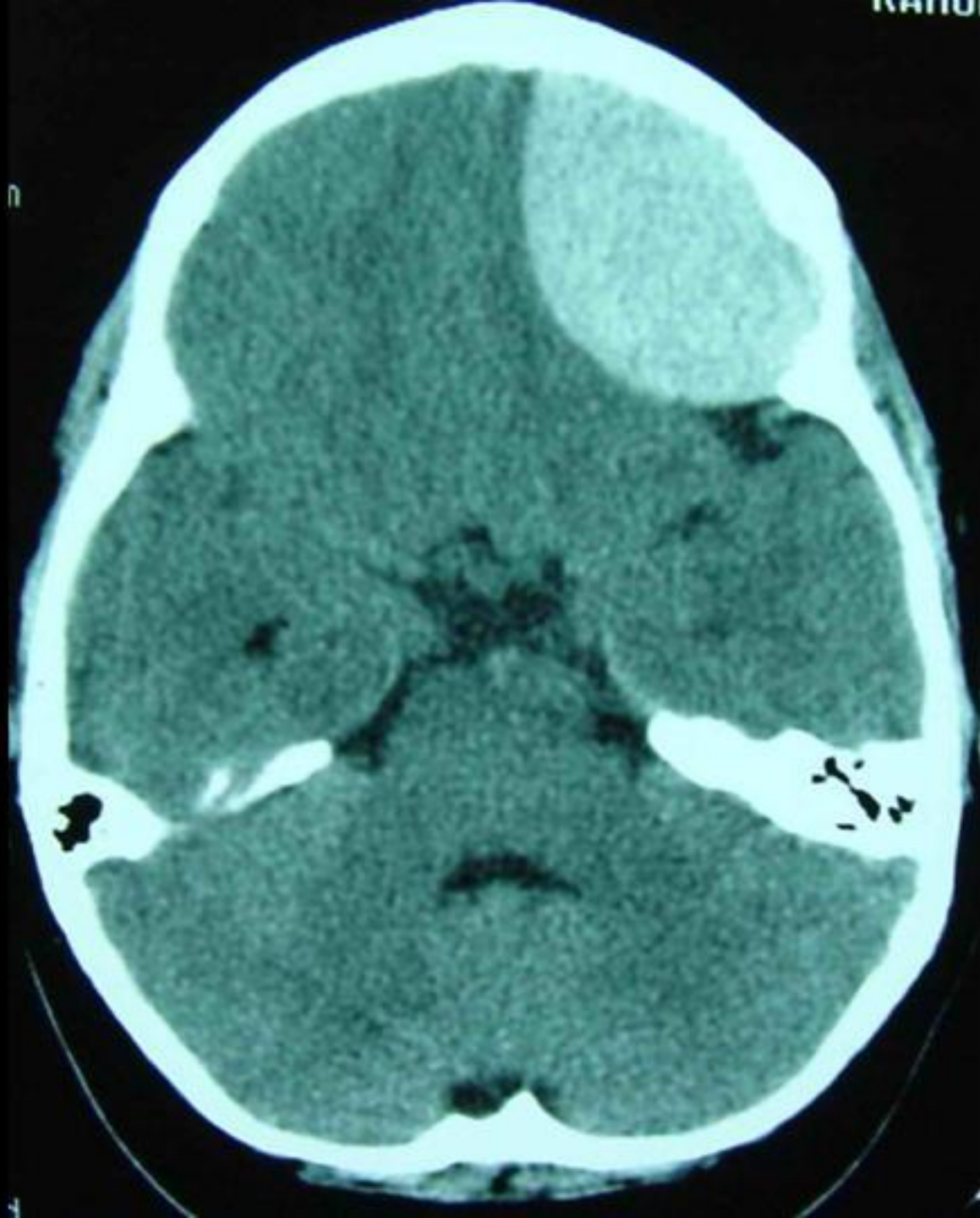
