Fourth Year 'Meds' Clinical Neuroanatomy

Ventricles, CSF, Brain Swelling etc.

David A. Ramsay, Neuropathologist, LHSC

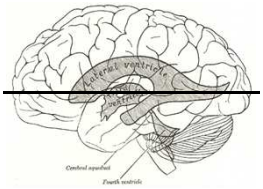
What Are We Going to Do?

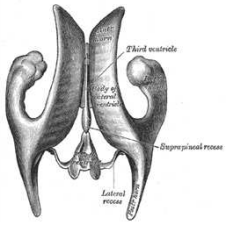
- Hydrocephalus and some effects of the interruption of CSF flow
- Some aspects of the effects of 'space occupancy' on the central nervous system

With audience participation (perhaps?) particular with reference to Neuroanatomy, and learning a bit of general neuropathology on the way!

Hydrocephalus and Effects of Interruption of CSF Flow

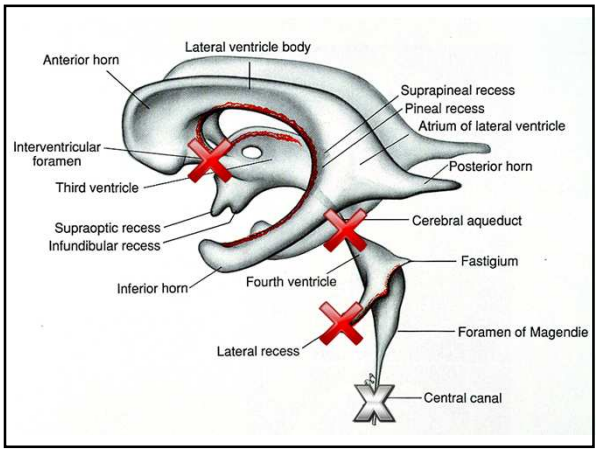
Cerebral Ventricles

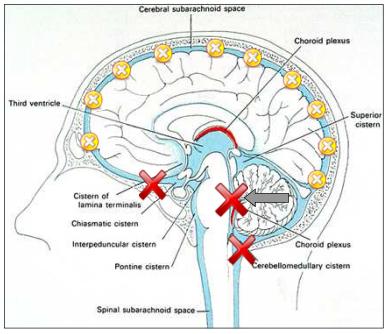




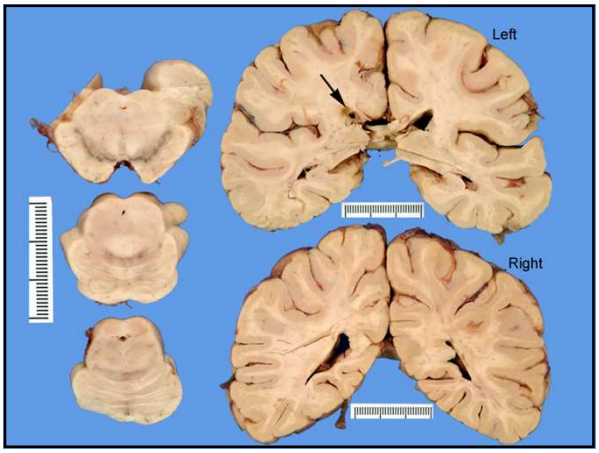
Tube Blockage Doctrine

- Something pressing on the tube
  - Tumour
  - Brain swelling
  - Hematoma
- Something in the wall of the tube
  - Tumour
  - Congenital abnormality
- Something in the tube
  - Hematoma
  - Tumour

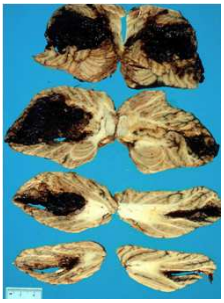
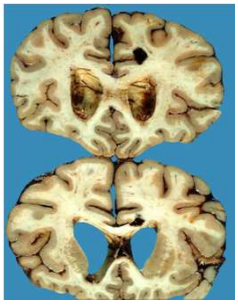




