Essentials in Non-accidental injury

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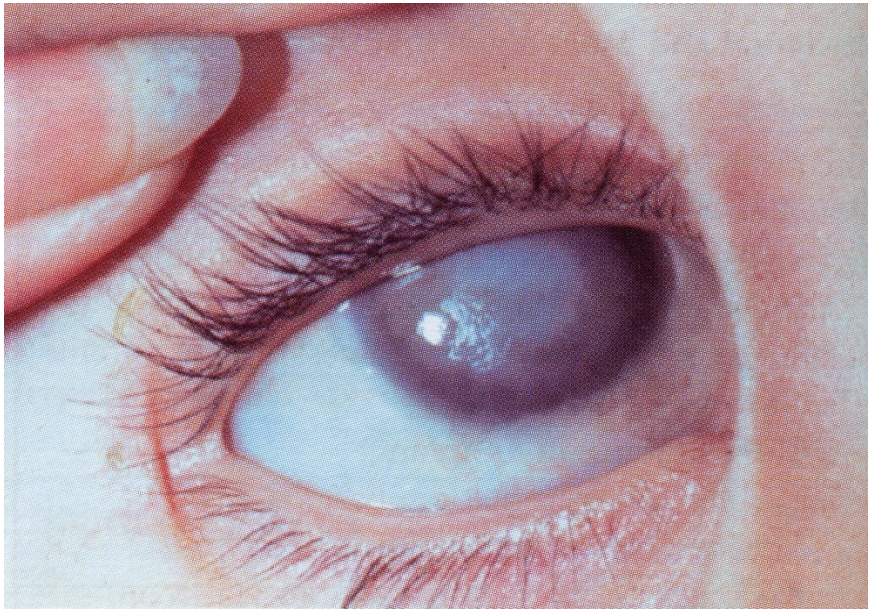
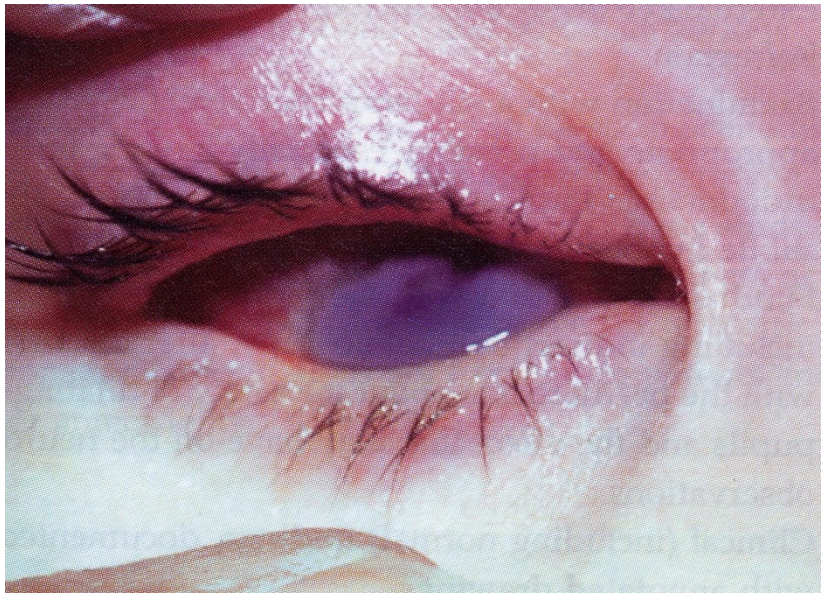
Non-accidental Injury and the eyes

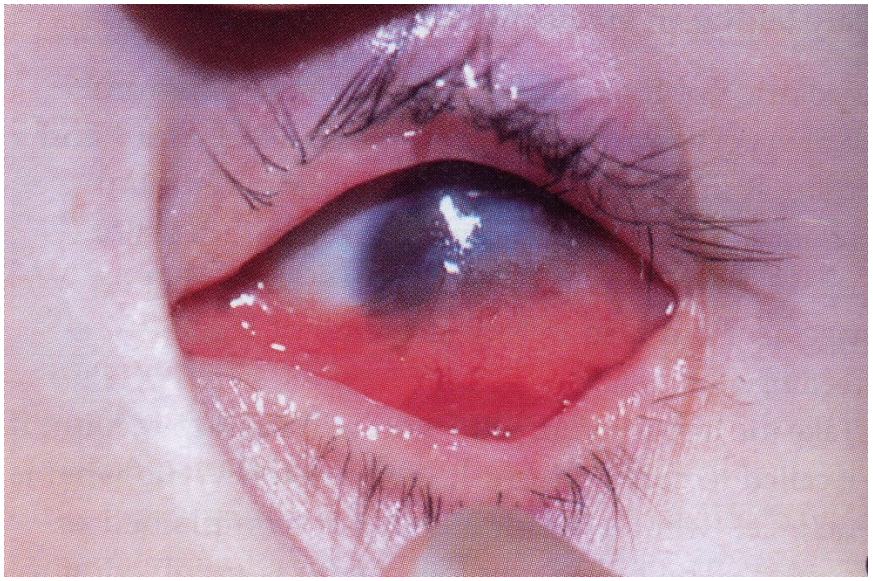
- Direct orbital and ocular trauma
  - 5% will present to an ophthalmologist first
- Indirect ocular trauma: abusive head trauma (AHT)
- Description of retinal Hbs
  - Practicalities of examination
  - Differential diagnosis of retinal haemorrhage
  - Current consensus on pathophysiology