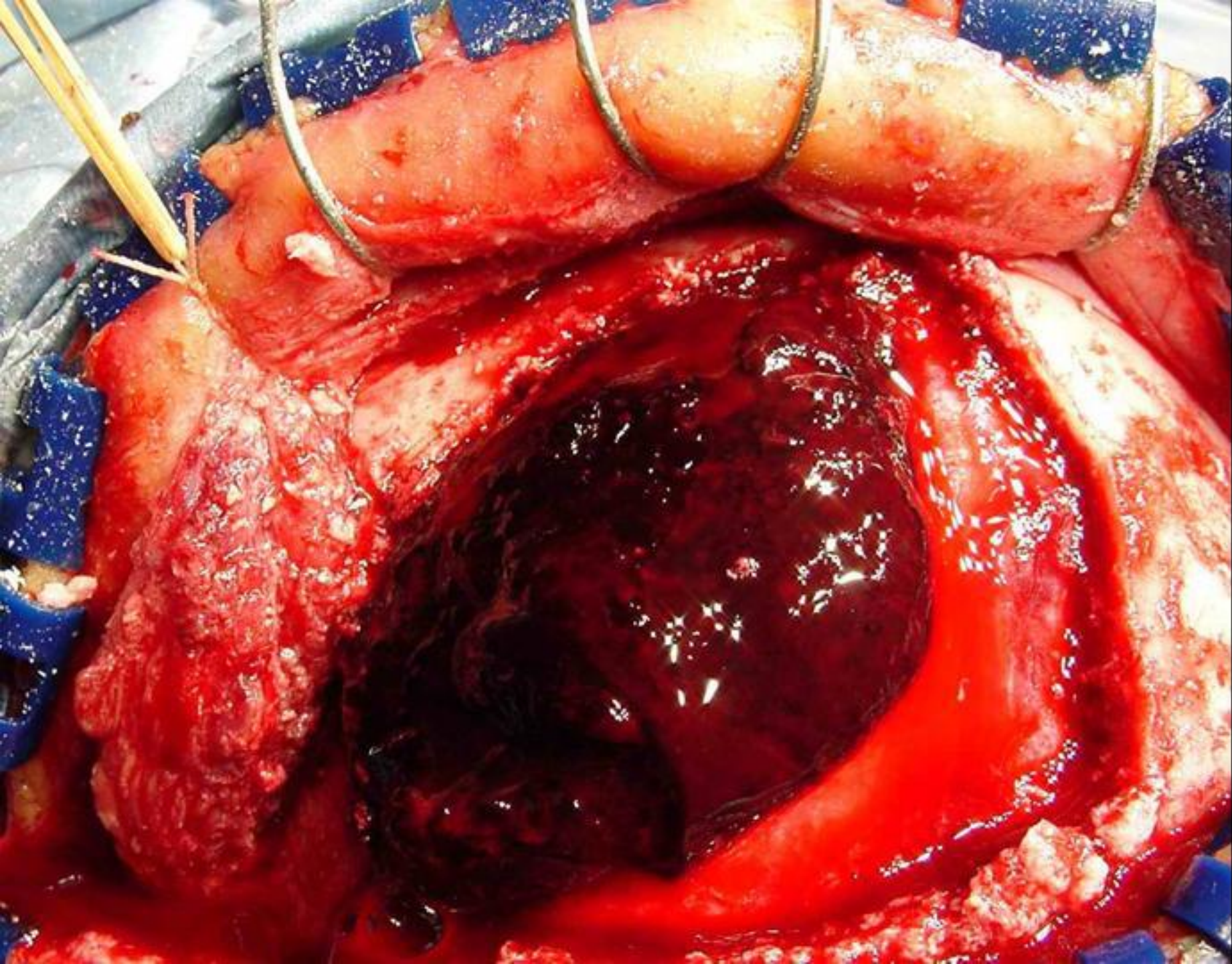


