

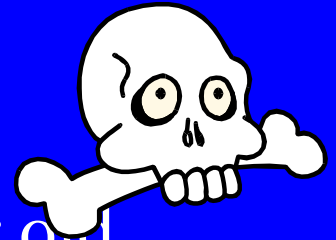
Head Injury in Children

Fiona Miles



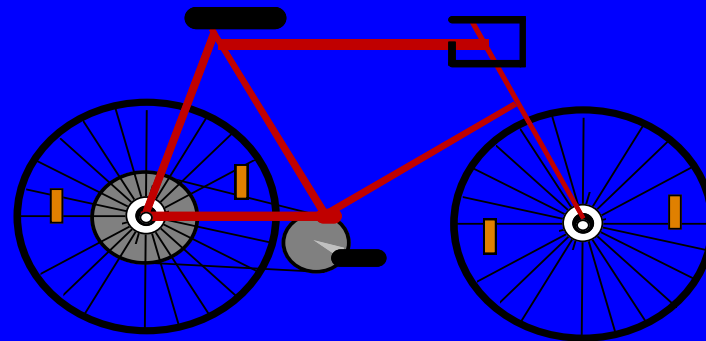
Trauma in NZ: A major problem

- 295 children hospitalised / week
- 20% admissions (second after resp)
- leading cause mortality > 6 /12
 - 113 0-14 year olds die / year
 - 35% of all childhood deaths, 45% > 1 yr old
 - 88% unintentional
 - 3x cancer, 4x resp, 7.5x infections



Pedestrian/cycle injuries

- Can't judge speed and distance
- poor peripheral vision
- can't locate sounds
- small, so not seen
- easily distracted, ignore surroundings
- freeze in danger



Reasons for head & spinal injury

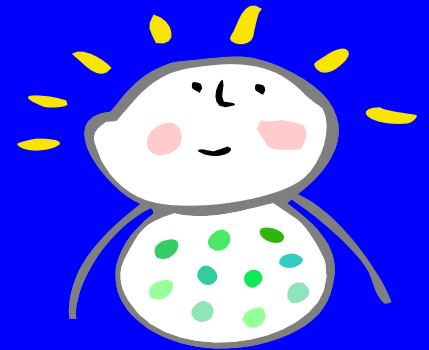
Small, likely to be thrown

Relatively large head on small body

Flexible spine, vertebrae horizontal

Weak neck control

Soft bones

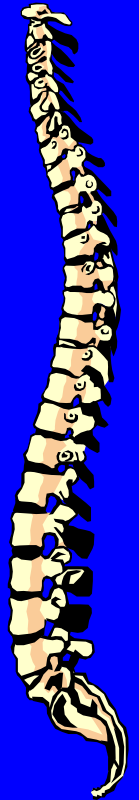


Types of head injury

- Diffuse injury:
 - cerebral swelling (loss of autoregulation from anoxia and impact)
 - axonal shearing from deceleration
- Focal: haemorrhage: less common

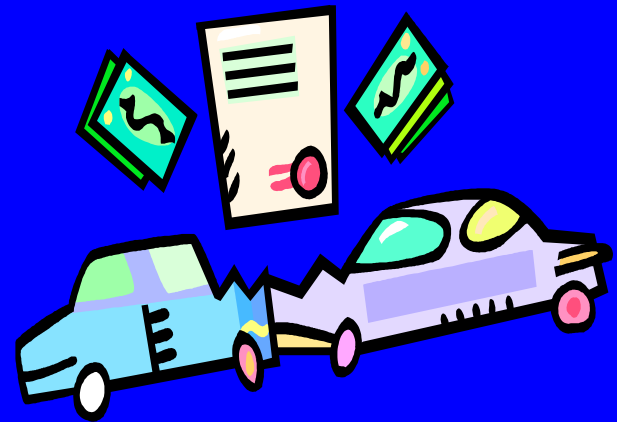
Cervical spinal injury in children

- Uncommon, 1.8 /100 000, (cf 185 head injury)
- High levels C0-C2 resulting in arrest
- Subluxation and odontoid fractures
SCIWORA - lateral shearing /axial stretching (20% paed spinal cord injury / deaths)



