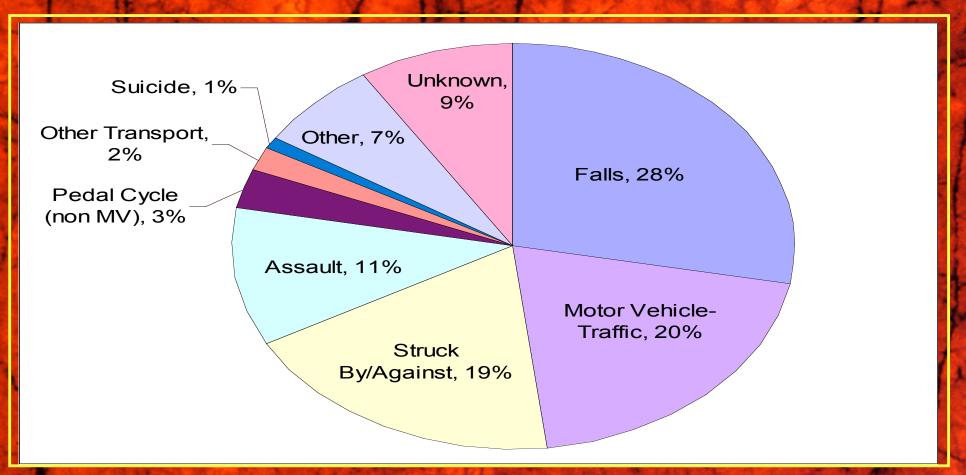


# **Epidemiology**

Percentage of Average Annual Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by External Cause, United States, 1995-2001