# Cranial Trauma - Transfer to Neurosurgery

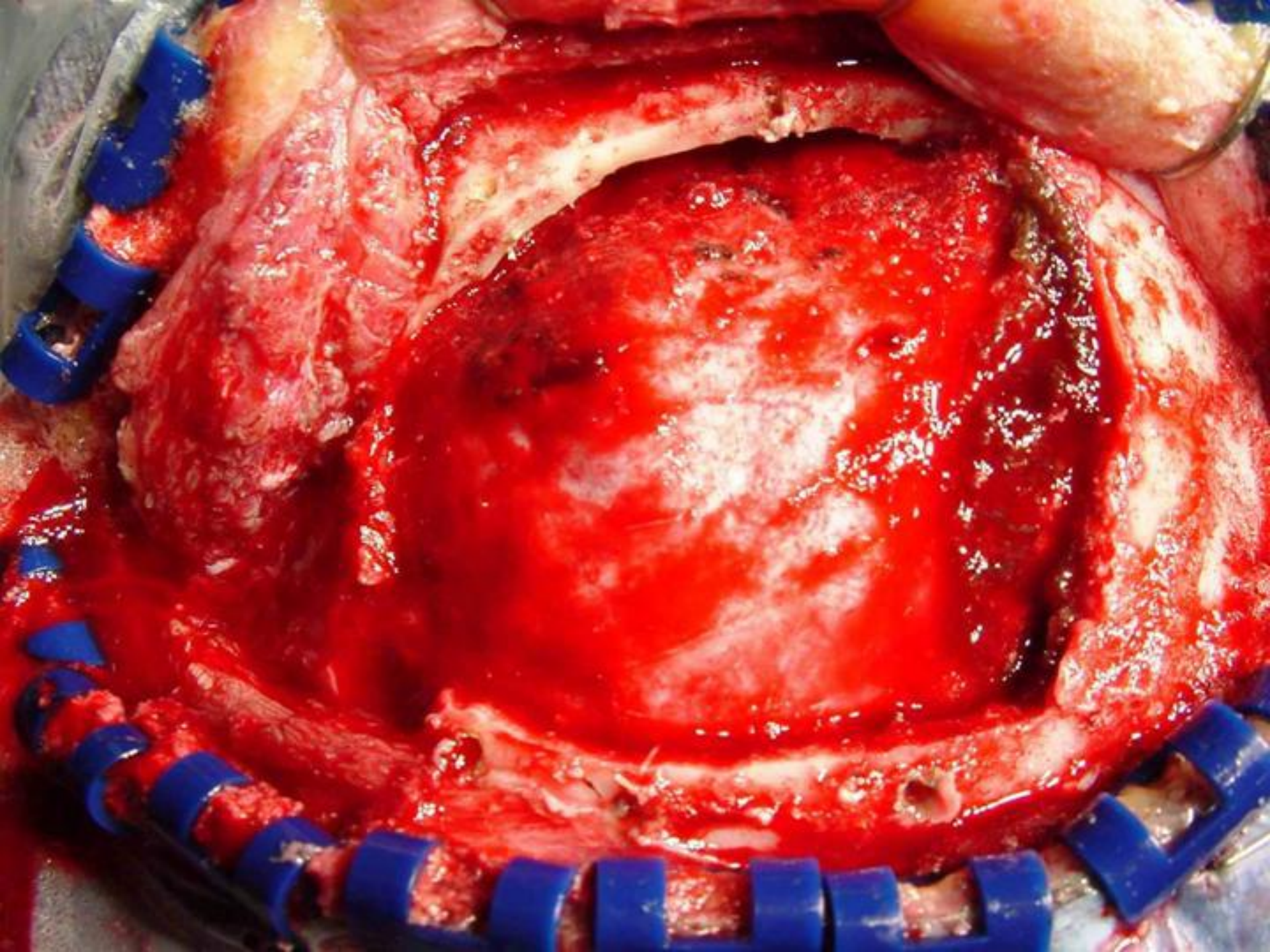
Andrew Law  
Neurosurgery  
Starship and Auckland Hospitals











# Primary Insult

- Injuries to scalp
- Injuries to skull
  - Vault fractures
  - Base fractures
- Intracranial haematomas
- Injuries to brain





# Mechanisms of Injury

- Falls
- MVA
- Sports
- Non accidental injury
- Death / Lifelong disability



# Mechanism

- Velocity
- Direction of forces
  - Acceleration
  - Deceleration
  - Rotational
- Projectiles
- ? Restrained
- ? Ejected from vehicle
- ? Other injured



# Injuries to skull

- Skull fracture

- Linear
- Depressed
- "Ping pong"
- Base of skull



- "Palpable edge"









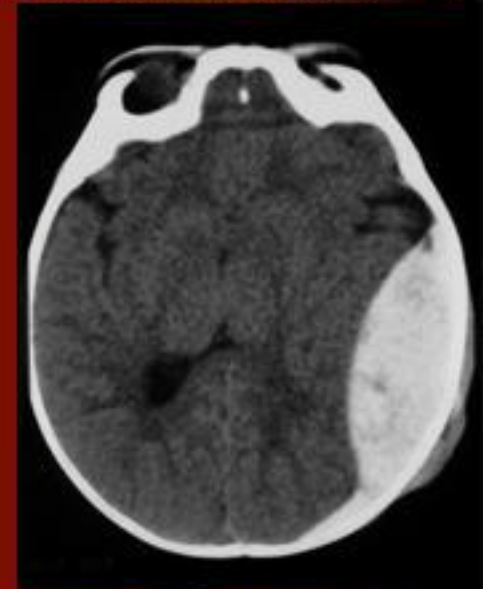
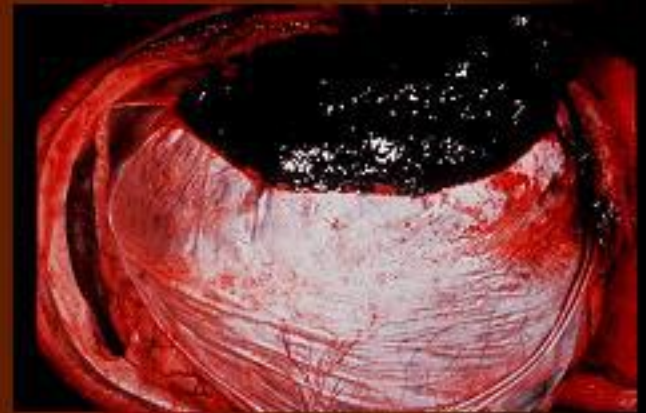