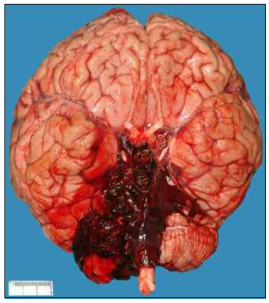
Aqueduct Stenosis



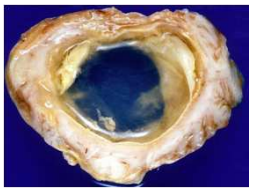
Acute Cerebellar Haemorrhage

Acute Basilar Subarachnoid Haemorrhage

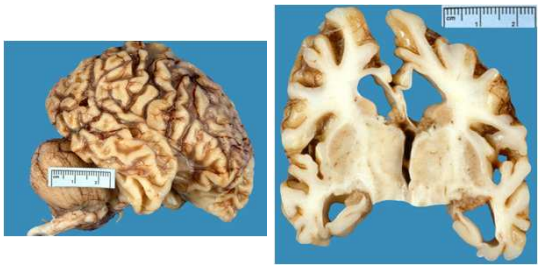



Acute Bacterial Meningitis in an Infant

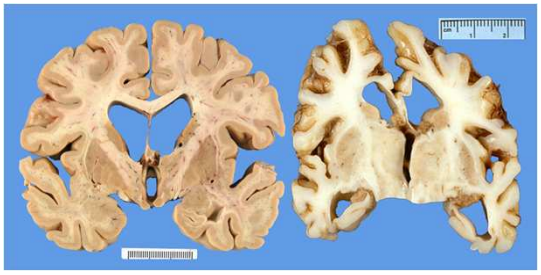



Compensatory ('ex vacuo') Hydrocephalus

(Niemann-Pick Disease)



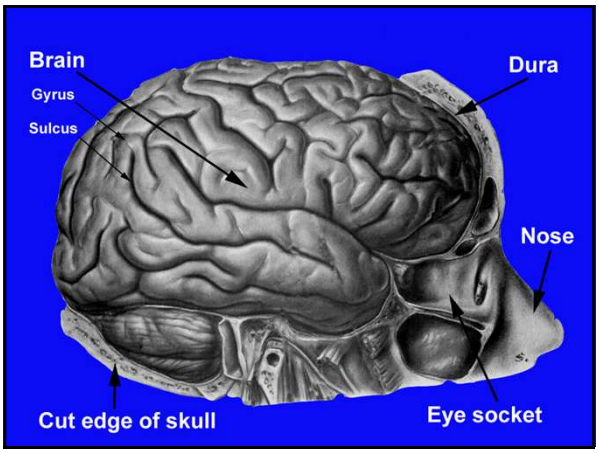
Ex Vacuo Hydrocephalus

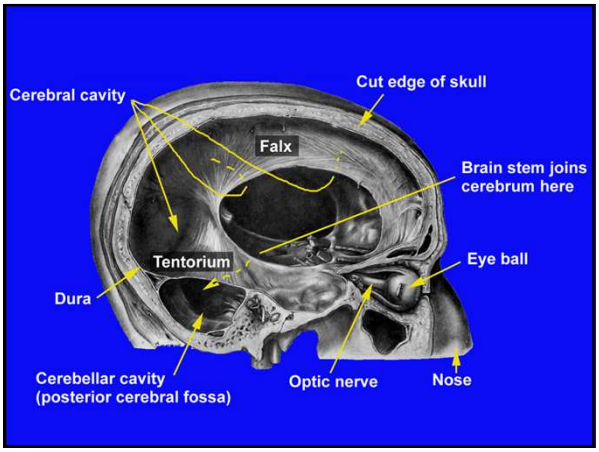


Alzheimer's disease

Niemann-Pick's disease

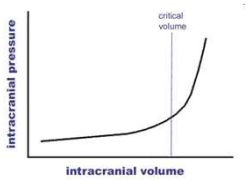
Some Aspects of the Effects of 'Space Occupancy' on the Central Nervous System