### National Prevalence Rates of Various Disabilities

400,000 w/ Spinal Cord Injuries

500,000 with Cerebral Palsy

2 million Americans with Epilepsy

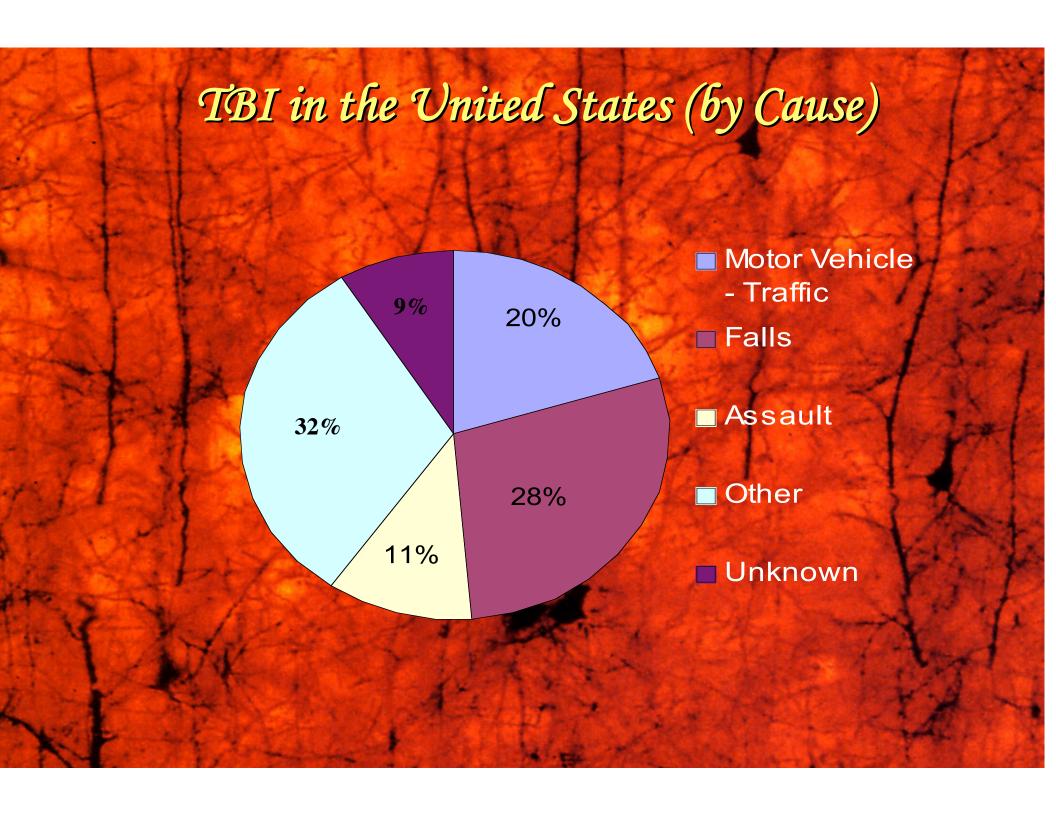
3 million with Stroke disabilities

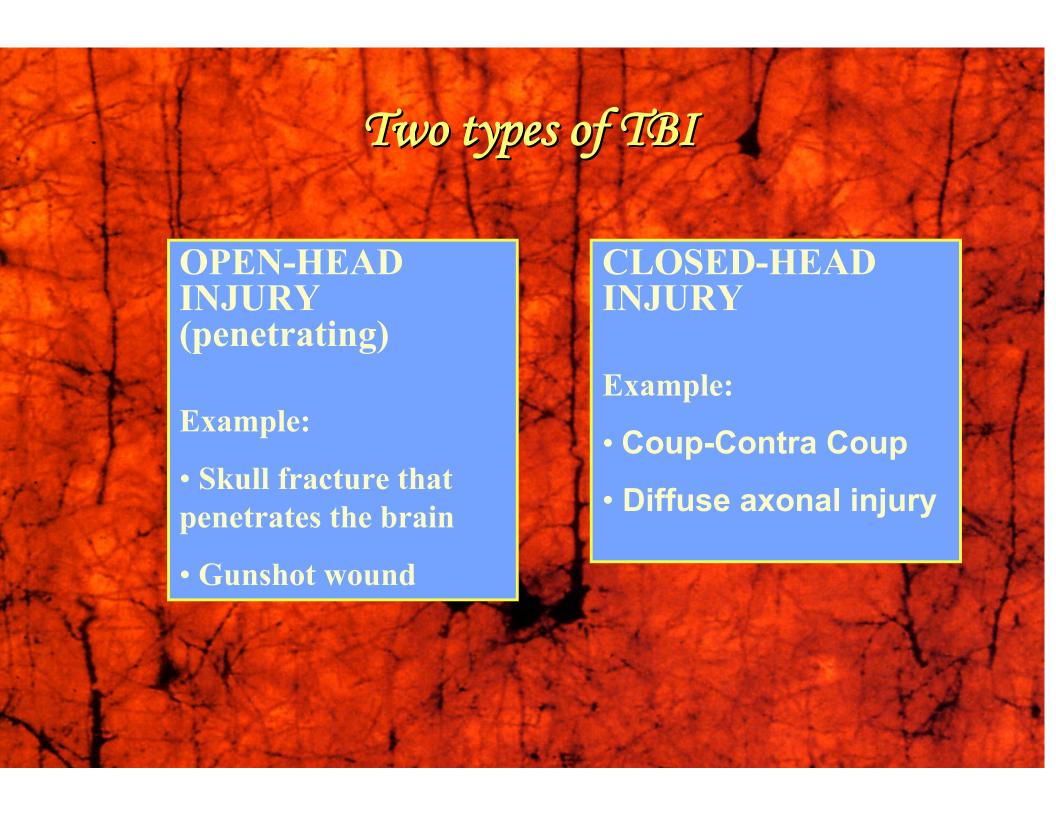
4 million with Alzheimer's Disease

5 million with persistent mental illness

5.3 million with TBI disability

7.3 million Americans with mental retardation





# Two Classes of Brain Injury

- PRIMARY

  THE INJURY IS MORE

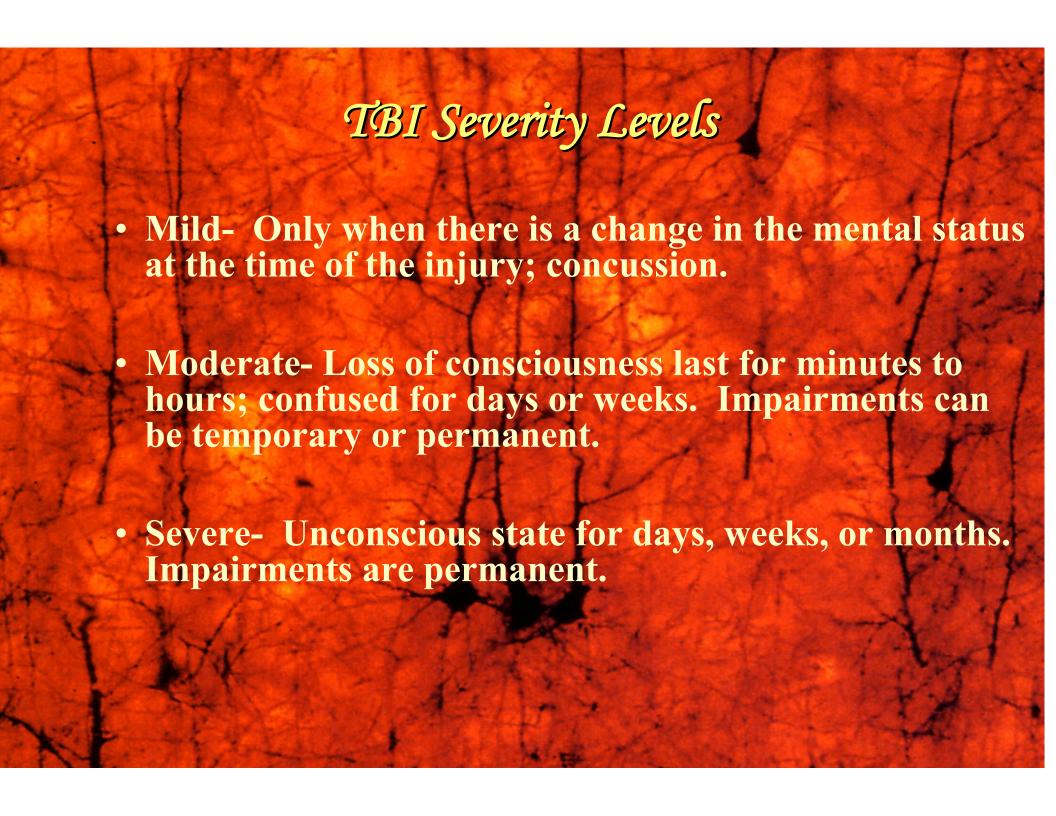
  OR LESS COMPLETE

  AT THE TIME OF

  IMPACT
  - 1. SKULL FRACTURE
  - 2. CONTUSION/ BRUISING OF THE BRAIN
  - 3. HEMATOMA/BLOOD CLOT ON THE BRAIN
  - 4. DIFFUSE AXONAL INJURY

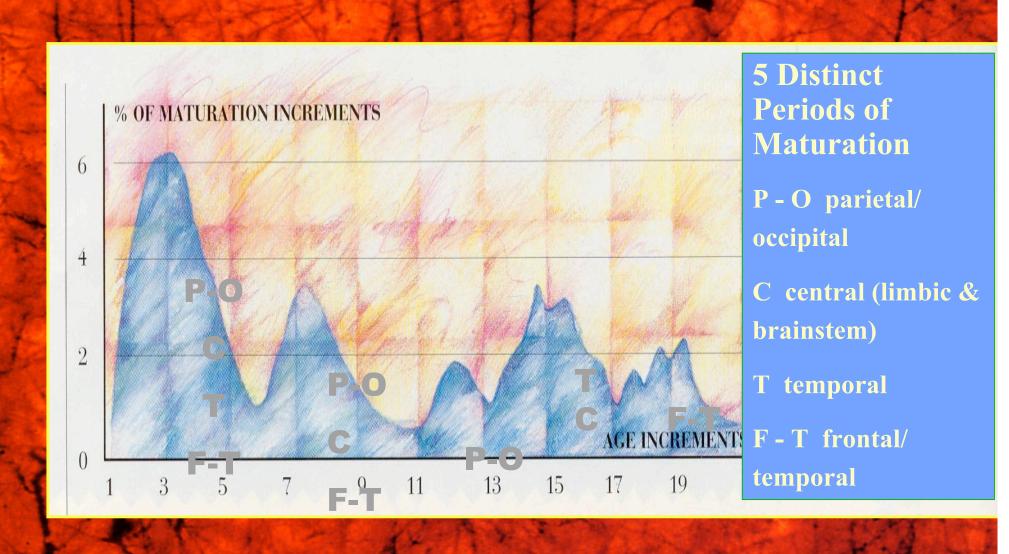
- SECONDARY

  THE INJURY EVOLVES OVER
  A PERIOD OF HOURS TO
  DAYS AFTER THE INITIAL
  TRAUMA
- 1. BRAIN SWELLING/EDEMA
- 2. INCREASED INTRACRANIAL PRESSURE
- 3. INTRACRANIAL INFECTION
- 4. EPILEPSY
- 5. HYPOXEMIA (LOW BLOOD OXYGEN)
- 6. HIGH OR LOW BLOOD PRESSURE
- 7. ANOXIA/HYPOXIA (LACK OF OXYGEN TO THE BRAIN)





