Guideline

Investigation of suspected abusive head trauma in children under two years of age

# Scope

For the treatment of children throughout the Trust.

# Purpose

* To detail recommended practice for the investigation of suspected abusive head trauma (AHT) including subdural haemorrhages in children under two years of age.
* [Section A](#SectionA): To provide background information concerning AHT in children.
* [Section B](#SectionB): To provide general practical guidelines.

# Abbreviations

AHT abusive head trauma

APPT activated partial thromboplastin time

CPR cardiopulmonary resuscitation

CSF cerebrospinal fluid

CRP C-reactive protein

CT computed tomography

CUH Cambridge University Hospitals NHS Foundation Trust

CYPS Children and Young People's Service

FBC full blood count

FLAIR fluid attenuated inversion recovery

GA1 glutaric aciduria type 1

ITP idiopathic thrombocytopaenia

MRI magnetic resonance imaging

MRRG medical records review group

NAHI non‑abusive head injury

Non-AHT non‑abusive head trauma

PICU paediatric intensive care unit

PT prothrombin time

SDH subdural haemorrhage

TEG thromboelastogram

Section A

# Introduction

1. Differentiating **AHT** from other causes of brain injury is complex and it is essential that the condition is correctly diagnosed.
2. **Abusive head trauma** (AHT) is an inflicted injury to the head and its contents. Brain injury may well include elements of both impact, and acceleration/deceleration injury, but the term **AHT** does not apply causality. **AHT** should be used in preference to ‘shaken baby syndrome’, ‘intentional head injury’ or ‘non accidental head injury’
3. **AHT** is the commonest cause of death in physical child abuse. It is predominantly seen in children under the age of two years: most commonly in those under six months of age. The mortality from abusive head trauma is up to 30%. Half of the survivors have residual disability of variable severity.
4. Infants with **AHT** present to hospital with a variety of symptoms. These range from poor **feeding, lethargy, seizures and respiratory difficulty to sudden death**. In some cases the absence of either a history or external signs of injury may delay diagnosis. Not all infants are acutely ill, others present for example with an **increasing head circumference**. Children with chronic subdural haemorrhage or effusions present a diagnostic problem because many lack a clear history of symptom-onset and corroborative findings are usually absent.
5. Many children suffering **AHT** may have experienced previous episodes of physical abuse. Any suspicion of physical abuse of a baby or child must be fully investigated to identify the condition and prevent further abuse. However, it is also essential to give full consideration to differential diagnoses (discussed further in sections).
6. 2011 guidance from the [Crown Prosecution Service](http://www.cps.gov.uk/legal/l_to_o/non_accidental_head_injury_cases/) states that **AHT** will usually be diagnosed by **‘the Triad’** of internal head injuries, namely **retinal haemorrhages, subdural haemorrhages and encephalopathy**[2].

# Involvement of the professional team

1. Once a diagnosis of **‘possible AHT’** has been raised, it is the duty of the consultant paediatrician responsible for the medical care to inform the [**safeguarding children team**](http://connect2/safeguarding-children). NICE guidance recommends that “professionals with expertise in non-accidental injuries in children should be involved in any suspected case of non-accidental injury in a child”
2. Whilst the child is on the paediatric intensive care unit (PICU) then the lead clinician would be the **intensivist**. If the child is on the general ward, then the lead consultant would be the **general paediatrician**, unless a direct referral was accepted by paediatric neurology or paediatric neuro-surgery.
3. Referral to the appropriate Children’s Social Care should be made as soon as possible. See the Trust’s [safeguarding children procedures and guidance notes](http://merlin/Lists/DMSRecords/DispRecordTabsDoc.aspx?ID=19681). Further assessment and investigations should then proceed in accordance with these guidelines, after the child has been clinically stabilised.
4. The child’s care and investigation will be led by the paediatrician at CUHFT whilst the child is an inpatient and transferred back to the local paediatrician on transfer or discharge.
5. The referring hospital should be kept informed after identification of suspected abusive head trauma and or subdural haemorrhage (SDH). This will usually be done via a consultant to consultant phone call and also **between the safeguarding teams** of the relevant hospitals.
6. Relevant specialist teams should be contacted with regard to the child’s clinical condition, and for expert opinion. The **on-call neurosurgical registrar** will discuss any child referred for a neurosurgical opinion with head trauma with their neurosurgical consultant.
7. Overall responsibility for the child protection investigation will lie with social care, who will liaise with relevant agencies including police and health. If a clear crime has been committed at the time of admission the police should be contacted directly.
8. It is essential for all medical professionals involved in the child’s care to remember that good documentation is vital, as all findings may have to bear examination in court. Any member of any team may be required to submit a medical report or “witness of fact” statement as part of child protection proceedings as requested by the police or social care.
9. Strategy meetings will need paediatric input, ideally from the named lead ie if the child is a regional referral the local team should lead as soon as they are aware of the possible diagnosis.
10. A list of useful contacts at CUH is provided in [section B](#SectionB).