Ocular signs of direct injury

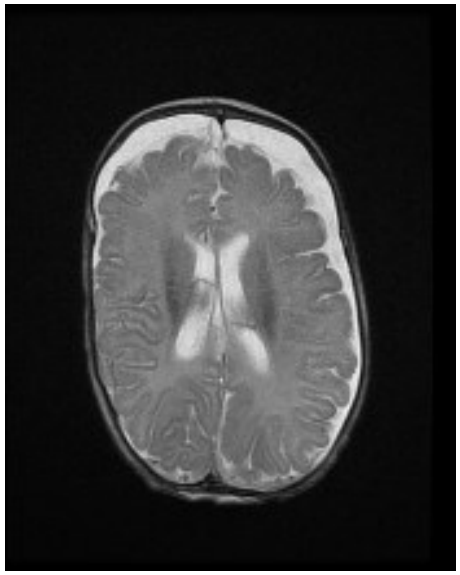
- Uncommon
- Periocular bruising / burns
- Lid lacerations
- Unexplained lens dislocation or cataract
- Conjunctival and/or corneal injuries
- Intraocular haemorrhages (less common)





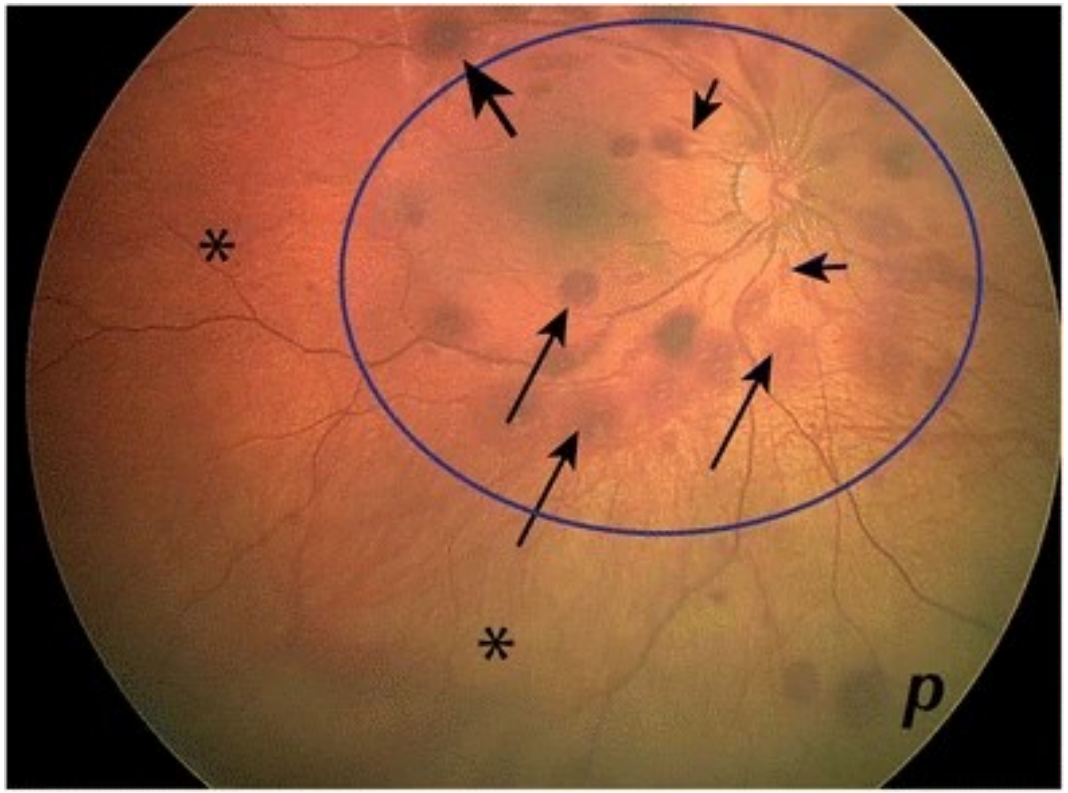


Inflicted head injury



TRIAD

- Sub-dural haemorrhage
- Retinal haemorrhages
- Encephalopathy
  - Diffuse axonal injury
  - Hypoxic ischaemic encephalopathy