# Brain Rates of Development



### **Cerebral Cortex**

### **Numerical Data**

Number of neuronal cells in cerebral cortex

neurons ----- 10-15 billion glial cells ----- 50 billion

Estimation of number of cortical neurons

von Economo and Koskinas (1925) 14.0 billion

**Shariff (1953)** 

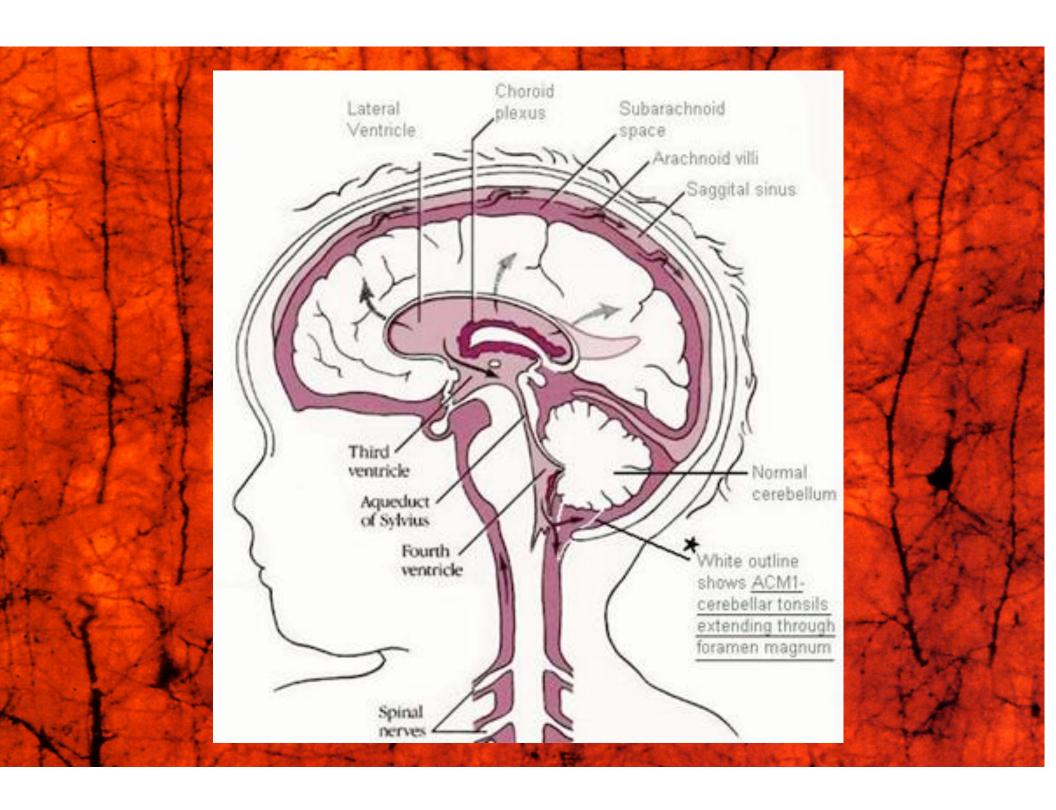
**Sholl (1956)** 

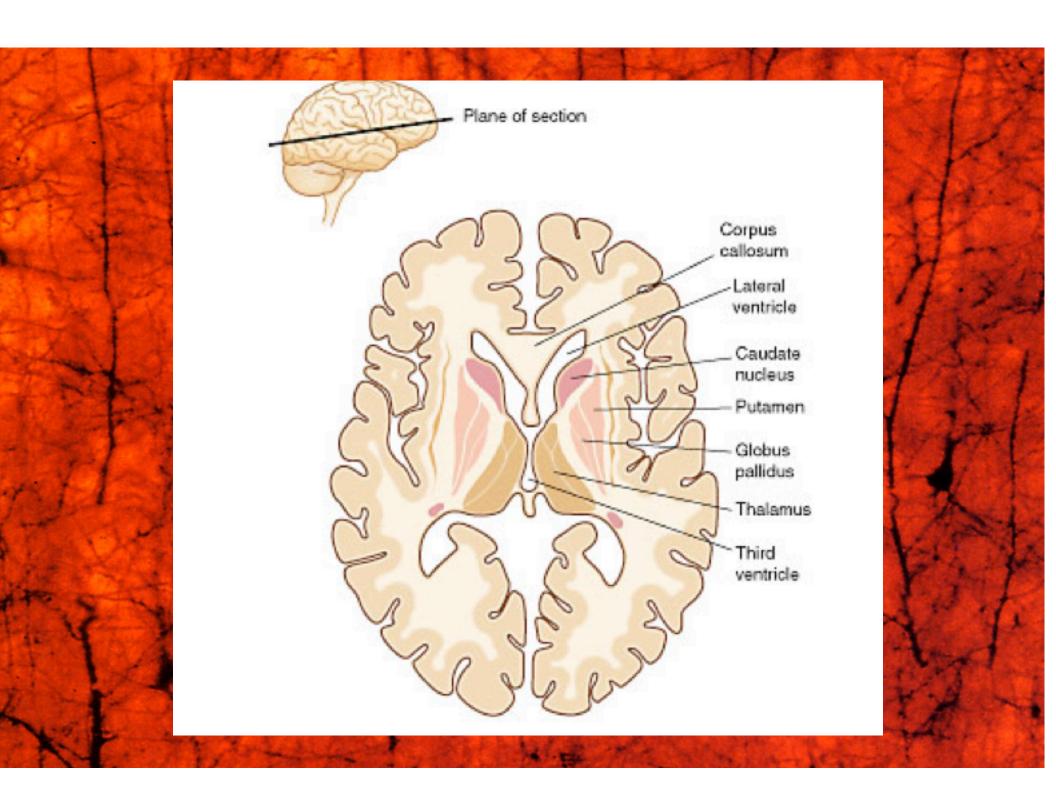
Pakkenberg (1966)

