

## Suspected abusive head trauma

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See also: [Severe traumatic head injuries in children / Head injuries with CT scan abnormalities and other neurosurgical emergencies / Head injury proforma / BRUE](#)

### Definition

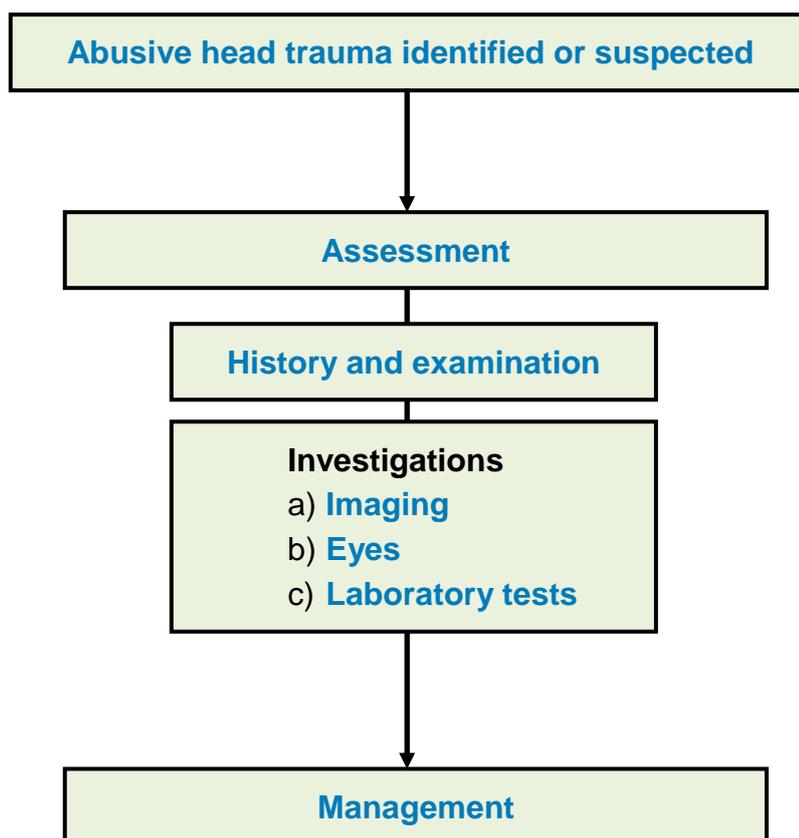
AHT= Abusive Head Trauma = **Inflicted injury to the head and its contents.**

Old terms: non-accidental head injury (NAHI), shaken baby syndrome (SBS).

### Background

AHT is the commonest cause of death from abuse and the commonest cause of death in children <1 year. Prevalence studies suggest rates comparable to neonatal meningitis. It occurs most commonly in < 1 year olds but can occur in any age group. Mortality up to 30% with 1/3 of survivors being left severely disabled. AHT can present acutely or non-acutely. Sometimes the term “extra-axial” is used by radiologists: this means blood outside the brain tissue but within the skull. **Extra-axial** haemorrhage can mean extradural, subdural or subarachnoid haemorrhage. It is subdural bleeding that has the strongest association with NAI.

### Management flow chart



## Identifying abusive head trauma

Children can present with a range of symptoms and signs. There is considerable overlap with features of meningitis / sepsis (including fever). Not all infants are acutely ill: A case series (n=49) of witnessed / confessed abuse found up to 1/3 present with NO neurological features. Therefore an infant with abdominal bruising may “declare” inflicted head trauma later in their presentation.

### Clinical presentation:

Bruises, especially to head and neck\*  
Apnoea \* or Irregular breathing\*  
Seizures\*  
Altered GCS  
Lethargy  
Poor feeding  
Cardiorespiratory collapse or sudden death.  
Vomiting

(\* correlates more strongly with AHT than accidental events)

RCPCH: AHT must be considered as a differential in any young child who has an **unexplained ALTE / BRUE or apnoeic episode (See ALTE / BRUE guideline)**.