Ocular features of repetitive acceleration / deceleration injury

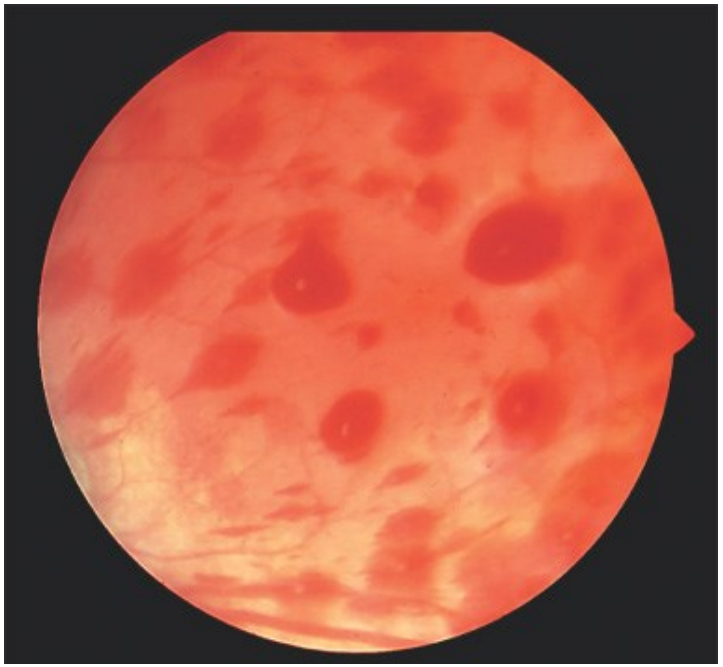
- Incidence of retinal haemorrhages 85%
- Often no visible external injury
- +/- Sub-conjunctival haemorrhages
- Bilateral severe multi-layer retinal haemorrhages
- +/- evidence of vitreous traction
- Not pathognomonic of NAHI

Retinal haemorrhage appearance

Papilloedema found in <10%

- Superficial retinal
  - Bright red
  - Flame shaped
  - From superficial capillaries
  - Disappear within days
- Intra-retinal
  - Dot / blot round Hbs
  - From deep capillaries
  - Disappear within weeks/months
  - Macular schisis

White centred retinal haemorrhage (Schisis with sub-ILM blood collections)