6.9 billion

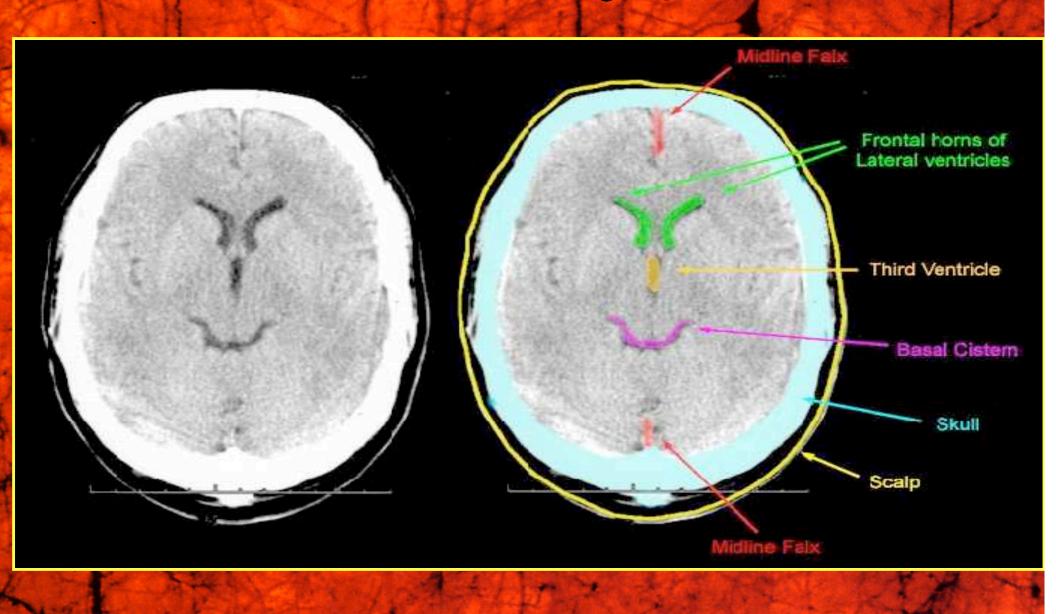
5.0 billion

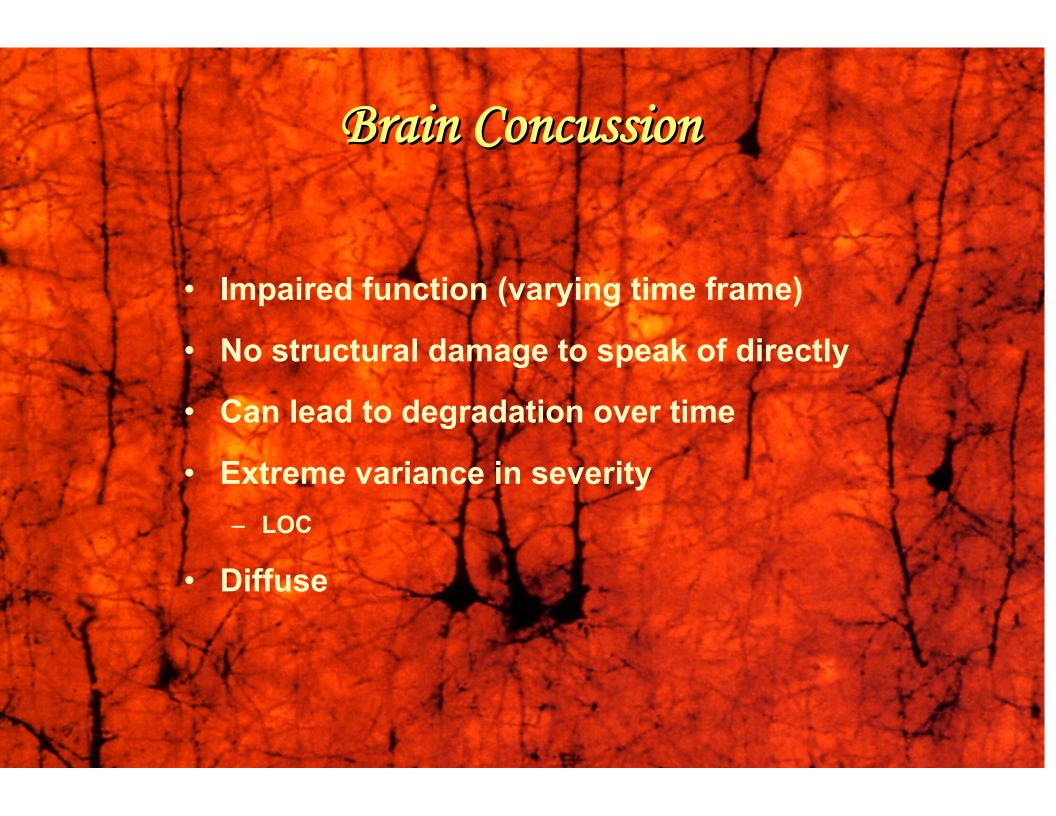
2.6 billion



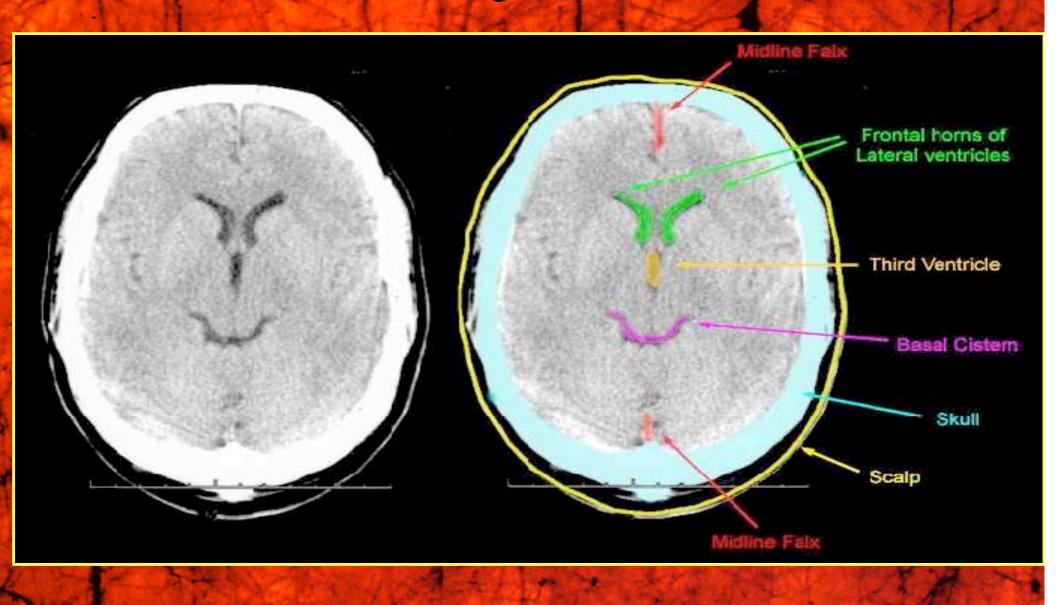


# Normal Brain CT Scan

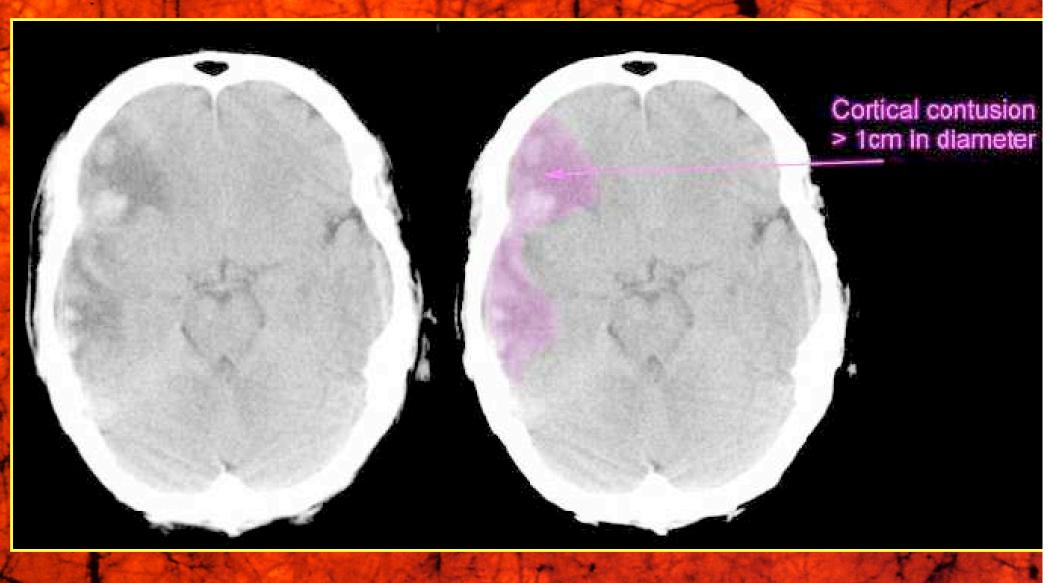




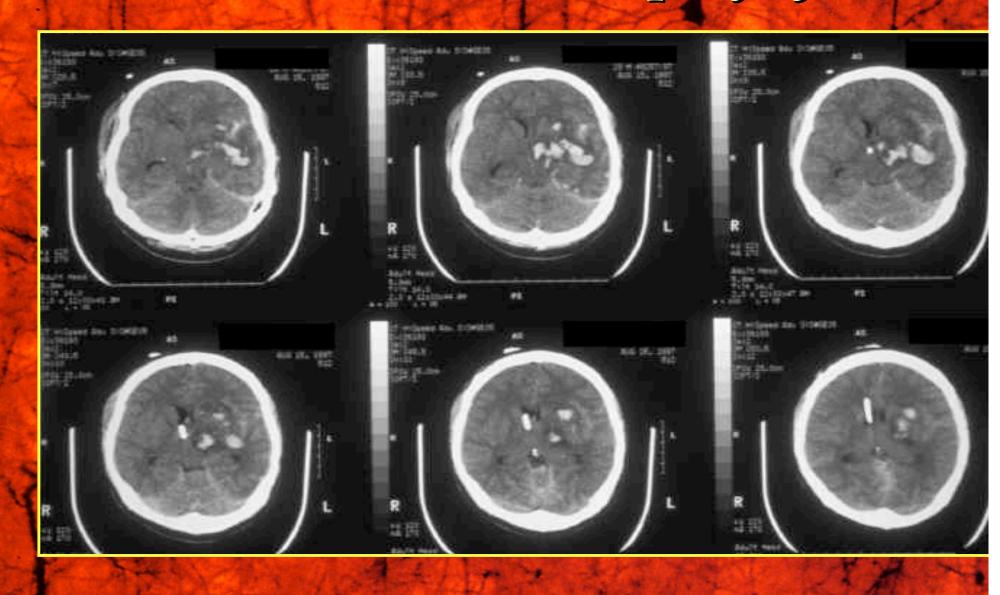
# Brain Concussion



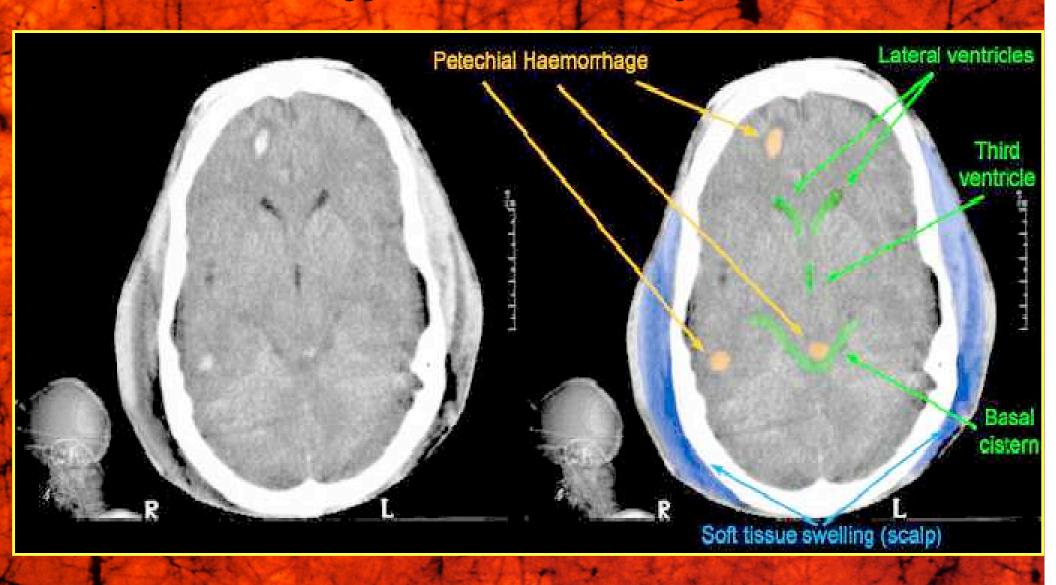