Intracranial 'Space Occupancy'

- Brain swelling occupies intracranial space
- Various lesions (hematomas, tumours) occupy intracranial space
- The expanding ventricles in obstructive hydrocephalus occupy intracranial space.
- **Intracranial space is limited.**



General Effects of Intracranial Space Occupancy

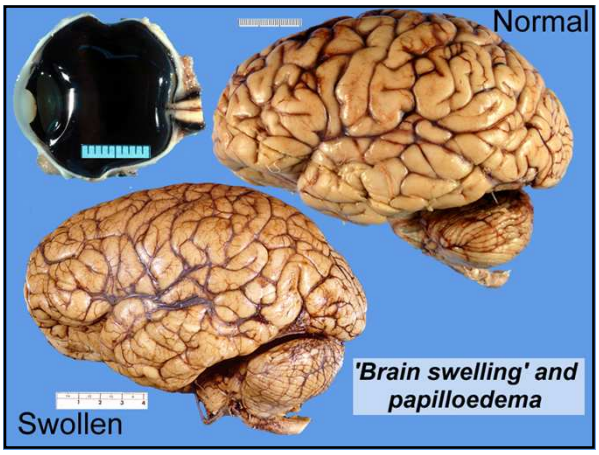
- Phase 1: 'Leeway' space is used up (sulci, ventricles become narrow)
- Phase 2: Localised areas of brain move ('herniate') into other intracranial compartments
- Phase 3: Caudalward displacement of the brainstem.
- Phase 4: Intracranial pressure exceeds blood pressure and cerebral perfusion stops.

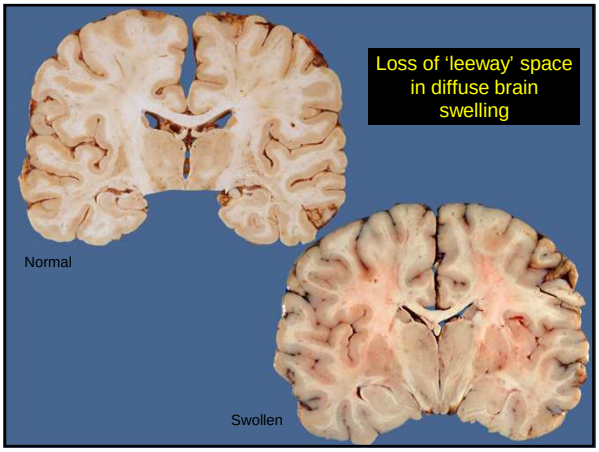
Neuropathological Features of Intracranial Space Occupancy

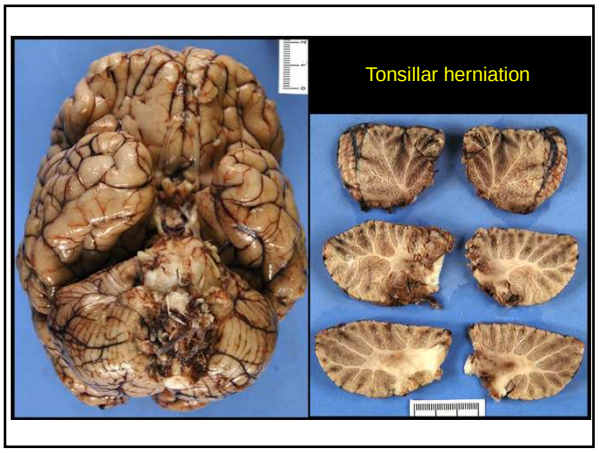
- Differ depending on the cause and the rate of increase in space occupancy
  - ➢ Diffuse brain swelling as a result of a severe hypoxic ischaemic encephalopathy
  - ➢ Localised (supratentorial) space occupancy
  - ➢ Obstructive hydrocephalus

Effects of Diffuse Intracranial Space Occupancy

- Phase 1:
  - Gyral crests are flat and sulci are effaced
  - Lateral ventricles are narrow
  - Papilloedema develops.
- Phase 2: Minimal uncal herniation.
- Phase 3: Severe tonsillar herniation
- Phase 4: Death or ventilator brain.