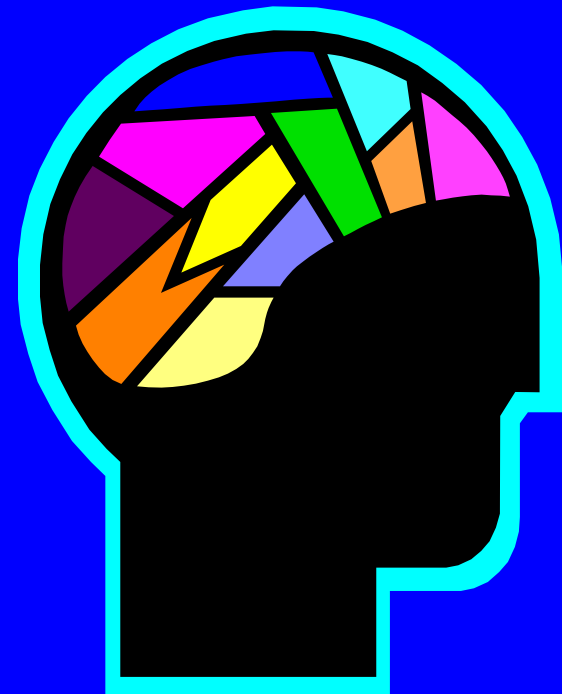
History

- Mechanism: level of force, types of injury
- Ht of fall (3m), witnessed?
- If MVA:
 - ped, cyclist, passenger: restraints
 - position in car, thrown
 - speed
 - GCS Motor score
 - at scene, SBP



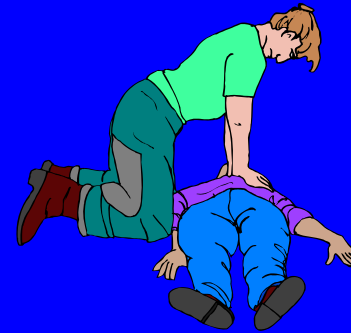
Assessment of Head injury

- Motor score GCS, esp arms
- Pupils
- Respiratory pattern
- HR/ BP
- Posturing
- Bruising, fracture, CSF leak
- CT /Ophthalmoscopy



Signs of Cervical Injury

- Cardiac Arrest at scene
- Paradoxical breathing & nasal flaring
- Neurological deficit
- Loss of autonomic control
- Priapism
- Bowel and Gastric distension

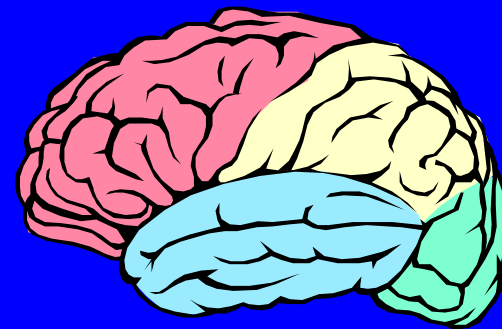


Initial TBI management

- Trauma evaluation
- ABC, intubate
- Ventilate pCO₂ 4.7-5.4, pO₂ >10.7 kPa
- Fluid resusc, look for cause bleeding
- Sedation: morphine, midazolam
- CT- Surgery, Codman, EVD
- Avoid C spine collars, sandbag

Head Injury Management

- Sedation: morphine, intubate paralyse and ventilate
- Position: 30 degrees head up, midline
- Cool to normothermia only. Avoid hyperthermia
- Osmotic Therapy: 3 ml/kg 3 % saline, aim Na>140m, osm>280
- Fluids 70 percent unless SIADH, isotonic, add glucose after 48 hours; feed <24 hours. NJ tubes
- Control seizures, phenytoin 1 week
- Maintain CPP: inotropes
- Hb >10