# Brain Contusion



# Contusion w/Contra-Coup Injury

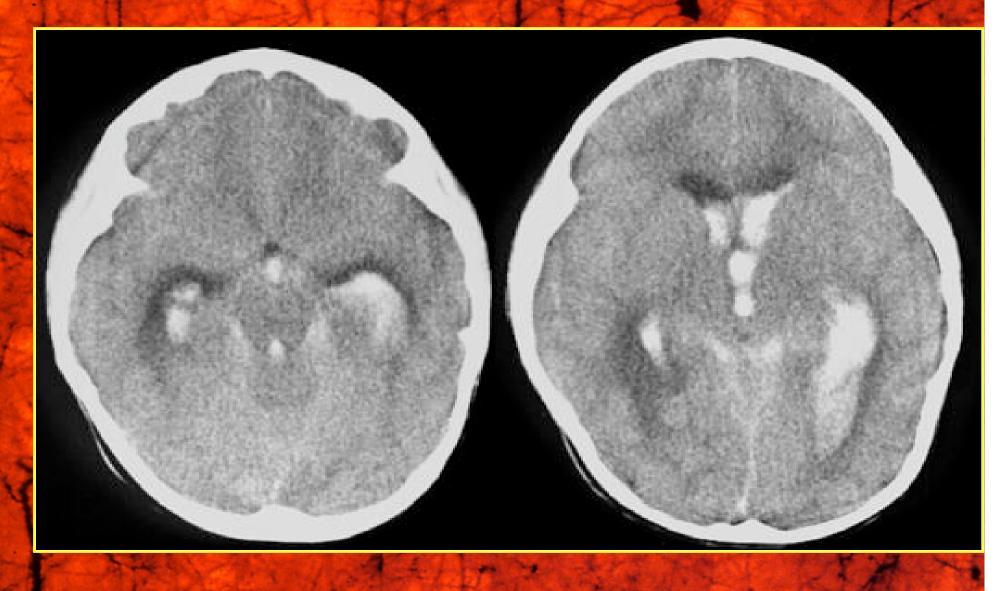


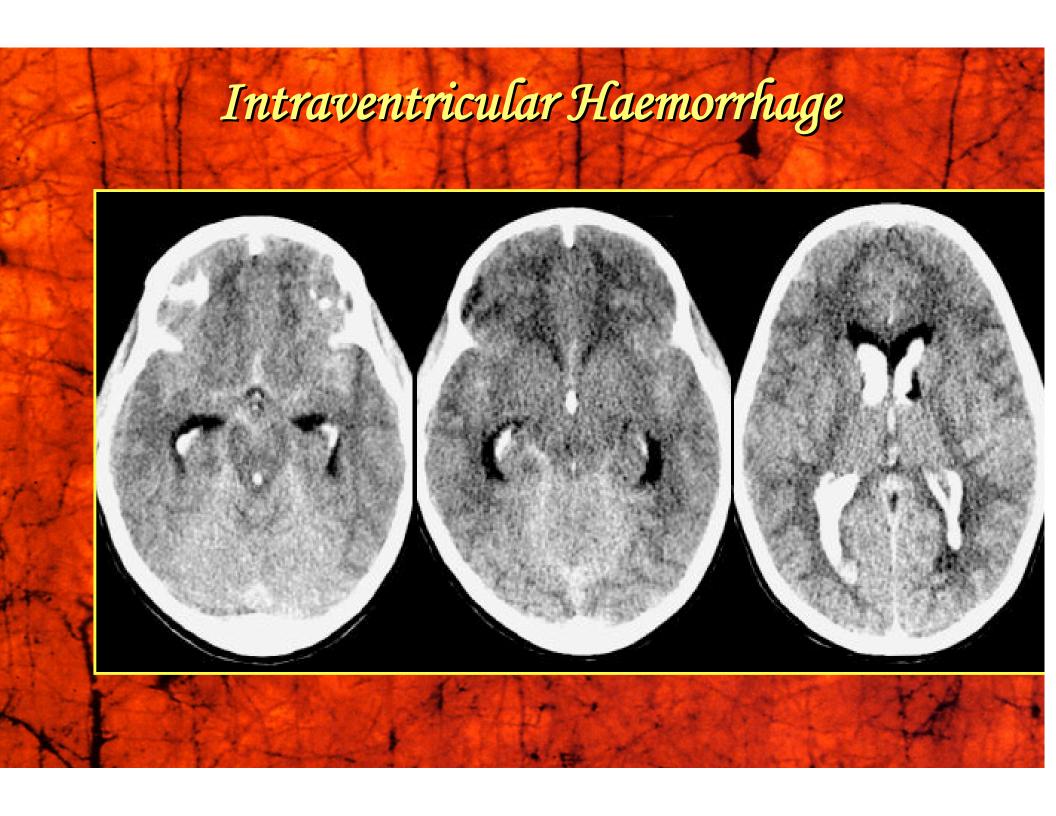
# Diffuse Axonal Injury







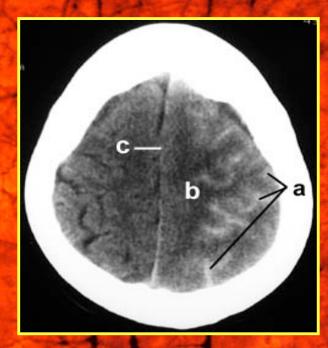


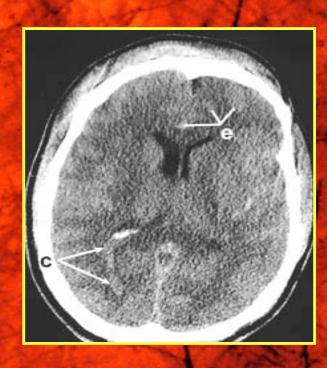


# Brainstem Haemorrhage

# Subarachnoid Hemorrhage







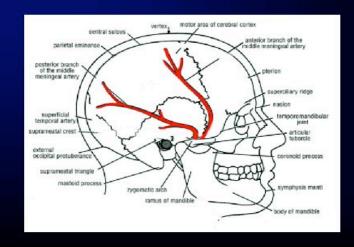
- a. Subarachnoid Hemorrhage