Normal
'Brain swelling' and papilloedema
Swollen

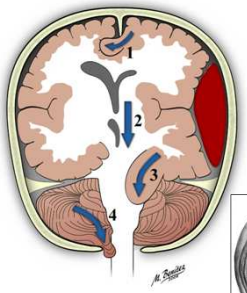

Loss of 'leeway' space in diffuse brain swelling
Normal
Swollen


Tonsillar herniation

General Effects of Focal Intracranial Space Occupancy

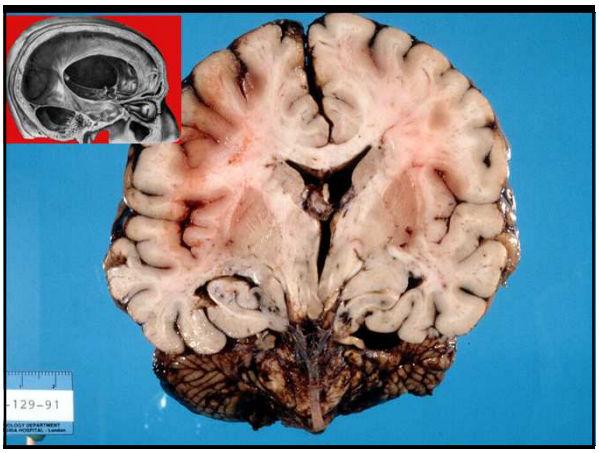
- Phase 1: Gyral crests are flat and sulci are effaced. Lateral ventricles are narrow
  - Paradoxical contralateral lateral ventricular dilatation may occur.
- Phase 2: Herniation:
  - Subfalcine herniation away from the lesion
  - Uncal herniation with oculomotor nerve compression (dilated pupil) and compression of posterior cerebral artery (infarcts)
  - Early tonsillar herniation
- Phase 3: Brain stem distortion
  - Kernohan's notch phenomenon
  - Brainstem haemorrhages
  - Severe tonsillar herniation
- Phase 4: Death or ventilator brain.

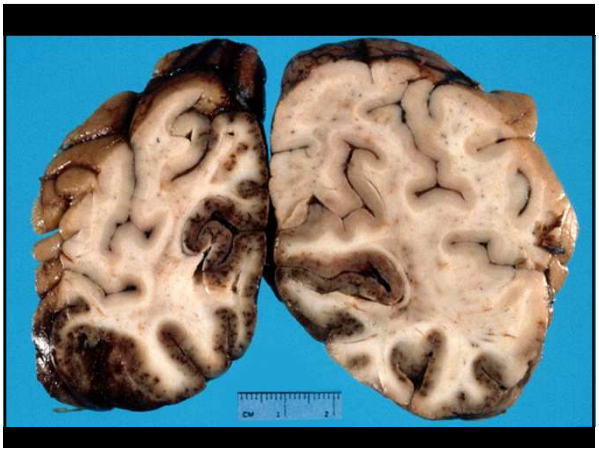
General Effects of Asymmetric Intracranial 'Space Occupancy'