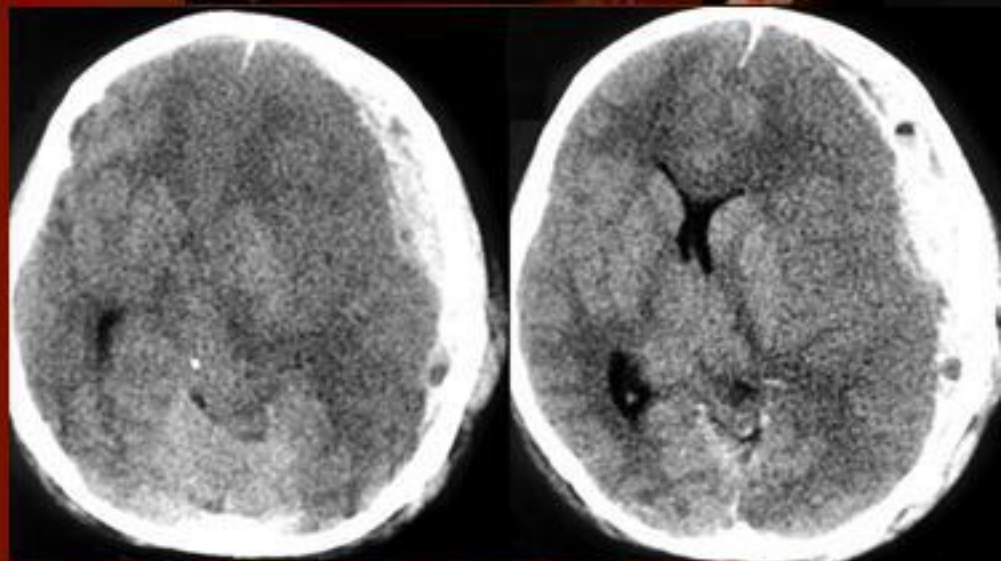
# Extradural Haematoma

- Arterial bleeding
- Venous (from sinus lacerations)
- Assoc with fractures
- Strip dura from skull inner table
- Early progression
- "Walked. Talked and Died"
- Surgery
  - Craniotomy



# Subdural Haematoma

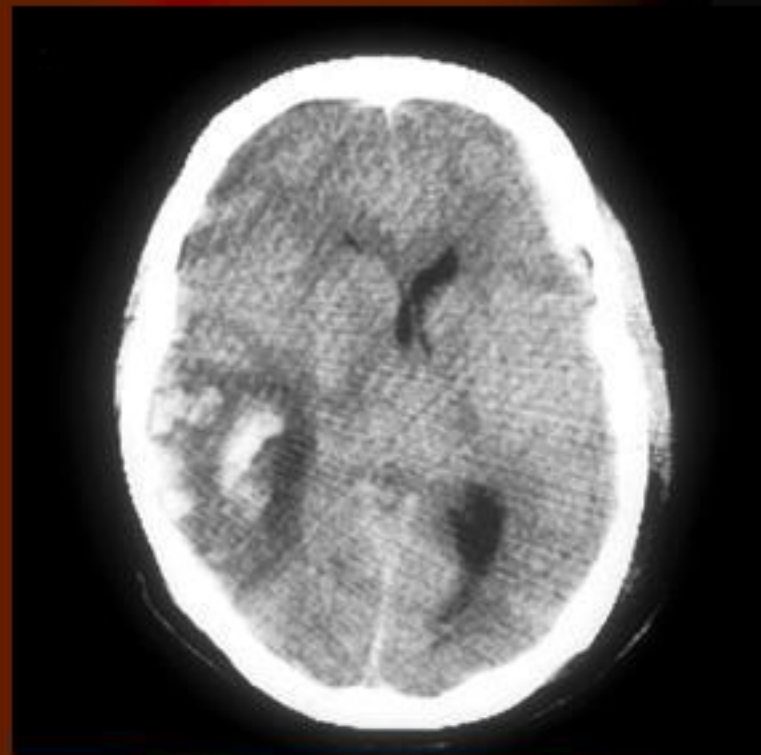
- Venous or arterial
- Bridging vessels to sinus
- Assoc with underlying cortical injury
- Surgery
  - Craniotomy