- c. Intraventricular hemorrhage

- b. Transtentorial herniation
- e. Diffuse axonal (shearing) injury

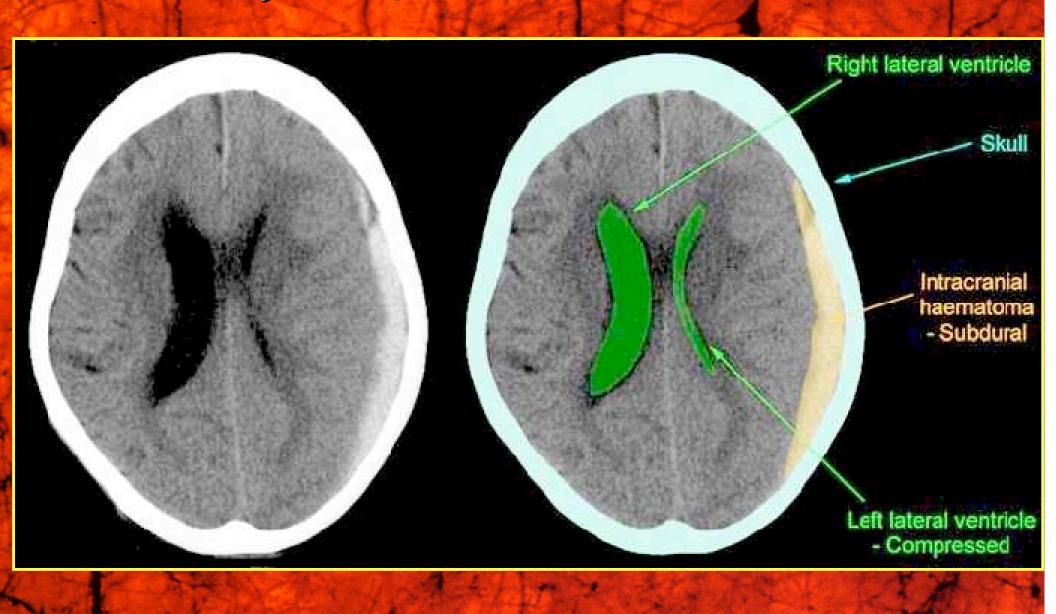
### Intracranial Haematomas

- Epidural
  - arterial bleeding
  - quick onset
  - less common
- Subdural
  - venous bleeding
  - wide range of onset time
  - can build on each other without symptoms