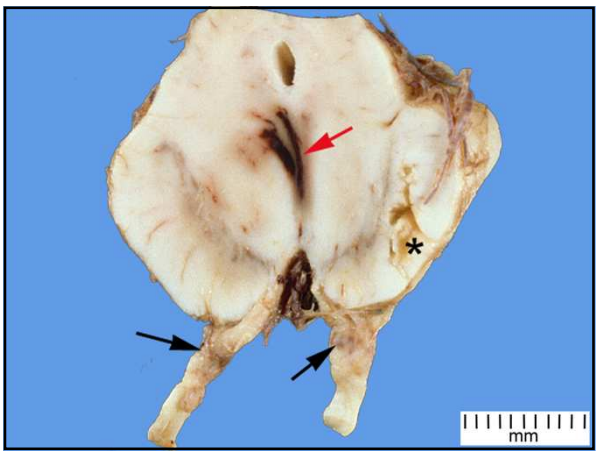


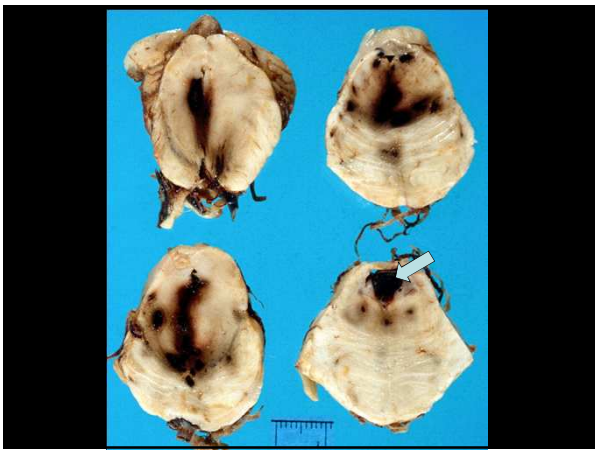
Displacement effects

- Subfalcine herniation
- Central herniation
- Transtentorial herniation
- Cerebellar Tonsillar herniation


129-91



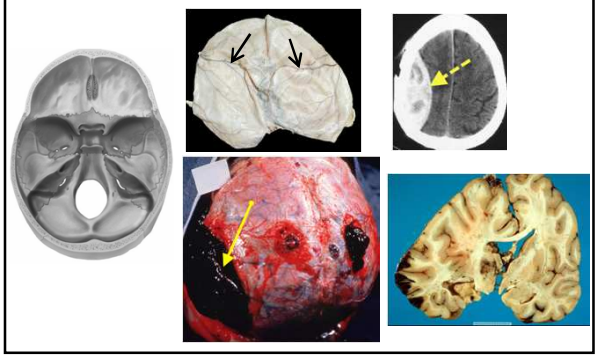

*
mm



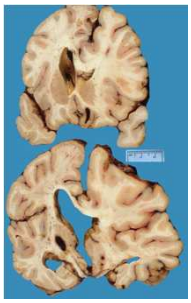
Examples of Asymmetric Intracranial Space Occupancy

Epidural Hematomas

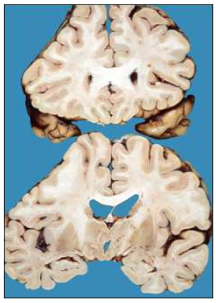
Very fast space occupancy



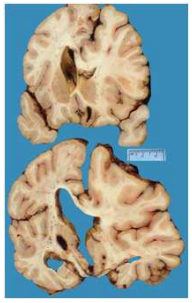
Acute Subdural Hematoma
(Fast Space-Occupancy)

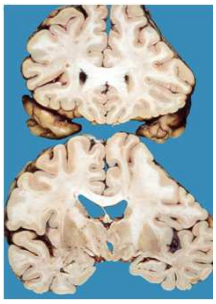


Chronic Subdural Hematoma
(Slow Space-Occupancy)