# Important features of abusive head trauma (AHT)

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

Features associated with AHT include:

1. Extra-axial bleeding: **subdural and subarachnoid** haemorrhages (extradural haemorrhages are rarely seen in AHT and far more commonly seen in unintentional injury)
2. **Subdural collections** are often **multiple**, and common sites are over the convexity of the cerebral hemisphere, inter-hemispheric or in the posterior fossa. In the acute stage they are typically small and do not cause mass effect
3. Brain injury: includes **hypoxic ischaemic** injury, **cerebral oedema** and **parenchymal injury**: which are likely to be responsible for the poor outcome in these children.
4. **Retinal haemorrhages** in one or more usually both eyes are reported in **70-80%** of AHT
5. **Bruising/abrasions**, lacerations or swelling to the head, including scalp or face
6. **Skull fracture**(s), usually with overlying haematoma if injury is recent
7. **Skeletal injury**: rib or long bone fractures. There is a recognised association with cervical spine injury.
8. **Bruising**
9. **Apnoea and seizures**
10. **Neck and cervical spinal cord** injury

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**Table 1:** From Kemp A (34)

Positive predictive values and **or** for features associated with AHT

|  |  |  |
| --- | --- | --- |
|  | PPV (97.5% CI) | OR (97.5% CI), p |
| Apnoea | 93% (73% to 98%) | 17 (5 to 58), <0.001 |
| Rib fractures\* | 73% (5% to 88%) | 3 (0.7 to 13), 0.13 |
| Retinal haemorrhage\* | 71% (48% to 86%) | 3.5 (1.1 to 11), 0.03 |
| Seizures | 66% (45% to 82%) | 3 (0.7 to 12), 0.13 |
| Long bone fractures\* | 59% (48% to 69%) | 1.7 (0.8 to 3.6), 0.14 |
| Skull fractures | 44% (22% to 68%) | 0.85 (0.3 to 2.3), >0.2 |
| Head and neck bruising | 37% (4% to 90%) | 0.8 (0.07 to 9), >0.2 |
| \* Estimates in this analysis are deemed to be conservative owing to missing data as children who have head trauma from non-abusive causes rarely have complete skeletal surveys or full ophthalmology examinations.  |

AHT, abusive head trauma; PPV, positive predictive value

* 1. **Subdural haemorrhage** – in three studies, 63%, 54% and 82% of cases of SDH were considered to be probable AHT (4,6).
	2. **Apnoea** (1, 7) apnoea is significantly associated with AHT and coincides with hypoxic ischaemic injury is commonly seen on magnetic resonance imaging (MRI).
	3. **Seizures** – seizures have been shown to occur more frequently in AHT than Non-AHT and may exacerbate further hypoxic ischaemic damage to the brain.
	4. **Rib fractures** (1, 7) **and long bone fractures** have been found to be associated with AHT. The explanation for this is likely to be the fact that most cases of AHT include a combination of shaking injuries with or without impact.
	5. **Retinal haemorrhages** (RH) are strongly associated with AHT. Most studies identified retinal haemorrhages in 80-90% of confirmed AHT. RH have also been observed in severe Non-AHT but not in trivial accidental head injuries (5,8).
	6. **Skull fractures** are more often associated with Non-AHT. But, most domestic falls up to 5 feet, solely under the force of gravity, do not result in a skull fracture. Most cases of significant accidental falls or impact injuries result in a linear unilateral parietal fracture. Other fracture types need to be put into the context of the history.
	7. **Bruises** to the head and neck(1, 7)

NICE Clinical Guideline 89: [When to suspect child maltreatment](http://guidance.nice.org.uk/CG89) and the RCPCH [Child Protection Companion – RCPCH Child Protection Portal](https://childprotection.rcpch.ac.uk/child-protection-companion/) provide useful information for the identification of a suspected non accidental head injury.