EVD

- Set at 20 cm H₂O
- Indicated if motor score <3
- May consider observation if motor 4-5
- EVD best: Better monitoring, can drain
- Open to monitor, closed to drain, no abx

MAP prior to ICP monitor

- <2 years: >55 mmHg
- 2-6 years: >60
- >6 years >70

ICP/CPP

- <6 years: ICP <18 CPP >45
- >6 years ICP <20 CPP >50
- Act if ICP high for >5 minutes
- May consider fentanyl pre cares

Raised Intracranial Pressure:

**FIGURE 1
MONRO-KELLIE DOCTRINE**

INTRACRANIAL COMPENSATION FOR EXPANDING MASS

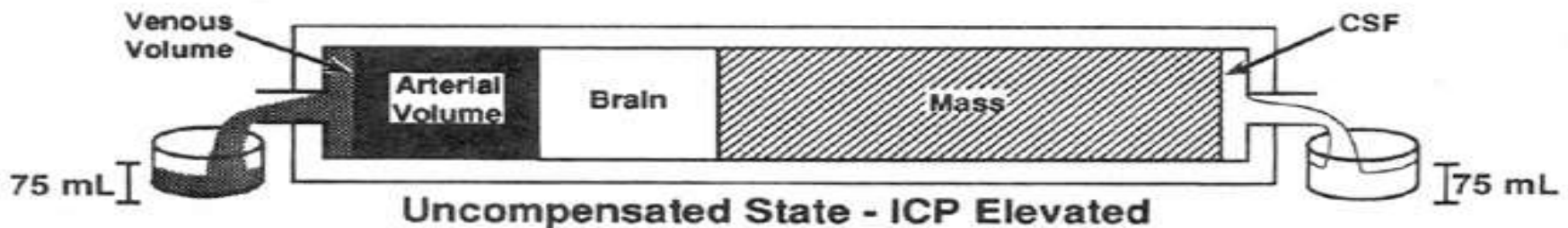
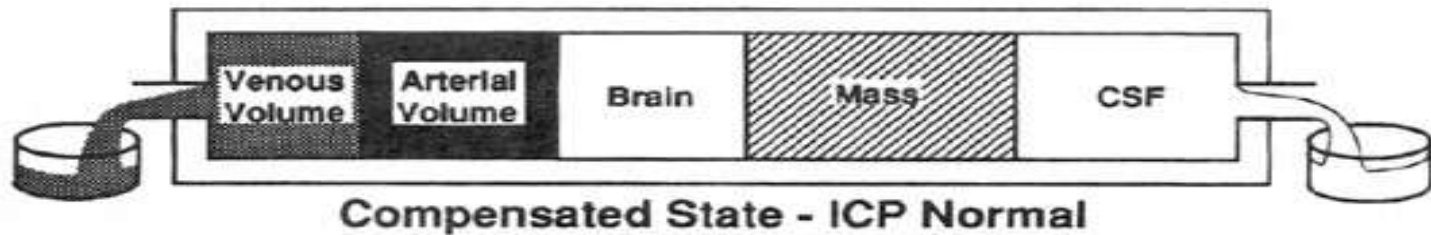
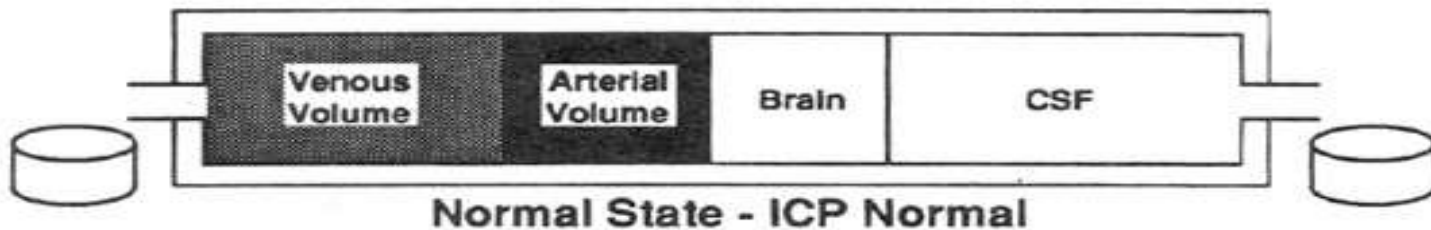
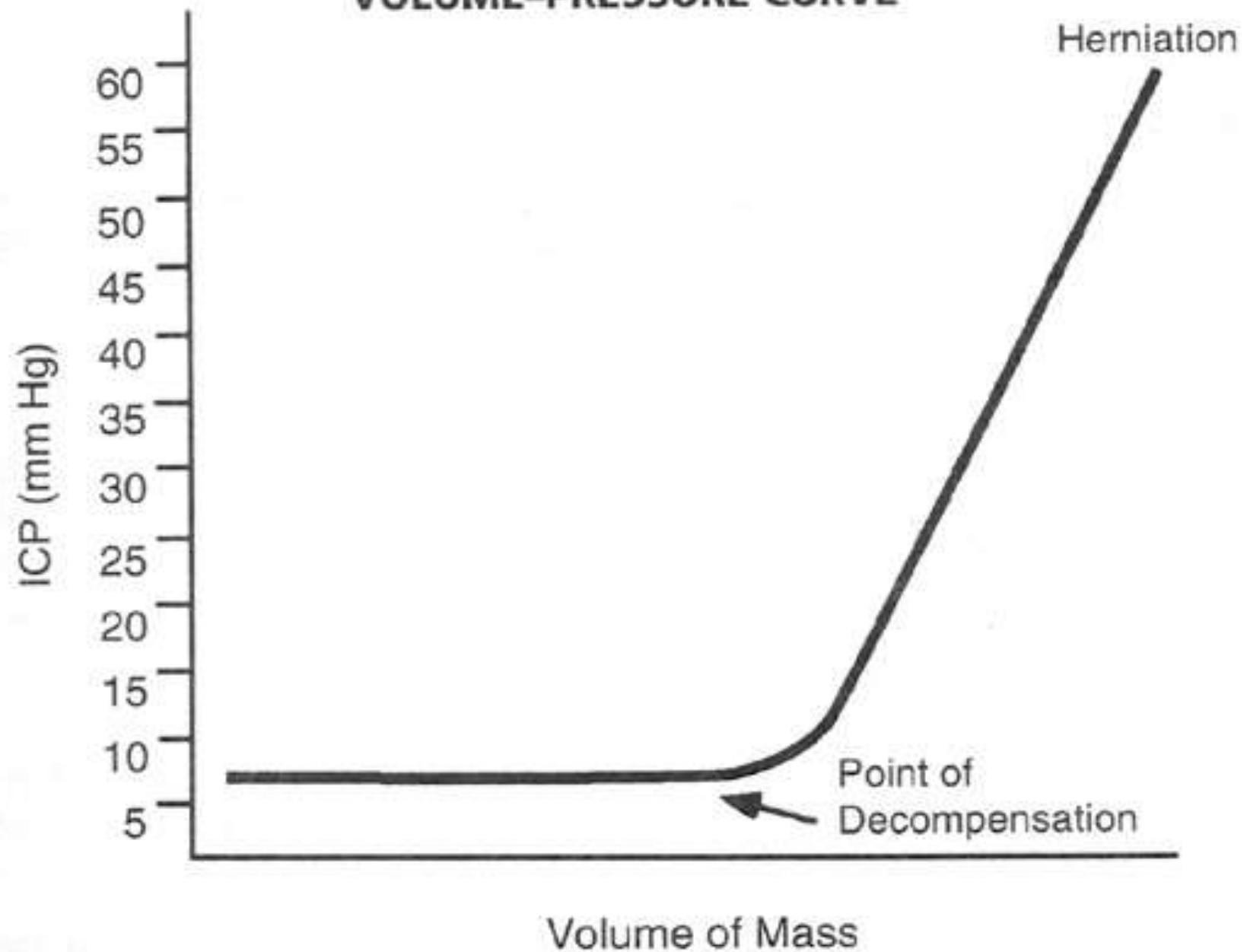