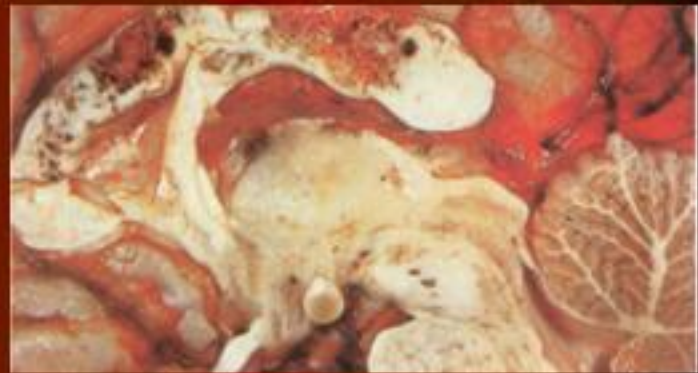
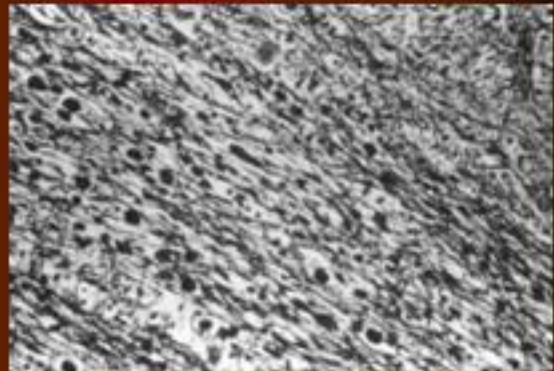
# Cerebral injuries

- Contusions
- Lacerations
- Meningeal Injury
  - CSF leak
    - rhinorrhoea / otorrhoea



# Cerebral Injury

- Diffuse axonal injury (DAI)
- Deep white matter petechial haemorrhages
- Poor GCS in setting of "unimpressive CT"
- Axonal retraction ball





# Secondary Insult

- Hypoxia
- Hypotension
- Cerebral Oedema
- Herniation syndromes



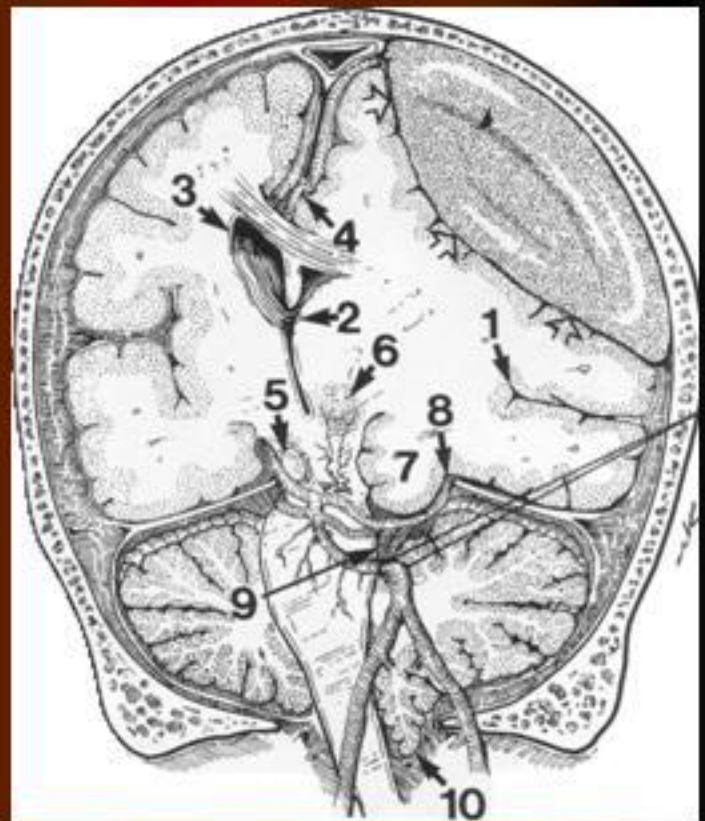
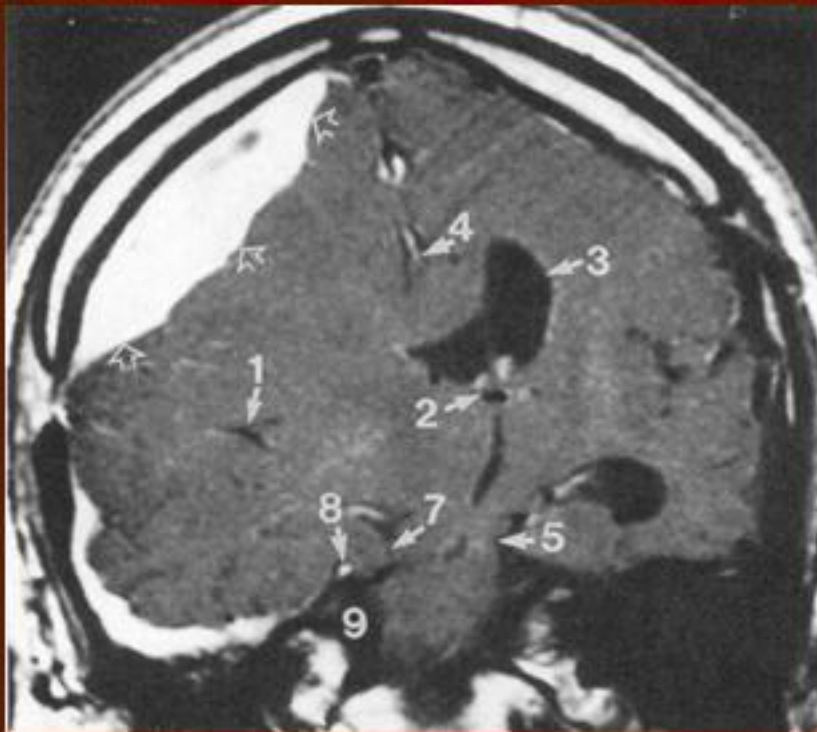
# Herniation Syndromes