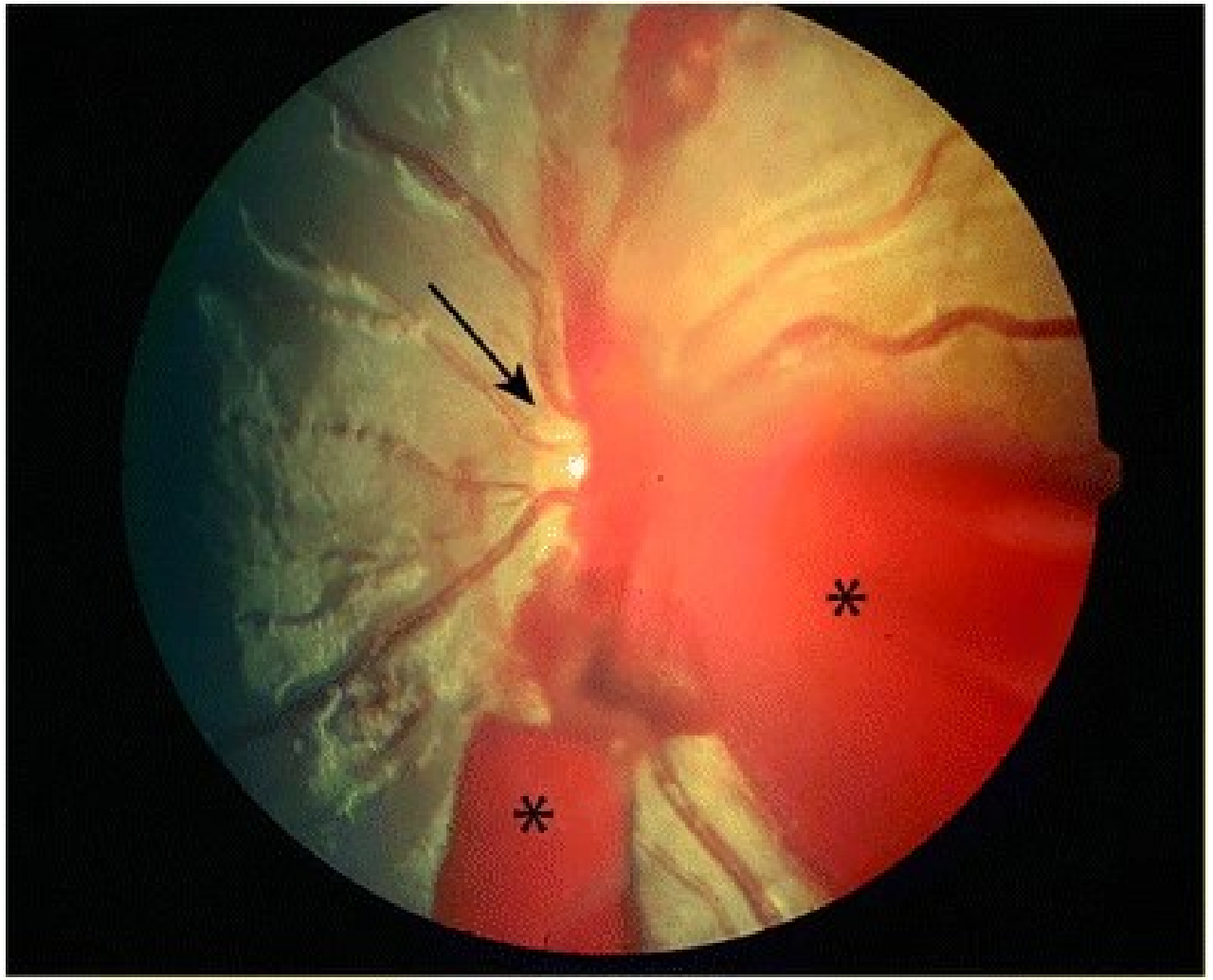


- Due to haemorrhagic retinal schisis,
- Darker red
- About the size of the optic disc
- May have white “light” reflexes at apex
- May develop a fluid level
- Indicate severe trauma / vitreous traction

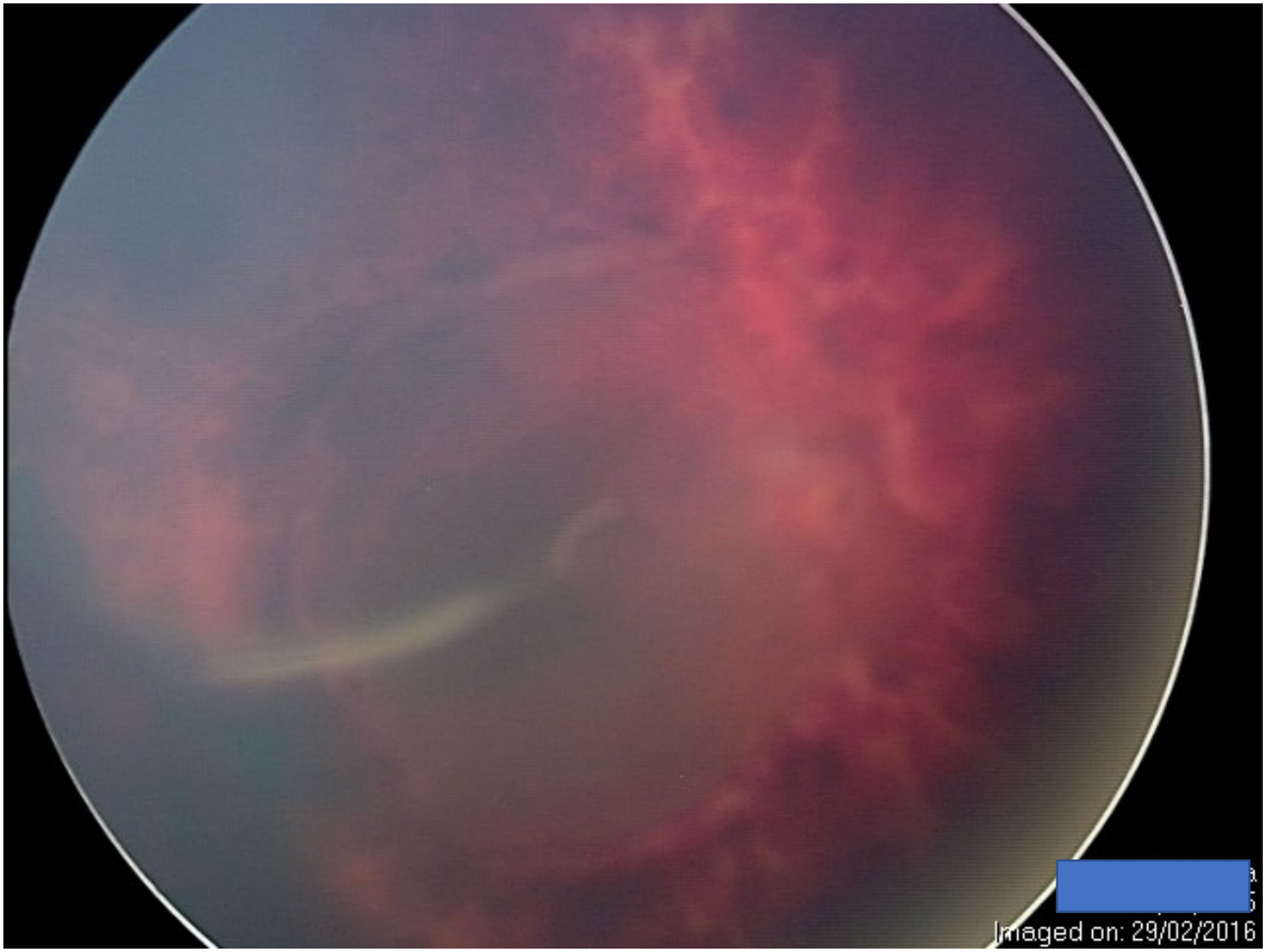
Sub-ILM haemorrhage - cont

- May have a fluid level
- May break through ILM and hyaloid face to give a vitreous Hb