Children with chronic subdural haemorrhage or effusions present a diagnostic problem in terms of timing of symptom-onset and corroborative findings being absent. They may present with increasing head circumference vomiting.

### Associated features that *may* be present

- subdural haemorrhage correlates strongly with AHT (subarachnoid haemorrhage is found in both, with extradural haemorrhages being far more commonly seen in accidental injury)
- Subdural bleeds are often multiple, with differing attenuation. Common sites are over the convexity of the cerebral hemisphere, inter-hemispheric or posterior fossa. In the acute stage they are typically small and do not cause mass effect. They may appear contra-coup to side of impact.
- Brain injury – includes hypoxic ischaemic injury, cerebral oedema and parenchymal injury; which are likely to be responsible for the poor outcome in these children
- Neck or cervical cord injury
- Retinal haemorrhages in one or more usually both eyes are reported in 70-80% of cases of AHT
- Bruising / abrasions, lacerations or swelling to the head (but the absence of external trauma does not exclude AHT)
- Parietal skull fractures- occur accidentally and non-accidentally - beware, bilateral, diastatic, depressed fractures.
- Fractures including CMLs and rib fractures
- Bites, cuts, abdo injury, abnormal bruising, frenulum injury etc.

AHT arises from severe repetitive rotational, acceleration-deceleration injury (from shaking) with or without additional impact, or impact alone.

### Differential Diagnosis

- Retinal haemorrhages are common after birth. Most disappear rapidly within the first few days of life, occasionally larger subhyaloid and intraretinal haemorrhages last up to 6 weeks
- Subdural haemorrhage (SDH) may occur following birth trauma presenting with severe symptoms or may be discovered incidentally in asymptomatic infants. Birth-related SDH usually resolve by 4 weeks.
- Both retinal and subdural haemorrhages may uncommonly be associated with severe accidental injuries [e.g. road traffic accident]
- Both retinal and subdural haemorrhage can occur in bleeding disorders [e.g. haemophilia, haemorrhagic disease of newborn] Factor 8, 9 vWF Type 3, Factor 5, 10, 13 deficiency
- Subdural collections can occur post meningitis
- Rare causes of SDH – glutaric aciduria type 1 [nearly always accompanied by frontal lobe hypoplasia], Battens disease, hypernatraemic dehydration, Menkes Disease.
- Retinal haemorrhages are very unlikely to follow resuscitation or seizures

### Assessment

- a. Assess the need for resuscitation and immediate clinical needs
- b. Look for and document any signs of external injury, including mouth, frenulum, ears and scalp
- c. Check fontanelle and head circumference
- d. Think of further internal injury e.g. intra-abdominal injury

### HISTORY

Once stable (or whilst stabilizing), a second doctor to take a detailed history, recording who has provided the history. Before paramedics leave, get their names and keep the ambulance sheet (it has call time and status of child on their arrival etc.)

You need a timeline of events / carers / witnesses (including siblings). Ascertain when the child was last well. Open ended questions as first and then more focused to ensure you have the info needed:

- Height of fall
- Shaking/impact
- Floor surface (e.g. carpet on concrete floor)
- Standing height of child
- Mechanism of fall (so you can picture it to describe it - draw diagram if helpful)
- Translational forces e.g. child running at time of fall
- Child's development
- Bleeding history (bleeding after cord cut / immunisations / epistaxis / vitamin K given)
- Family: mucocutaneous bleeding / post partum haemorrhage / dental extraction
- Recent NSAIDs (within 14 days)

The history may need to re-taken over time which can often reveal important gaps in information. Has the child had any other recent injuries or trauma / falls / bleeding from nose/bruises.