- "Coning"
- Trans-tentorial
  - Pupillary dilatation
  - Contra-lateral hemiparesis
- "Upward cone"
- Foraminal herniation





# Herniation Syndromes



# Role of Neurosurgery

- Management of all head trauma?
- Management of severe head trauma?
- Surgical management of severe head trauma?



# Surgical Techniques

- ICP monitor insertion
- EVD (External ventricular drain) insertion
- Craniotomy and repair depressed skull fracture
- Craniotomy and evacuate intracranial haematoma
- Craniotomy and lobectomy
- Decompressive craniectomy (DECRA trial)
  - Decompressive bifrontal craniotomy

# Issues

- Identification of need for Neurosurgery
- Communication
- Rapidity of transfer
- Surgical interventions
- ?Neurosurgical flying squad



# Identification

- Mechanism of injury
- GCS at scene
  - Posturing / Hemiparesis
  - Best motor function
- Pupillary response
- Hypotensive / Hypoxia episodes

# Imaging

- CT Scan
  - Head
    - All patients with GCS <13
    - All patients with GCS 13-15
      - AND ongoing symptoms post 4 hours
      - Or high risk eg anticoagulants
  - Cervical spine



# Communication

- Transfer of images
  - PACS
- Neurosurgery Registrar on Call
  - 2 Advanced trainees, 2 USA senior registrars
- DCC Consultant
- Decision on need for transfer

# Transfer process

- Stabilised by Regional Trauma Centre
- Intubation for transfer
- Transfer from RTC coordinated by ICU services (DCC)
- Air vs Ambulance
- Recc max transfer time = 4 hrs

# Management on transfer

- Management of Primary insult
  - Surgery ASAP
- Early management of secondary insults
  - Strict avoidance of hypoxia / hypotension
  - Osmotic diuresis
    - Demonstrable deterioration
      - Pupillary change
      - Bradycardia



# Surgery “On site”

- Local surgeon with experience and willing
- Rapidly deteriorating patient
  - No response to anti-ICP measures
  - Dilating second pupil
- Transfer time > 2hrs?
- Flying squad?