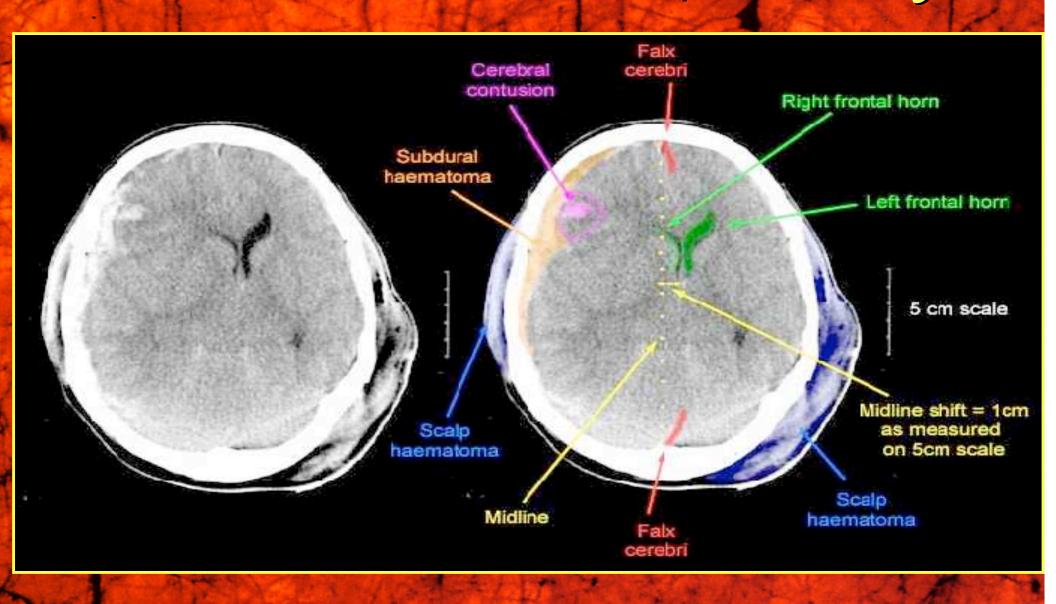
### middle meningeal artery



## Acute Subdural Haematoma



# Acute Subdural Haematoma w/Midline Shift

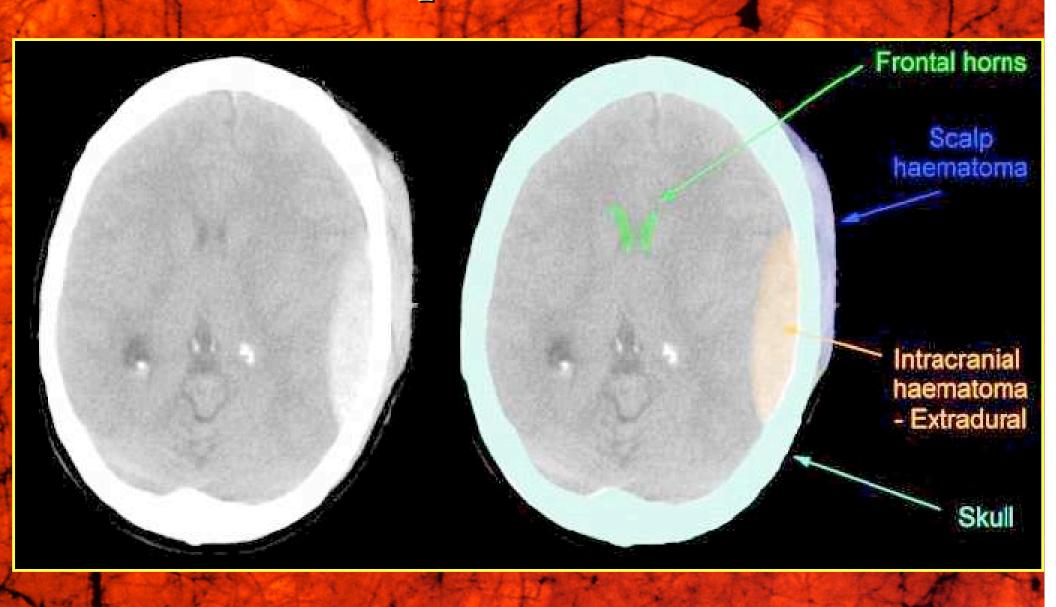


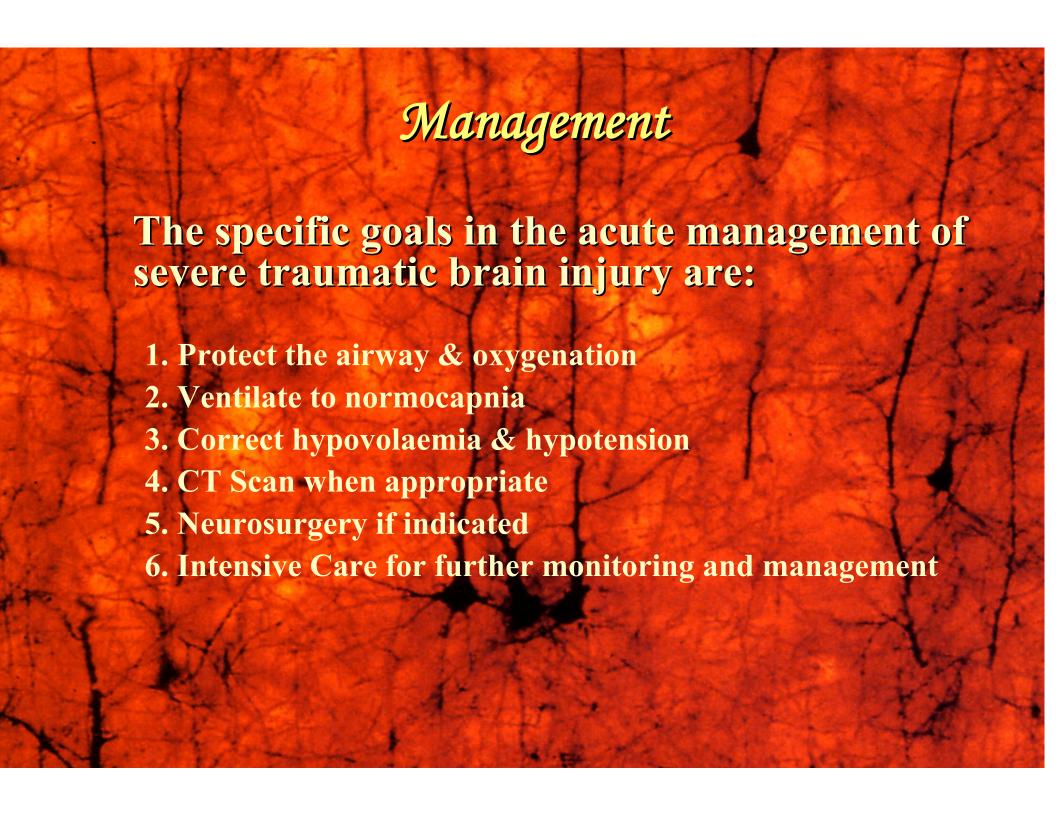
### Chronic Subdural Haematoma



- \* Heterogeneous mass
- a. Focal convexity of medial margin
- b. Dilated Ipsilateral Ventricle
- c. Midline Shift
- d. Diffuse Brain Edema
- e. Scalp Hematoma

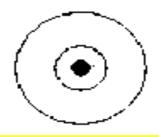
# Acute Epidural Haematoma







- Signs of increased intercranial pressure
  - Visual difficulties
  - Vomiting
  - Dyspnea
  - Decreased pulse



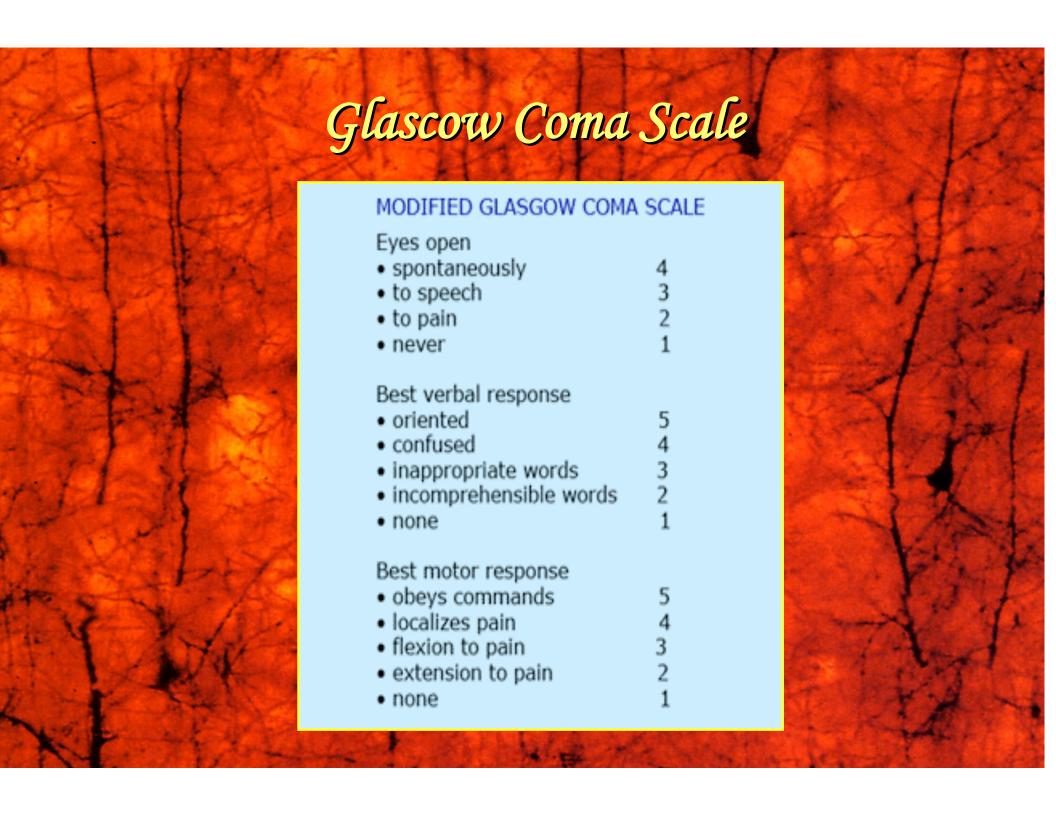


### left 3rd CN lesion

patient is being asked to look straight ahead

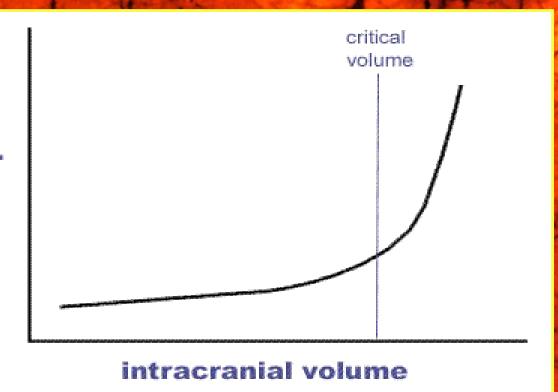