FIGURE 2
VOLUME-PRESSURE CURVE



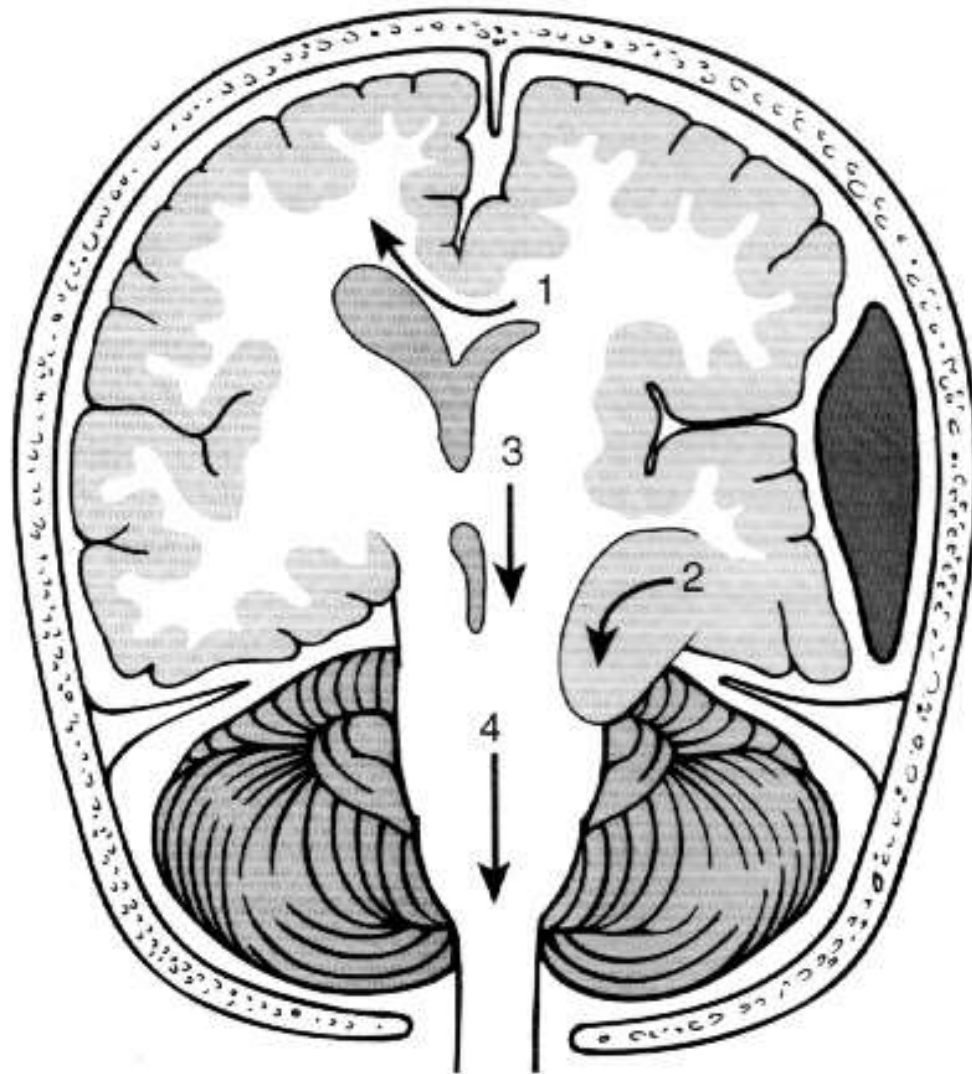
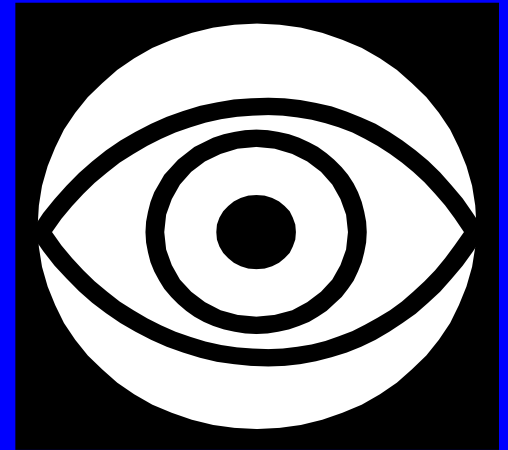