# To attempt to treat or not?

- Can be operated on!
- Should be operated on!
- Who makes the decisions?
  - Neurosurgery
  - Intensive Care
  - Relatives
  - Patient wishes

# No treatment / transfer

- Fixed dilated pupils
  - >30mins
  - No response to mannitol / hyperventilation
- Massive cerebral injury
- Significant cerebral injury
  - + Major co-morbidities
  - Age



# Transfer delays

- 38 intubated TBI patients in 2002
  - Median time 6.5 hrs
  - Within Auckland 4 of 12 < 4 hrs
  - 30% improvement in transfer times if documented ICH

Submitted research : Inter-hospital transfer of intubated patients with traumatic Brain Injury to ACH

Peter Heppner / Christopher Lind et al

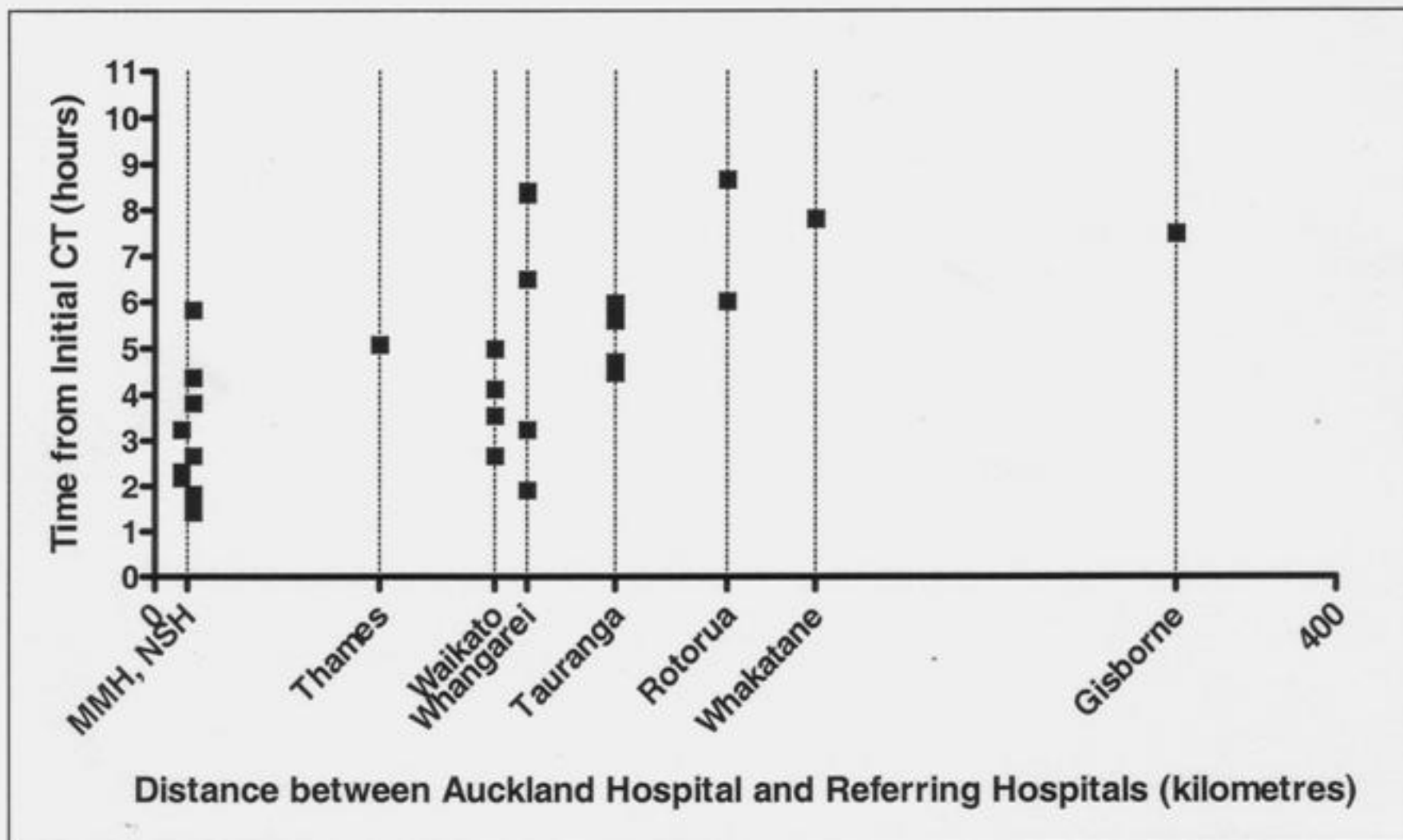


Figure 1.