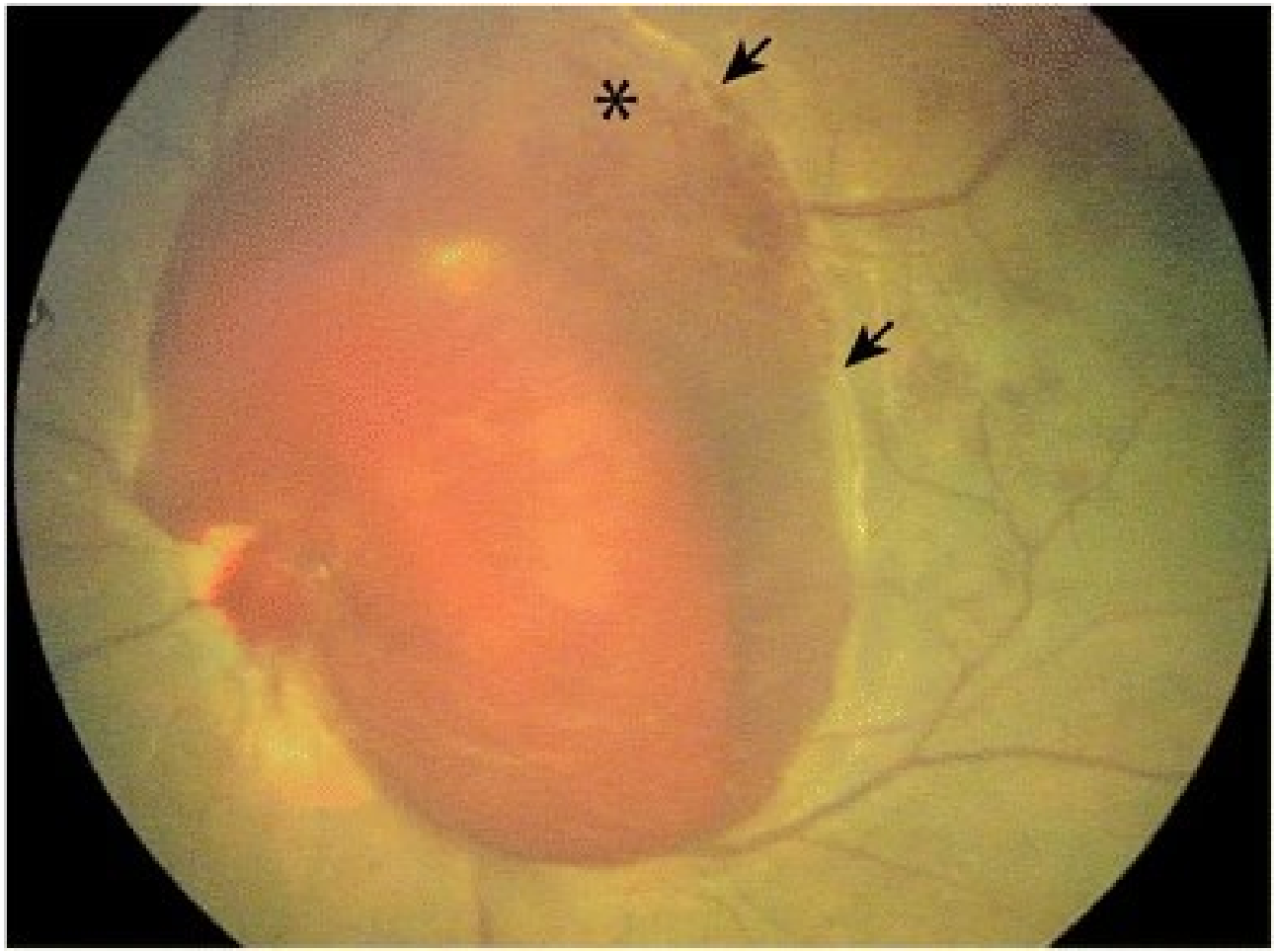
Vitreous haemorrhage



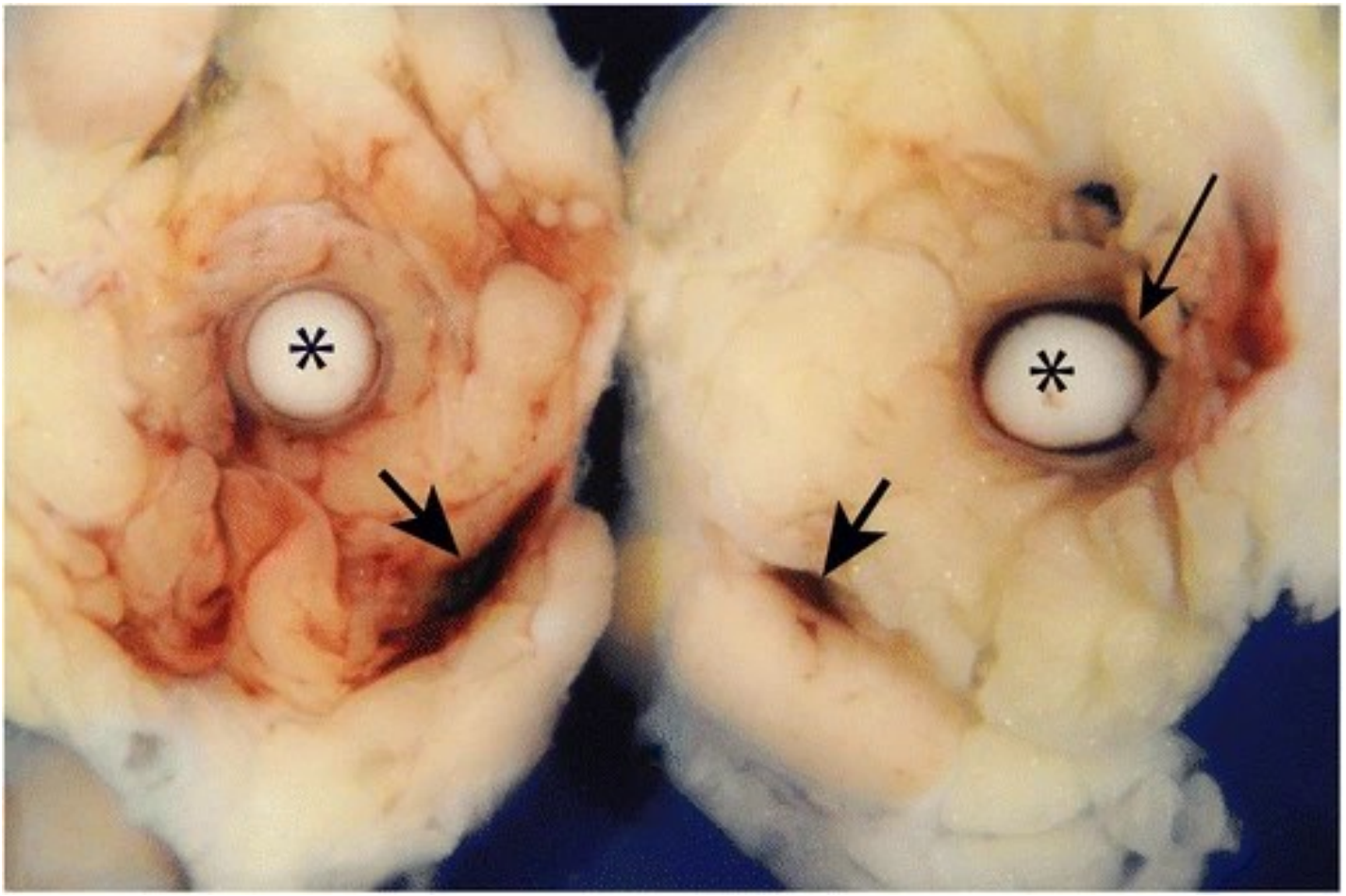
Peri-macular folds – 3% (but 40% in fatal cases)



Macular schisis with hypopigmented RPE edge



Optic nerve sheath and orbital fat haemorrhage



Asymmetrical retinal haemorrhages – 3%

Ophthalmologist's role

- Rare to be the first to recognise AHT
- Dilated indirect ophthalmoscopy
- Accurate documentation of retinal appearance
- Report for police / court
- Imaging where available
- Ophthalmic care and follow up
- Ensure safe guarding team are aware
- LVAs/support/blind registration where necessary

Ophthalmic examination

- Best when baby is still sedated
- Check with neuro if OK to use mydriatics
- Dilate pupils with 0.5% cyclopentolate and 2.5% Phenylephrine if possible (often miosed)
- Use indirect ophthalmoscope (and speculum if required)
- Imaging and review by consultant before baby is extubated
- Review in 1 week can be helpful for timing of onset

RECORDING OF OPHTHAMOLOGICAL FEATURES IN SUSPECTED PAEDIATRIC HEAD TRAUMA

HISTORY
Continue on reverse

PATIENTS DETAILS

If possible to assess

Visual Acuity	**Right** eye	**Left** eye

OCULAR MOTILITY

Right eye | Left eye

SUBCONJUNCTIVAL HAEMORRHAGES

Right eye		**Left** eye	
Yes	No	Yes	No

ANTERIOR SEGMENT

Right Eye	**Left** Eye

Pupil size and Pupillary reflexes

Pupils dilated with

PERIOCULAR BRUISING: (mark areas of bruising)