# Differential diagnoses

1. There are many reported causes and associations of subdural haemorrhage, which must be considered in the production of a differential diagnosis. These include: (11)
* accidental trauma
* traumatic labour
* neurosurgical complications
* cranial malformation (aneurysm, arachnoid cyst)
* cerebral infections
* coagulation and haematological disorders
* metabolic disorders (glutaric aciduria, galactosemia, Menkes)
* biochemical disorders (hypernatraemia)
1. **Traumatic labour** – prospective examination of a cohort of neonates showed that presence of unilateral or bilateral SDH was not necessarily indicative of excessive birth trauma ie some babies with normal vaginal or elective caesarean deliveries may have SDH. All haematomas had completely **resolved by four weeks** of age in one small series.
2. **Arachnoid cysts/ external hydrocephalus** – SDH is an extremely rare complication of arachnoid cyst, and there is no generally acknowledged agreement that external hydrocephalus predisposes to SDH. For these diagnoses to be applicable there must be evidence that the putative causative lesion was present prior to the development of the symptomatic SDH. This is obtainable by correct interpretation of imaging and head circumference measurements .
3. **Glutaric aciduria type 1 (GA1)** – this is a rare inborn error of metabolism which is associated with acute SDH and chronic subdural collections. Children with SDH in this condition **do not have associated injuries such as fractures**. It has been recommended that screening for GA1 should be added to the standard array of investigations for suspected NAHI. This screen involves urine organic analysis, glutarylcarnitine measurement on blood spots and plasma total and free carnitine estimations, (followed by confirmatory enzymology, if indicated by expert opinion).
4. **Menkes disease,** is a severe neurological disorder that produces severe neuro-degeneration in children over six months of age (normally occurs earlier). Therefore caeruloplasmin levels may be considered in children under six months and over that age with a previous history of neurological or developmental difficulties. Copper analysis is complex and is only done on recommendation of a consultant paediatric neurologist.
5. **The ‘unified hypothesis’ -** This states that SDH in infants could arise from a combination of factors as a ‘phenomenon of immaturity’ in the absence of head trauma. However, subsequent papers have concluded that unexplained SDH according to the unified hypothesis was ‘an extreme rarity’ and that AHT was the most common cause of SDH in children <1 year.
6. Further details of differential diagnoses and recommended investigations are detailed in [section B](#SectionB).

# Timing of injury

1. In court, the paediatrician may be asked to give an estimate of the age of the injury. It must be appreciated that only approximations can be given.

1. It is not possible to accurately age a subdural haematoma on MRI scans alone.
2. Accurate ageing of a subdural haematoma on CT scan is not possible after one week. There may some visible characteristics on CT which can suggest the age of a haematoma: acute (1-5 days) haematomas appear hyper-dense relative to grey matter, whereas sub-acute (7‑20 days) haematomas appear iso-dense and chronic (over 20 days) haematomas appear hypo-dense(30). However, other studies have shown that SDHs may remain hyper-dense up to 11 days after injury, so this method of ageing injuries is not accurate. Advice should be sought from an experienced neuro-radiologist.
3. Spectophotometry of subdural aspirate can identify presence of bilirubin, which suggests that bleeding occurred 24 hours – three days prior to aspiration.

1. CSF cytology and assessment of macrophage markers provide further tests for timing of bleeding. These investigations may be useful in assessing the consistency of a given injury with a reported/ suspected cause eg birth trauma/ accidental injury.
2. Xanthochromia from physiological jaundice of the newborn may persist in the CSF for up to six weeks.

# Legal implications and guidelines

1. Guidelines have been issued by [The Crown Prosecution Service](http://www.cps.gov.uk/legal/l_to_o/non_accidental_head_injury_cases/) regarding the prosecution approach to non-accidental head injuries (2). The salient points are listed below:
* **AHT** cases will usually be diagnosed by a triad of internal head injuries**, ‘the Triad’, consisting of subdural haemorrhages, retinal haemorrhages and encephalopathy**.
* Proof of AHT usually requires the triad of injuries plus **supporting evidence** (see CPS guidelines for details of supporting evidence).
* CPS policy is to resist challenges to the Triad diagnosis based on the ‘Unified Hypothesis’.
1. **Careful and efficient documentation** of all findings is essential.
2. The diagnosis of ‘suspected AHT’ has to be confirmed or rebutted on the basis of subsequent investigations. The degree of suspicion will then be qualified by a degree of certainty:
* probable (on a balance of probabilities, greater than 50% chance)
* possible/ questionable (legally not provable at the time)
* not AHT(suspicion not sustained)

Section B – A practical guide to investigations

The first objective on acute presentation is **clinical stabilisation** of the child. Following stabilisation, if **AHT** is suspected social care should be informed at the earliest opportunity within 24 hours.