Past medical problems – e.g. prematurity

**EXAMINATION**

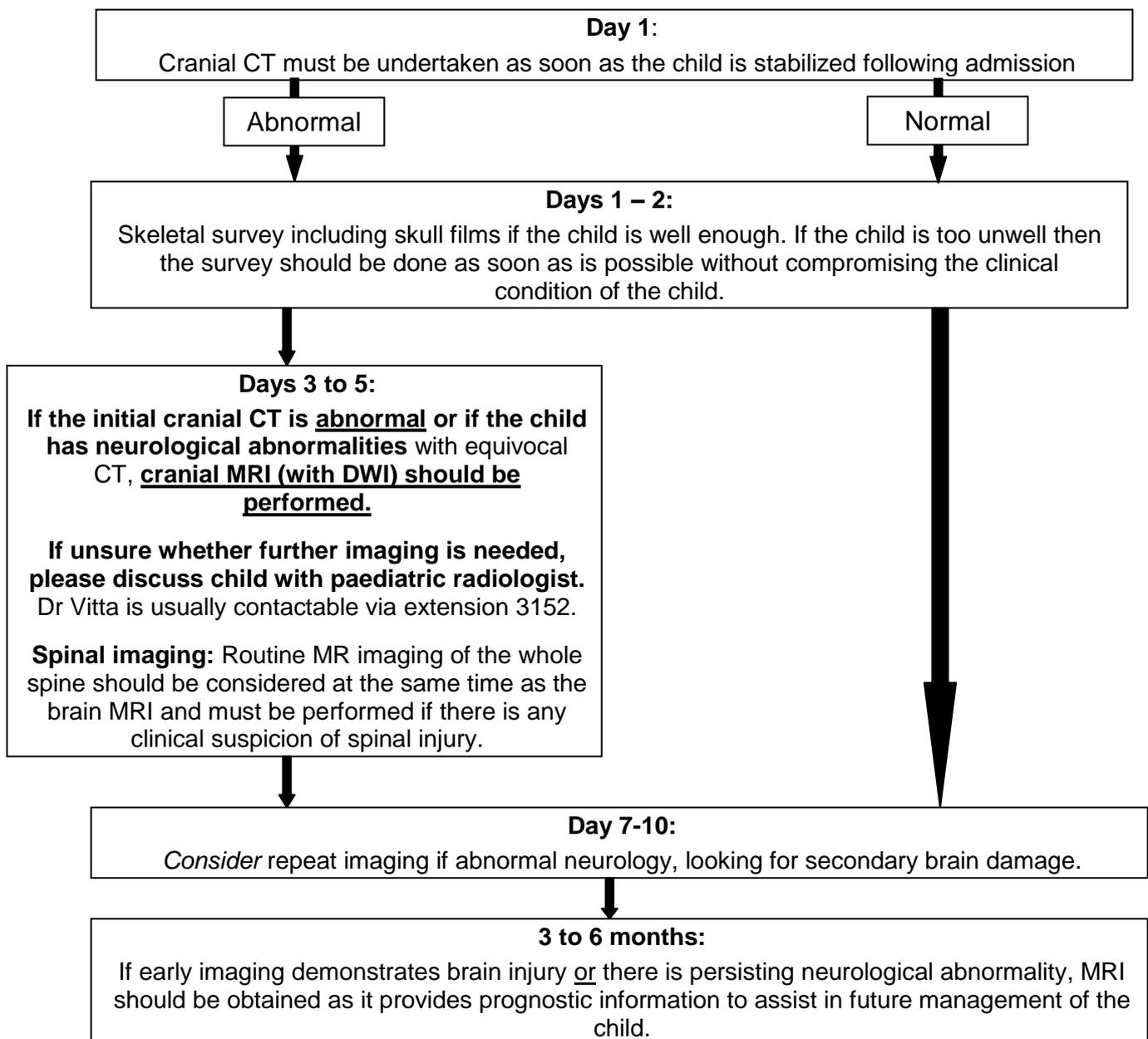
A **thorough** physical assessment is required and needs to be rigorously documented. Use body map to document all injuries. Remember to check OFC at time of presentation and ask for red book.