Effects of Acute and Chronic Subdural Hemtomas Compared

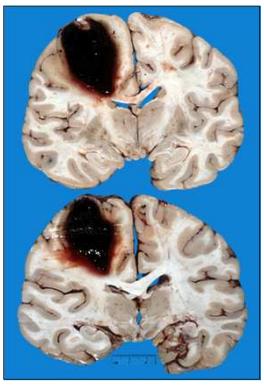




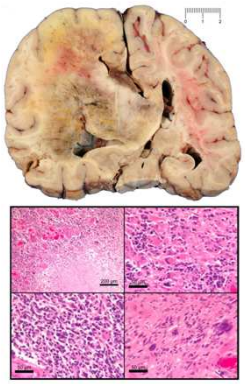
Some Other Space-Occupying Phenomena

Cases

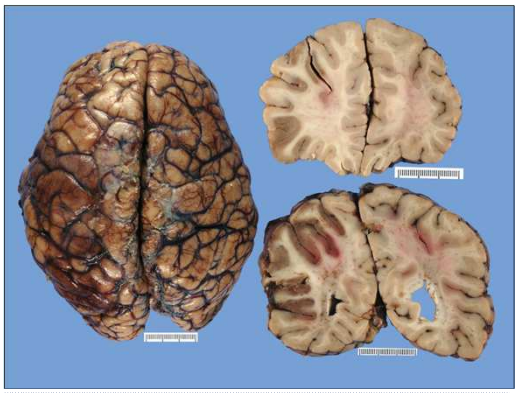
1. Describe type of hydrocephalus and/or effects of space-occupancy
2. Name the disease process
3. Provide a differential diagnosis



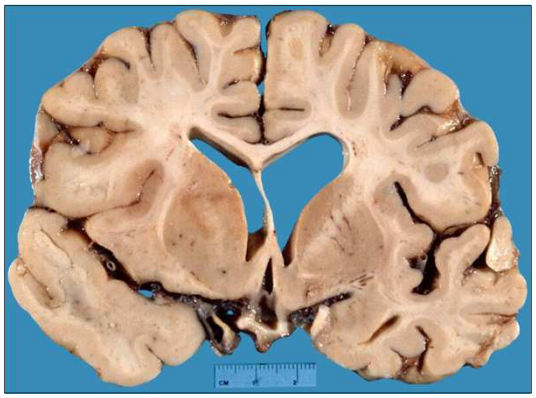
DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS



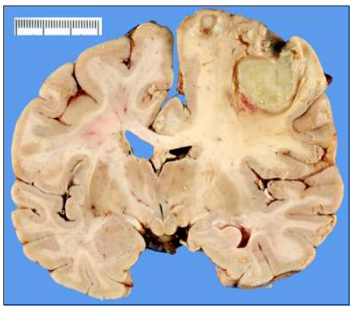
DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS

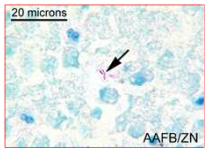


DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS

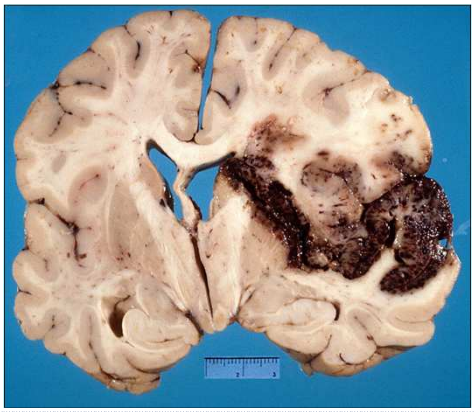


DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS

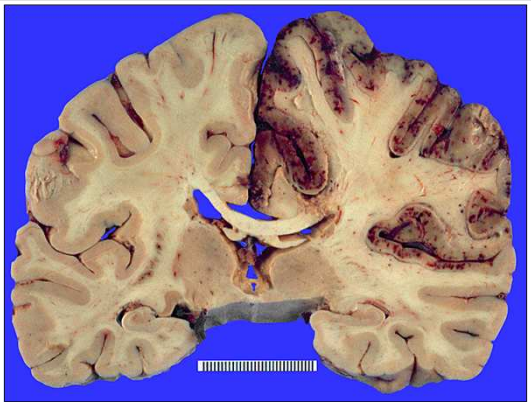




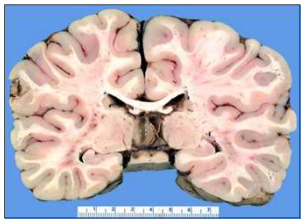
DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS



DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS



DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS



DESCRIBE HCP/SO EFFECT, NAME THE DISEASE PROCESS, DIFFERENTIAL DIAGNOSIS