Care should be taken to inform social care of any other children living within the same household and if possible their current whereabouts. Within working hours the [safeguarding children team](http://connect2/safeguarding-children) should be informed and the following protocol for investigation followed. Relevant specialist teams should be contacted as normal with regard to the child’s clinical condition. Remember that good documentation is essential. A ‘checklist’ to assist with tracking of investigations is provided in Appendix 2.

Concerns that **AHT** is a possibility should be shared with key professionals at the earliest opportunity; this includes children’s social care, the safeguarding children team at Cambridge University Hospitals (CUH), police and the local referring general paediatrician/ general practitioner.

**Strategy discussions** will be held in accordance with the wishes of the social care department and police, but usually within 24 hours of referral. Trust staff will be invited to participate in these discussions. The responsible paediatrician will be asked for an opinion about the nature of the injuries. **Interim reports** maybe required whilst further investigations are carried out. It is the responsibility of the **consultant in charge** of the patient and the **safeguarding team** to liaise with Social Care and Police on a regular basis whilst any safeguarding investigations continue.

The allocated social worker may convene further strategy meetings in order to gather more information and plan further investigations. Whilst the child is an inpatient these are likely to be held in the hospital setting or by teleconference. A **consultant or senior member** of the medical team or the consultant responsible for the child’s safeguarding in their local hospital should attend as well as a member of the **safeguarding team and nursing staff** to represent CUH to ensure that up to date and relevant information is shared.

# Imaging protocol

1. The protocol for head imaging recommended in guidelines published by the Royal College of Radiologists in association with the Royal College of Paediatrics and Child Health is shown below(22):
2. It is important to perform **diffusion-weighted MRI** as this is capable of detecting secondary ischaemic sequelae of AHT which may be occult on routine sequences(22).
3. An **MRI of the spine** should be performed.
4. A **full skeletal survey** should also be performed, including a **plain skull x-ray** if no CT has been undertaken (22). Full details of the views to be taken are available from the [Skeletal surveys for suspected physical abuse [QSI Ref: XR-505, XR-512] | The Royal College of Radiologists (rcr.ac.uk)](https://www.rcr.ac.uk/career-development/audit-quality-improvement/auditlive-radiology/skeletal-surveys-for-suspected-physical-abuse-qsi-ref-xr-505-xr-512/) (p20) along with further details and guidance concerning head imaging.
5. A repeat **chest x-ray** and **other areas of concern** should be re-imaged more than 12 days after putative timing injury, looking for callus formation that was previously inapparent.
6. If a child with confirmed AHT has a sibling under two years of age, a skeletal survey for the sibling should be considered as part of the safeguarding assessment.
7. Radiation risk: A recent studies have found a small, but increased in risk for all cancers following diagnostic radiography in early infancy.

