2 years of age [1, 2]. When a child with AHT was severely injured, the neurosurgical management and intensive care show high

homogeneity among different institutes; however, the circuit of patients with AHT may vary widely. This study presents the efforts that have been made for this potentially preventable disease in Taiwan in the past decade.

## Impact of pediatric abusive head trauma (AHT) in Taiwan

In a nationwide population-based study between 2006 and 2015, there were 538 cases of AHT and 67 fatal cases in Taiwan. The incidence in children is 20/1,000,000 person-years under 1 year of age and 1.7/1,000,000 person-years between 1 and 2 years of age, respectively. Over 40% of cases had severe sequelae, and the mortality was around 13% [3]. In the USA, over half of the AHT survivors need further medical care [4]. In Taiwan, the cost of healthcare utilization is 10 times greater than that of the non-AHT children of the same age [5]. Despite the significant impact of AHT, it is easily overlooked by the healthcare providers who are not familiar with child protection.

✉ Meng-Fai Kuo  
mfkenator@gmail.com

- <sup>1</sup> Division of Pediatric Pulmonology and Critical Care Medicine, National Taiwan University Children's Hospital, Taipei, Taiwan
- <sup>2</sup> Child Protection Medical Center, National Taiwan University Children's Hospital, Taipei, Taiwan
- <sup>3</sup> Department of Emergency Medicine, Division of Pediatric Emergency Medicine, National Taiwan University Hospital, Taipei, Taiwan
- <sup>4</sup> Division of Pediatric Neurology, National Taiwan University Children's Hospital, Taipei, Taiwan
- <sup>5</sup> Division of Neurosurgery, Department of Surgery, National Taiwan University Hospital, National Taiwan University College of Medicine, Taipei, Taiwan

**Table 1** Key recommendations of the Taiwan Pediatric Association on the management and prevention of abusive head trauma (AHT)[6] (translated from the original statements in Chinese)

---

AHT is a type of child abuse with severe consequence. The child abuse reporting and prevention system should be activated aiming at preventing further injury to the child whenever AHT is suspected
The pediatricians should be familiar with the etiologies of AHT
Pediatricians should be familiar with the symptoms and signs of AHT in children
Pediatricians should learn how to evaluate suspected AHT in a comprehensive and objective way
Crying is common in normal infants. Pediatricians should instruct the parents and caregivers how to sooth the infants. Holding in arms, music, and storytelling are recommended. Avoid shaking or patting infant's head to avoid irreversible cerebral injury
Children are not the property or appendage of anyone. Every child has the absolute right to grow up free from fear and violence

---

## Efforts of the Ministry of Health and Welfare and Taiwan Pediatric Association

The Taiwan Pediatric Association (TPA) had long been concerning the underrecognition of AHT in Taiwan society. TPA issued its first recommendations for the prevention and management of AHT in 2013, which was updated in 2021 [6]. The recommendations highlight the importance of education and training of all healthcare providers to be familiar with the symptoms and signs of AHT (Table 1). To facilitate the education and training of pediatric healthcare providers on the recognition and management of child abuse and neglect, the TPA and the Ministry of Health and Welfare (MOHW) had published a child abuse and neglect manual for medical professionals [7]. The manual emphasizes the multiple mechanisms of AHT, which include not only shaking, but also blunt impact or other abusive ways. It also provides a checklist for children with suspected abuse or neglect and recommends laboratory and imaging studies for these children (Tables 2 and 3).

## Challenges in the determination of abusive head trauma

Although the medical professionals in Taiwan are aware AHT more than before, the diagnosis and subsequent managements of the suspicious cases are still challenging.

There is not a specific single sign, examination, or criteria that can differentiate AHT from the non-AHT with sufficient sensitivity and specificity. For example, retinal hemorrhage can be caused by many etiologies other than AHT. Most AHT patients had bilateral retinal hemorrhage; however, unilateral or no retinal hemorrhage cannot rule out AHT [8]. In many cases, a multidisciplinary expert committee is needed to cautiously review the results of medical examination and the history provided by the caregivers. The multidisciplinary expert committee of our Child Protection Medical Center consists of at least 6 physicians as the core team. The pediatricians need to be trained both in child abuse and neglect and critical care and emergency medicine. The other core members include radiologists, forensic pathologists, and so on. Related specialists such as neurologist, neurosurgeon, orthopedic physician, obstetrician, gynecologist, ophthalmologist, and others will be invited to meet the needs of specific cases.

In Taiwan, there are 23 medical centers and 5 children's hospitals [9]. The MOHW had funded 10 regional centers for child protection medical service. Most of the regional centers are operated by Children's Hospitals and the Pediatric Departments of Medical Centers with sufficient facilities and well-trained personnel in that region. The regional centers of child protection medical service are responsible to receive medical referral and provide instant medical consultation, medical, psychiatric and psychological support, and follow-up of the survivors of

**Table 2** Important observation of the clinical symptoms and history of the abusive head trauma (AHT) [7]

---

	Important observation
Clinical symptoms	Irritability, somnolence, vomiting, convulsion, mental status change, and apnea may indicate intracranial injury Look for facial bone fracture when there is facial or scalp bruise Battle's sign and cerebrospinal fluid rhinorrhea indicate skull base fracture Retinal hemorrhage is a characteristic finding in AHT Bilateral skull fracture, highly suspicious for AHT Be aware for neck injuries associated with AHT (May need a MRI to confirm the injury that may not be evident on X-ray)
History	Fall from a short distance (less than 150 cm) is not likely to cause severe intracranial injury