**INVESTIGATIONS**

**1. Imaging:** Neuroimaging should be undertaken:

- i) CT in any infant with encephalopathic features, focal neurological signs or haemorrhagic retinopathy. Consider when presenting with ALTE / BRUE.
- ii) Same day reporting is required for acute imaging and should be actively chased.

Imaging schedule:



iii) **Non-acute presentation/screening for “occult abuse” in children under 1 year where there is suspected non accidental injury.** Is MRI acceptable alternative ?

**-personal correspondence with Drs Offiah and Stoodley (experts in Radiology of Child Abuse):** Skull fracture detection can be compromised if a CT is not performed. *Therefore even if imaging non-acutely, a CT should be performed first. There is a study currently looking at MRI in non-acute setting- new RCR guidance may be issued next year – BUT until then, perform CT head, unless radiologist requests otherwise.*

### **When an intracranial bleed is identified, why do CT and MRI ?**

*CT and MRI provide complimentary information. CT is a quick and effective first line investigation of choice and highly sensitive in detecting acute haemorrhage. It can reliably diagnose sequelae of AHT that may require urgent surgical intervention. Additional use of MRI can detect new information in 25% of cases with an abnormal CT. MRI is a more sensitive method of detecting small intracranial collections and subtle parenchymal abnormalities, especially in areas less well seen on CT. Cerebral oedema and ischaemic changes are also well-demonstrated by diffusion-weighted MRI (DWI).*

*Evolving secondary brain damage is best assessed 7 to 10 days after the acute injury. This is not routinely recommended, so discuss with Paediatric Radiologist / Neurologist.*

## **2. Eyes- to look for retinal haemorrhages (RH- causes/differential [here](#))**

**RCPCH / RCOPTH state that fundi to be examined within 24 hours (as RH can rapidly disappear):**

- a. Eye review to check for RH in Eye Casualty by Registrar or consultant (out of hours the Registrar must discuss the case with consultant) – please contact consultant directly if unable to get through to the eye casualty.
- b. ANY suspicion of abnormal fundi needs retcam images and consultant review (TMBU). ANY intracranial abnormality (such as a subdural) needs consultant review + retcam images if RH seen.

OUT OF HOURS: Ophthalmology registrars should be able to get a clear view of the fundus and document this and discuss ALL patients referred for suspected NAI with on call consultant. The Retcam is located on TMBU – child will need to be taken to TMBU to have photos taken (TMBU senior nurse).

In reality many patients with suspected AHT will have reduced GCS and be transferred to neurosurgical centre. There are a few cases where patient is stable with small SDH who may remain at RACH for observation on HDU.

## **3. Laboratory samples if RH or ICH detected**

### **Bloods- at RACH**

- FBC - baseline and repeat 24-48hrs later
- Clotting screen (including APTT, PT, TT, Fibrinogen + D-dimer), VwF screen and blood group (as levels vary if bld Group O or not), Factor 8c levels, Factor IX, Factor X111 assay
- CRP, blood culture, LFTs, blood gas, lactate, acylcarnitine, plasma amino acids, copper / caeruloplasmin

*(NB) Both Factor 8 and vWF are acute phase reactants. Discuss case+ results with a Paed Haematologist at GOSH to determine if platelet function or repeat assays are needed at GOSH. Telephone GSST newborn screening lab to get results of heelprick GAD*

**Urine:** Organic acids + urine toxicology + dipstick (to check for blood)

**LP** - when chronic subdural identified (assuming no contraindication to LP) – take pressure reading

## Initial Management

1. ABCD
2. Photograph any injuries / bruises:  
9 - 5pm: medical photography to take photos of any injuries.  
OOH – CED camera to be used (Email images to medical photography at [Clinical.Photography@bsuh.nhs.uk](mailto:Clinical.Photography@bsuh.nhs.uk))
3. Referral to Social services from CED even if child being retrieved (by Nurse / doctor) – see below
4. STRS retrieval if indicated or anaesthetist if time-critical transfer.