# Intracranial Pressure (ICP)

v.Intracranial (constant) = v.Brain + v.CSF + v.Blood + v.Mass Lesion



CPP = MAP - ICP

**CPP: Cerebral Perfusion Pressure** 

**MAP: Mean Arterial Pressure** 

**ICP: Intracranial Presure** 

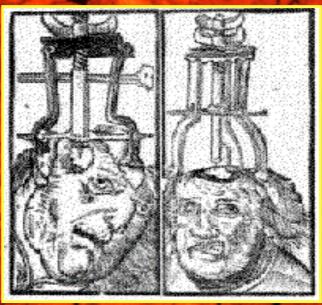
# Indications for ICP Monitoring

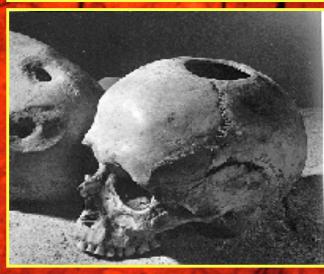
Indications for ICP monitoring	Risk of raised ICP
Severe Head Injury (GCS 3-8)	
* Abnormal CT scan	50-60%
* Normal CT Scan	
Age > 40  or  BP < 90  mm Hg	50-60%
or abnormal motor posturing	
* Normal CT scan	13%
No risk factors	
Moderate Head Injury (GCS 9-12)	
* If anaesthetised/sedated	Approx. 10-20% will deteriorate
* Abnormal CT scan	to severe head injury
Mild Head Injury (GCS 13-15)	
* Few indications for ICP measurement	Only around 3% will deteriorate



# How Brain Injuries treated?







# How Brain Injuries treated?