# Haematology protocol

1. A **haemostatic history** is essential and should include the following:
* history of bleeding in the child (ask specifically about circumcision or other surgery, particularly ENT or dental procedures)
* history of bleeding disorders in the family
* history of menorrhagia in the mother or other female members of the family
* history of consanguinity
1. **Essential** tests in children under two years of age. These will exclude most serious bleeding disorders but not all
* FBC and blood film
* ‘Coag screen’ PA, APTT,TT, Fibrinogen
* Factor assays: FII, FV, FVII, FVIII, FIX, FX, FXI, (FXII), FXIII, VWF
* TEG
* Blood Group (essential for interpretation of VWF results)
* PFA
1. Note the interpretation of the **PFA and TEG** is difficult under the age of two years, and must always be done in discussion with the **paediatric haematologist.**
2. Minimum volumes required (all citrate samples) are as follows:
* Coagulation screen – 1.2ml
* Factor assays – 1.2-2.4ml
* TEG (for α2 anti-plasmin) 1.2ml.
* PFA – ideally 4ml (must be analysed within four hours)
* These may need to be done in stages.
1. It is important to ensure that there is no contamination with heparin (potentially problematic eg if drawn from arterial lines in PICU).
2. Ideally, send 6x1.4ml citrate (green) bottles before any blood products are given or as soon as possible and send to haematology lab within four hours for spinning and freezing.
3. Results of these tests should be based on the age-specific normal ranges, which can be found in Liesner et al, Blood Coag Fibrinolysis 2004, or on request from paediatric haematology.
4. If bleeding is still unexplained after these tests, discuss with the consultant paediatric haematologist who will recommend further tests.
5. **Please discuss with the specialist haemostasis lab** before taking samples to arrange suitable time for lab to process tests, usually within normal working hours. If child is moribund or situation dictates that samples cannot wait, then arrange with lab for samples to be spun down and frozen immediately, to be analysed at a later date.

# Ophthalmology

An ophthalmologist should perform a retinal examination using mydriatic drops and an indirect ophthalmoscope

If retinal haemorrhages are seen, a consultant paediatric ophthalmologist or consultant with paediatric sub-specialty interest should be asked to review, document and comment on the findings. Where possible **retinal digital imaging** should be performed. This is usually only possible when the baby is sedated and so the ophthalmology team should be contacted quickly (as this may be easiest to perform before a child leaves PICU).

It is important to remember that all children will require referral for follow up with the local ophthalmologist at discharge.

## Multidisciplinary social assessment

##  (Strategy Meeting)

This should include input from the following people:

* Consultant social worker (chair)
* Allocated social worker
* Consultant paediatrician or senior trainee under consultant supervision
* Well Child nurse/ clinical nurse specialist neurology/neurosurgery
* Ward nursing staff
* Safeguarding team
* Police child abuse investigation team
* Legal representation

Essential points for the **chair** (senior social worker) of the meeting to establish:

* A clear history of the presenting symptoms. The nature of any witnessed fall, including the height and surface of contact must be established.
* Who has had contact with the child in the time during which the injury may have occurred.
* Who is **allowed to visit** and care for the child on the ward, and whether they should be chaperoned (and if so by whom). This should be carefully and clearly documented in the notes.
* Whether other **children are in the household**, and whether appropriate measures are in place to protect them.
* Social care will be responsible for ensuring the safety of other children within the home, but it is the responsibility of the medical team to ensure that social care are aware of the existence of such children and concerns about their safety.
* Any written agreement made with parents and/ or carers should be filed on EPIC.

# List of useful contacts

* Consultant paediatric ophthalmologist
* Consultant paediatric haematologist
* Named doctors and named nurse – [safeguarding children team](http://connect2/safeguarding-children)
* Consultant paediatric neurologist
* Consultant paediatric neurosurgeon
* Consultant paediatric radiologist
* Consultant paediatric neuroradiologist

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# Associated documents

* Bruising in children not independently mobile procedure LSCB
* [Child protection - safeguarding children policy](http://merlin/Lists/DMSRecords/DispRecordTabsDoc.aspx?ID=19680) CUHT
* [Child protection - safeguarding children procedures and guidance notes](http://merlin/Lists/DMSRecords/DispRecordTabsDoc.aspx?ID=19681) CUHT
* NICE Clinical Guideline 89 - [When to suspect child maltreatment](http://guidance.nice.org.uk/CG89) 2009

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Appendix 1: Exclusion of differential diagnoses

Whilst the investigations listed above comprise the essential protocol for suspected AHT, some further, more specific investigations may be performed for exclusion of specific differential diagnoses. Such differential diagnoses, the investigations to elucidate them, and some guidance regarding results suggestive of AHT are given in the table below. Many of the investigations will already have been performed as part of the basic essential protocol.