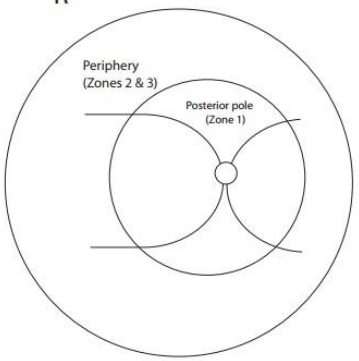
Circle single or multiple appropriate responses if present or enter free text

FUNDUS Circle if present	**RIGHT** EYE				**LEFT** EYE			
Retinal Haemorrhages	YES		NO		YES		NO	
NUMBER. of Retinal haemorrhage	Few (1-10)	Many(10-20)	Too numerous to count		Few (1-10)	Many(10-20)	Too numerous to count	
LOCATION of retinal haemorrhages	Pre retinal	Intraretinal	Subretinal	Multilayered	Pre retinal	Intraretinal	Subretinal	Multilayered
DISTRIBUTION of retinal haemorrhages	Posterior Pole Few/many/ too numerous to count (Zone 1- ROP classification)		Periphery Few/many/ too numerous to count (outside Zone1)		Posterior Pole Few/many/ too numerous to count (Zone 1- ROP classification)		Periphery Few/many/ too numerous to count (outside Zone1)	
SIZE of retinal haemorrhages	Small (< 1dd)	Medium 1-2dd	Large >2dd		Small (< 1dd)	Medium 1-2dd	Large >2dd	
MORPHOLOGY of haemorrhages White centered or other								
Macula Retinoschisis								
Perimacular folds								
Optic disc								
OTHER findings								

History (cont.)

Other findings

R



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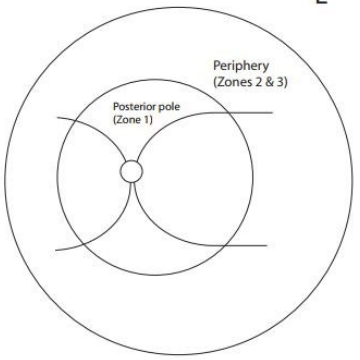


Comments

Name

Signature

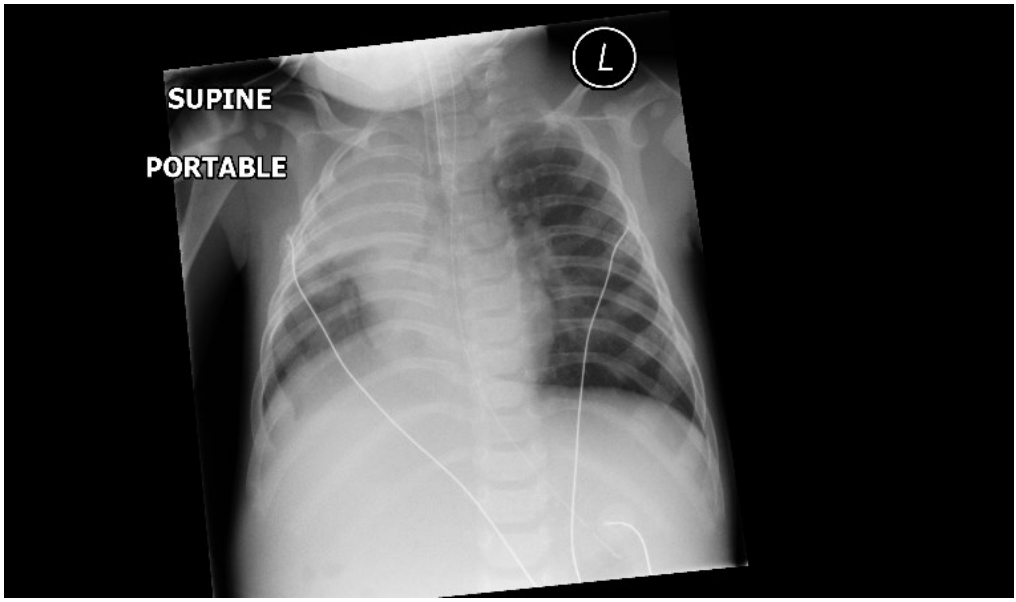
www.rcophth.ac.uk/wp-content/uploads/2014/12/2013-SCI-292-ABUSIVE-HEAD-TRAUMA-AND-THE-EYE-FINAL-at-June-2013.pdf