*If the child is to be retrieved you should send a copy of your body/map and notes to the receiving hospital as well as the transfer letter, making clear any safeguarding concerns.*

## WHO TO INFORM

1. COW consultant to be contacted if being admitted.
2. If being retrieved to neurosurgical centre / PICU, ask ward registrar to add name to handover sheet.
3. **Doctor OR Nurse** in CED to make telephone **referral** to social services / EDT (even if child is being retrieved). You do NOT need to be certain this is NAI / AHT in order to refer, but you do need to document your thought process e.g. low level fall with subdural haemorrhage raises suspicion of NAI (SDH uncommon from low level fall). You can prompt social services about police. Follow up with written referral within 24 hours.
4. Inform the Named and designated Doctor for Child Protection about the case (even if transferred out). Email [frances.howsam1@bsuh.nhs.uk](mailto:frances.howsam1@bsuh.nhs.uk) and [jamie.carter@nhs.net](mailto:jamie.carter@nhs.net).
5. It is good practice to keep the family up to date with investigations and results. Parent leaflets are available to aid communication. (See [NAI investigations - leaflet 1](#), [skeletal survey - leaflet 2](#)).
6. If there is doubt over diagnosis of subdural bleed or radiology opinion- obtain formal neuroradiology opinion from Kings (particularly if child is not being retrieved, or non-acute or incidental finding)

**DECISION MAKING:** Is this due to a medical condition or trauma (accidental or inflicted)?

1. Strategy meeting will be needed after the referral to social services. Use [Strategy Meeting Checklist](#) to ensure thorough discussion.
2. 2<sup>nd</sup> strategy meeting and updated CP report might be needed once all results become available (or if child returns to RACH).
3. *Distinguishing Between AHT and Accidental Trauma?*

**There is no gold-standard for the diagnosis of inflicted injury, however features can be cumulative and strengthen the likelihood of inflicted injury.**

e.g. SDH + 3 out of 6 findings (RH, apnoea, facial bruising) gives PPV for abuse as >85% - see *Maguire et al* (below). It is essential that a multidisciplinary approach is used.

Paediatricians, radiologists, ophthalmologists, neurosurgeons, social workers to work closely together to piece together information via a strategy meeting (use proforma).

4. Ensure follow-up is arranged e.g. AP / lateral chest views and outpatient appointments / MRI if needed. Feedback further results (e.g. rib fractures, urine organic acids) to police/social services in writing.
5. **Children who have been managed at neurosurgical centres need close liaison with RACH with doctor to doctor (including named Dr) handover prior to return to RACH. Kings Safeguarding Team is 02032991187.**

## Useful Reading / References

1. Piteu et al - PEDIATRICS Volume 130, Number 2, August 2012 . Clinical and Radiographic Characteristics Associated With Abusive and Non-Abusive Head Trauma: A systematic Review
2. Kemp AM. *Arch Dis Child Educ Pract Ed* (2011). doi:10.1136/adc.2009.170449 Abusive Head Trauma- recognition and essential investigations
3. Maguire SA, Kemp AM, Lumb RC et al (2011) Estimating the probability of abusive head trauma: a pooled analysis. *Pediatrics* 128:550–564
4. RCPCH/RCR guidance ([www.rcr.ac.uk/audit/neuroimaging-non-accidental-injury](http://www.rcr.ac.uk/audit/neuroimaging-non-accidental-injury))
5. RCPCH Handbook for CP 2<sup>nd</sup> Edition
6. Diagnosing Abusive Head Trauma- challenges faced by clinicians. *Pediatr Radiol* (2014) 44 (Suppl 4)
7. AAP 2013: Evaluation for Bleeding Disorders in Suspected NAI Carpenter et al
  8. <https://www.rcophth.ac.uk/wp-content/uploads/2014/12/2013-SCI-292-ABUSIVE-HEAD-TRAUMA-AND-THE-EYE-FINAL-at-June-2013.pdf>