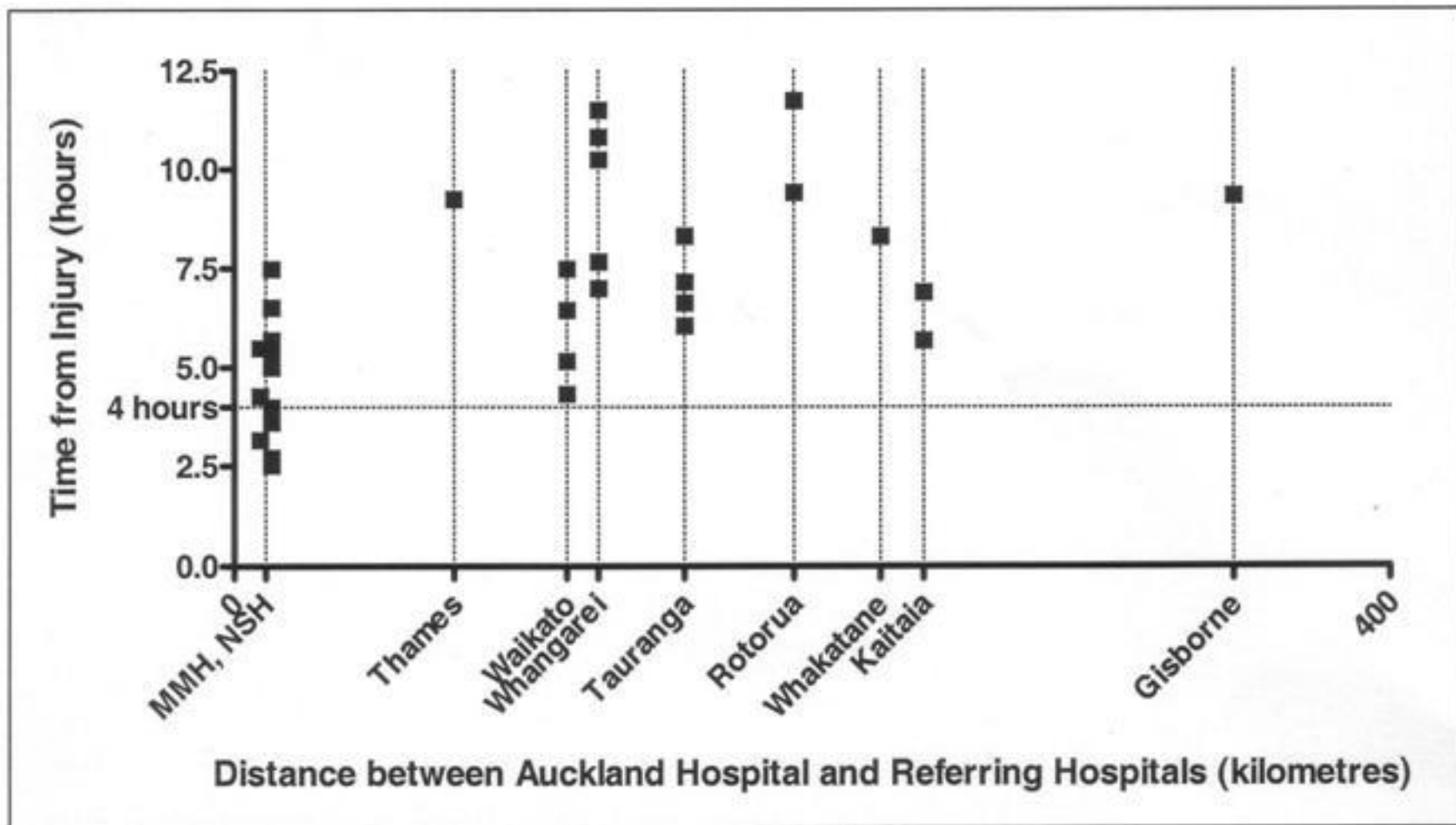


Figure 2.



# Prognostic factors

- GCS post resus
  - 3 : 5% Mod disability --> Good, 80% Dead
  - 5 : 25% MD --> Good, 40% Dead
  - 7 : 60% MD --> Good, 20% Dead
- Pupils
  - Mortality/Vegetative Survival with fixed pupils
    - 15% if recovers with resus, 80% if prolonged
- Age
  - <5yrs and >45yrs - worst outcomes
- CT Scan findings
  - Loss of gray-white interface, basal cistern loss, diffuse petechial haemorrhages, infarcts
- Hypoxia or hypotension
  - Good/Mod 30-40% either, 20% both, 50% neither
- ICP Monitoring
  - V poor if ICP sustained > 30mmHg

# Paediatric specific

- Extradural most common Intracranial haematoma
- Occipital impacts most concerning
- Significant intracerebral / cerebellar haematomas are unusual
- Any child with head injury who has persistent altered level of consciousness, headache, persistent vomiting or skull fracture should have CT scan.

# Paediatric Head Injury

- Late swelling
- SIADH / Hyponatraemic cerebral oedema
  - Avoid hyponatraemic fluid replacement
  - Daily U&Es if GCS <14