---

**Table 3** Recommended examinations for children with suspected abusive head trauma (AHT) by Ministry of Health and Welfare and Taiwan Pediatric Association [7]

Physical examination	Body height, weight, head girth, developmental milestones, any bruise, and tenderness
Fundoscopy	Recommended for all children suspected to have AHT
Laboratory studies	Complete blood count, prothrombin time, activated partial thrombin time, blood gas analysis, electrolytes, and CSF study (optional)
Skeletal survey	Axial and appendicular. Do not use a “babygram”. Recommended for all children less than 2 year of ages if AHT is suspected. Optional for children 2–5 years of age
Head CT	Emergency imaging if intracranial hemorrhage is suspected
Head and neck MRI	To identify lesions which is not visible on CT

AHT. They also provide expert opinions of injury identification, the clinical and forensic evidence for the judicial system. Besides, each center arranges training and continuing education courses for the child protection network annually. These educational programs strongly facilitate the knowledge and sensitivity in the network.

In some cases, the cause of injury could not be determined after the cautious review by the multidisciplinary expert committee. Incomplete initial clinical assessment and workup, poor quality or incomplete medical images, lack of photography, and detailed description of the retinal examination are the possible obstacles that may hinder the team from determining the cause of injury in the review process. Children with special needs are also often overlooked when they are abused, because the presentation may be ascribed to their underlying clinical condition. Experts of medical genetics also need to be incorporated in the committee to review patients with rare genetic disorders.

### The collaboration between the healthcare, social welfare administration, and the judicial system

To identify, recognize, and properly manage cases of AHT, a child protection network across the healthcare, social welfare administration, and judicial systems has to be established. The healthcare system is usually the first system to get involved in the case of AHT. The high level of alertness of the clinicians on the suspicion of AHT is crucial for early identification and management of AHT. With the assistance of government social workers, important information can be collected for a best decision of the care plan and disposition of these children.

In 2018, an Early Judicial Investigation Process was established in Taiwan for the majorly injured cases due to child abuse, which included the cases of AHT. This process led by the prosecutors may be initiated as early as within 24 h after the notification of the child protection service, which is composed of the medical professionals and police

officers. With the collaboration of these teams, early investigation of the clinical, social, and legal issues can be undertaken and the important information can be shared across the child protection network aiming at making a care plan in the best interest of these children.

### Conclusion

After the setting up of the child protection network and the continuing cross-system professional trainings, there is more consensus and improvement of the diagnosis and care management of AHT than before in Taiwan. However, there are always challenges in the diagnosis and management of AHT. There is no end to protecting children from AHT.

**Author contribution** Yen-Ju Chu collected the data and wrote the draft. Frank Leigh Lu critically revised the draft in a specialist view. Meng-Fai Kuo initiated the direction and focus of the study and finalized the article.

**Availability of data and material** Not applicable to this article as no datasets were generated or analyzed during the current study.

### Declarations

**Competing interests** The authors declare no competing interests.

**Ethics approval and consent to participate** No ethical approval is required in this study.

**Consent for publication** NA.

**Conflict of interest** NA.

### References

1. Hung KL (2020) Pediatric abusive head trauma. *Biomed J* 43:240–250. <https://doi.org/10.1016/j.bj.2020.03.008>
2. Narang SK, Fingarson A, Lukefahr J, Council on Child Abuse and Neglect (2020) Abusive head trauma in infants and children. *Pediatrics* 145(4):e20200203. <https://doi.org/10.1542/peds.2020-0203>

3. Chang YT, Chang HY, Chen LW, Lu TH, Tsai HJ, Chen YW, Chang YC, Feng JY (2021) Incidence and characteristics of paediatric abusive head trauma in Taiwan, 2006–2015: a nationwide population-based study. *Inj Prev* 27:356–362. <https://doi.org/10.1136/injuryprev-2020-043805>
4. Fraser BD, Lingo PR, Khan NR, Vaughn BN, Klimo P Jr (2019) Pediatric abusive head trauma: Return to hospital system in the first year post injury. *Neurosurgery* 85:E66–E74. <https://doi.org/10.1093/neuros/nyy456>
5. Chang YT, Feng JY, Chang HY, Lu TH, Wu J, Chang YC (2022) Health services utilization and cost of abusive head trauma in Taiwan: a population-based retrospective matched cohort study. *Child Abuse Negl* 128:105603. <https://doi.org/10.1016/j.chiabu.2022.105603>
6. Taipei Pediatric Association (2021) Recommendations on the prevention and management of abusive head trauma. [https://www.pediatr.org.tw/member/bedside\\_info.asp?id=31](https://www.pediatr.org.tw/member/bedside_info.asp?id=31). Accessed 30 Sept 2022
7. Ministry of Health and Welfare and Taipei Pediatric Association (2016) Child abuse and neglect medical professionals manual 2nd edition <https://health99.hpa.gov.tw/material/3350>. Accessed 30 Sept 2022
8. Maguire SA, Watts PO, Shaw AD, Holden S, Taylor RH, Watkins WJ, Mann MK, Tempest V, Kemp AM (2013) Retinal haemorrhages and related findings in abusive and non-abusive head trauma: a systematic review. *Eye (Lond)* 27:28–36. <https://doi.org/10.1038/eye.2012.213>
9. Ministry of Health and Welfare (2022) List of accredited hospitals and teaching hospitals. <https://dep.mohw.gov.tw/DOMA/lp-949-106.html>. Accessed 30 Sept 2022

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.