Fig. 3.3 Brain herniations. A lateral supratentorial mass will cause displacement of the lateral ventricles with (1) subfalcine herniation of the cingulate gyrus below the falx cerebri; (2) herniation of the uncus into the tentorial hiatus; (3) caudal displacement of the brain stem. Raised pressure within the posterior fossa may cause herniation of the cerebellar tonsils into the foramen magnum (4). (Adapted from Jennett and Teasdale 1981. Reproduced with permission.)

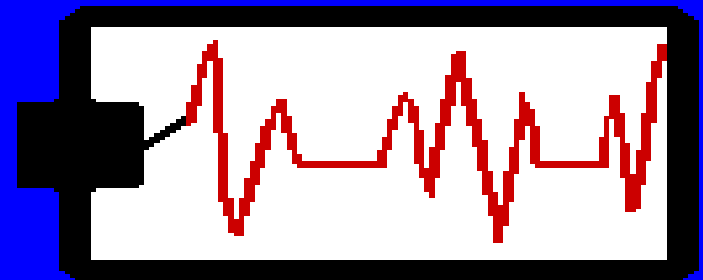
Signs and Symptoms of Raised Intracranial Pressure.

- Irritability, vomiting, headache
- Decreasing LOC
- Pupillary abnormalities/ papilloedema
- Seizures
- Cushing's triad



Cushing's triad

- Hypertension
- Bradycardia
- Irregular respiratory pattern.



Emergency Treatment

- Change pH: Hyperventilation
- Diuresis: hypertonic saline, mannitol
- Drain CSF: tap, burr holes, EVD if not already
- Force up BP: inotropes to maintain CPP
- Remove causes
- Craniectomy

Monitoring

- Moderate: Clinical: wake and assess
- CT scanning, repeat if high ICP
- SSEPs: spinal injuries, subdurals
- EEG: caution with phenobarbitone

Decompression in Children

- DECRA has raised concerns
- Few trials in children
- Selected cases where good Motor score and acute change with pupils, consider doing.

Literature

- no large-scale randomized clinical trials for the use of DC in children with severe TBI, evidence case series and single-institution studies, with Class III evidence.
- Pediatric Guidelines DC may be effective in reversing early neurological deterioration or herniation, and correlated with improving outcomes in patients with intracranial hypertension refractory to medical management.
- Kochanek et al.: *Pediatr Crit Care Med* 13:Suppl 1S1–S82, 2012

NAI: Risk factors

- include age<1, prematurity, mental or physical disability,
- family history of physical or substance abuse, mental illness, and poor social
- support networks and home environment

Clinical

- Intracranial bleeding subdural haemorrhage
- Diffuse axonal injury/retinal haemorrhages
- Skull fracture
- Ruptured viscera
- Genital trauma
- Long bone fractures <3 years old
- Unusual injuries: bites, cigarette burns, rope marks, bruises
- Neglect: malnutrition, poor hygiene
- Emotional disturbance

Management NAI

- Full examination: centiles, documentation suspected sexual abuse, Te Pua
- • Skeletal survey: healed fractures
- • Full blood count, coags (+ vWf)
- • Fundoscopy by ophthalmologist
- • CT <2 years if history of concern
- • MRI if history of shaking
- • Medical Photography

Summary

- Leading cause of morbidity/ mortality
- Children have different injuries from adults
- Most are preventable
- Remember NAI

MINDSET:

- THESE INJURIES ARE PREVENTABLE