Differential diagnosis

Injury or Condition	Discussion
Accidental trauma	— Few in number except in very severe trauma (see below) — Usually limited to posterior pole — Predominantly intraretinal and pre-retinal — Extremely rare (most studies <3 % incidence) after short falls except if there has been an epidural hemorrhage [16,50] or occipital impact
Motor vehicle crash or severe crush injury	— Easily determined by history[47]
Intraocular surgery	— Easily determined by history
Cardiopulmonary Resuscitation (CPR)	— Extremely rare,[48] few in number, posterior pole
Extracorporeal Membrane Oxygenation (ECMO)	— 5 out of 37 (13 %) of ECMO patients had retinal hemorrhage.[49]
Birth	— Between 19.2 % and 37.3 % incidence in vaginal birth — 6 % incidence after C-section — see text regarding timing
Prematurity	— Retinal hemorrhage occur at the peripheral circumferential demarcation between the vascularized and avascular retina
Intracranial hypertension or Papilledema	— Small number of retinal hemorrhage on or around the optic disc[51]
Cancer	— Leukemia -usually with white retinal infiltrates
Coagulopathy/anemia	— Uncommon, few in number, posterior pole severe anemia and usually thrombocytopenia required, often with cotton wool spots
Meningitis	— More often if coagulopathy or sepsis is present — Only severe retinal hemorrhage if purulent meningitis[52] otherwise ew in number, posterior pole
Cytomegalovirus	— Necrotic retinitis
Ruptures aneurysm/arteriovenous malfomation	— May have severe extensive RH easily recognized on neuroimaging
Cyanotic congenital heart disease	Few in number, posterior pole with tortuous retinal veins
Endocarditis	Few in number, usually with white centers (Roth spots)
Hypoxia	— Few in posterior pole
Menkes disease	Causes blue sclera
Galactosemia	Vitreous hemorrhages reported
Glutaric aciduria	Rarely occurs and is confined to posterior pole
Carbon monoxide poisoning	Few in posterior pole
Other retinal disorders (e.g. juvenile X-linked retinoschisis, subretinal neovascular membrane retinal hemangioma)	Recognized by other characteristic features

Levin, A.V., Luyet, F.M. & Knox, B.L. Ophthalmologic Concerns in Abusive Head Trauma. *J Fam Viol* **31,** 797–804 (2016) doi:10.1007/s10896-016-9840-0

Other investigations



- CT / MRI
- Skeletal survey
- PT and APTT – normal
- Extended clotting screen – normal
- Platelet function analysis - pending
- Urinary organic acids glutaric acidaemia

Pathophysiology: current consensus

- Repetitive acceleration – deceleration and rotational trauma
- This causes shearing stress and vitreo-retinal traction
- Infant vitreous is tightly adherent to the retina, especially at macula, blood vessels and retinal periphery
- Disruption of blood vessel auto-regulation either due to local traction or autonomic nerve supply to the globe

- 25% of survivors suffer severe visual impairment – main causes: CVI, optic atrophy, retinal fibrosis and/or detachment

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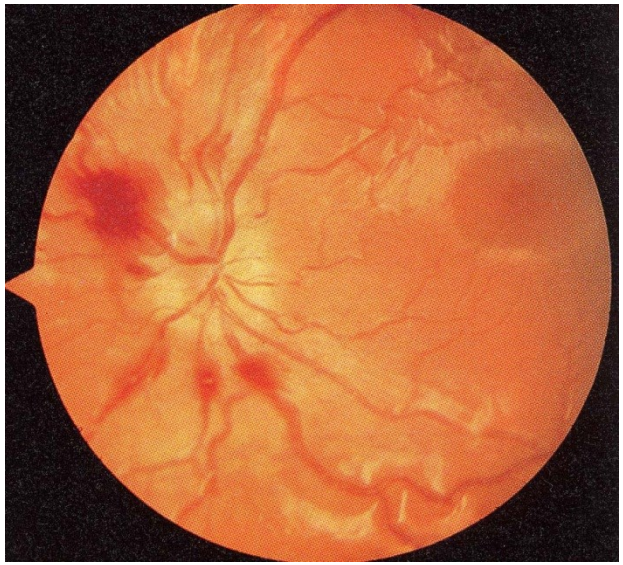
Abusive Head Trauma and the Eye in Infancy

June 2013

Birth haemorrhages



- Flame shaped and dot Hb in posterior pole
- Occur in 3-60%
- Increased incidence with prolonged labour and intervention
- Resolve within 6 weeks

Baum et al. Arch Dis Child 1970;45:344

Review of diagnostic accuracy of Ret Hb in AHT

Bhardwaj et al. Ophthalmology 2010;117(5):983 review of 971 articles

- Sensitivity of retinal haemorrhages was 75%
- Extensive bilateral and multi-layered haemorrhages give specificity of 94%
- Optic nerve sheath haemorrhage (only seen post-mortem) has sensitivity and specificity of 72%
- Traumatic retinoschisis and perimacular folds occur in 8% and 14% of cases respectively but rarely seen in other conditions

Summary

- Retinal haemorrhages are not specific for AHT
- Evidence of schisis suggests a vitreo-retinal tractional cause
- Usually the retinal injuries themselves are not responsible for LOV
- Although we cannot be sure of the mechanism that causes them, experience with confessed injury and evidence of other abuse adds credence to the association and pattern
- Rule out clotting and metabolic conditions
- **Your role**: document examination in the notes fully, if examination is satisfactory and normal, no sub-specialist referral is necessary. If haemorrhages are seen, urgently discuss case with sub-specialty service and ask PICU team to keep infant sedated until imaging has been undertaken.