|  |  |  |
| --- | --- | --- |
| **Differential diagnoses for consideration** | **Investigations to be performed** | **Warning signs for NAI****(\* = sign of neglect)** |
| **Differential diagnosis of SDH/encephalopathy:** |
| * Adequate accidental trauma
* Birth trauma
* VP shunt or neurosurgery
* Cardiopulmonary bypass
 | * Detailed clinical history to be taken from parents/ other carers. This is the responsibility of the lead paediatrician.
* Full, detailed physical examination
* High-quality photography of lesions (Media Studio, digital camera with date and time)
* Illustrations on body chart if indicated or if child too unwell otherwise for Photography/HAIKU
 | * Absent or minor traumatic explanation\*
* Inconsistent or changing history\*
* Delayed presentation\*
* Acknowledged/ witnessed NAI
* Bruising of different ages
* Sub-galeal haemorrhage
* Signs of neglect
* Malicious injury (burns, bites, cuts, whip marks)
 |
| Drugs/vitamin K deficiency | * Clinical history
* Coagulation screen (section B3)
* Rapid urine toxicology for recreational drugs
 |  |
| Kawasaki disease | * Medical history and examination
* FBC, ESR, CRP
 |  |
| Menke’s disease  | * Clinical examination for phenotype
 |  |
| Alagille syndrome | * Liver function tests
 |  |
| * Coagulopathy
* Idiopathic thrombocytopenia (ITP)
* Leukaemia
* DIC
* Dehydration
* Renal failure
* Meningitis
* HSV
 | * Full blood count
* Blood film
* Coagulation screen (section B3)
* Urea and electrolytes
* Blood culture (if unwell/ indicated)
* CSF virology and PCR (if unwell/ indicated)
 |  |
| Glutaric aciduria | * Urine organic analysis
* Glutaryl carnitine measurement on blood spots
* Plasma total and free carnitine estimations
* Confirmatory enzymology ONLY if indicated
 |  |

|  |
| --- |
| **Differential diagnosis of retinal haemorrhage** |
| * Papillodema
* Leukaemia
* Thrombocytopenia
* Vasculitis
 | * Fundoscopy by paediatric ophthalmologist with pharmacological papillary dilation (if possible: discuss with neurosurgeon)
* Retinal photography or detailed drawings
* Document location of haemorrhages and layers involved.
* Coagulation screen (section B3)
 | * Multi-layer retinal haemorrhage
* Vitreous haemorrhage
* Retinal detachment
* Lens dislocation
* Retinoschisis
 |
| **Differential diagnosis of skeletal lesions** |
| Injury | * Full skeletal survey (section B1)
* Detailed history of injuries
 | * Multiple rib fractures
* Femoral fractures
* Mid-shaft fractures of the humerus
* Inconsistent/ changing history
 |
| Osteogenesis imperfecta  | Investigation after expert medical opinion only (paediatric orthopaedics) |  |
| Osteoporosis | Investigation after expert medical opinion only |  |
| Vitamin C deficiency | * FBC
* Clinical history and examination
* Serum ascorbic acid level ONLY if clinically indicated after discussion with paediatric haematologist.
 |  |
| Sickle cell anaemia | * FBC, blood film
 |  |

Appendix 2:

Quick-glance checklist for investigation of suspected NAHI

These pages can be printed and scanned into patients EPIC notes if AHT suspected. The purpose of this page is to provide a quick-glance summary of the investigations which have been performed. Not all of the investigations listed will be appropriate for all cases, and are not necessarily listed in the order in which they will be performed. Some cases will require additional investigations. It is helpful if such additional investigations are added to the form.

|  |  |  |
| --- | --- | --- |
| **Investigation/ action** | **Date**  |  |
| Safeguarding children team informed |  |
|  | **Date Name**  |
| Lead consultant paediatrician at CUH identified |  |  |
| Lead consultant paediatrician at DGH |  |  |
|  |  | **Date results received** |
| Initial CT head (acute presentation) |  |  |
| Initial MRI/ CT head (non-acute presentation) |  |  |
| Initial MRI head (3-5 days post acute presentation) |  |  |
| MRI spine |  |  |
| Radiological skeletal survey |  |  |
| Initial Fundoscopy |  |  |
| Fundoscopy (by consultant ophthalmologist) |  |  |
| Retinal photography |  |  |
| Initial FBC, U&E, LFT, CRP,  |  |  |
| Clotting screen and platelet studies |  |  |

|  |  |  |
| --- | --- | --- |
| Investigation/ action | Date  |  |
| Multidisciplinary social assessment |  |  |
| Urine organic acid analysis |  |  |
| **Further investigations (eg repeat imaging)** |  |  |
| Strategy meeting |  |  |
| Case conference |  |  |
| Interim report/ medical report |  |  |
| Referral to local ophthalmologist |  |  |