Fourth Year 'Meds' Clinical Neuroanatomy

Ventricles, CSF, Brain Swelling etc.

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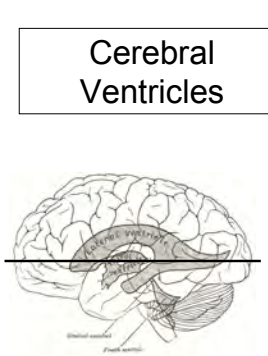
What Are We Going to Do?

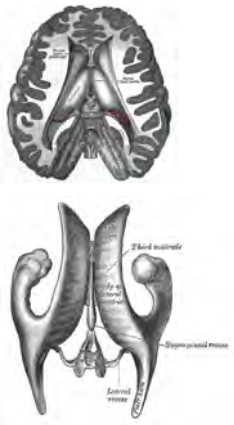
- Hydrocephalus and some effects of the interruption of CSF flow
- Some aspects of the effects of 'space occupancy' on the central nervous system

With audience participation, particular reference to Neuroanatomy, and learning a bit of general neuropathology on the way!

Hydrocephalus and Effects of Interruption of CSF Flow

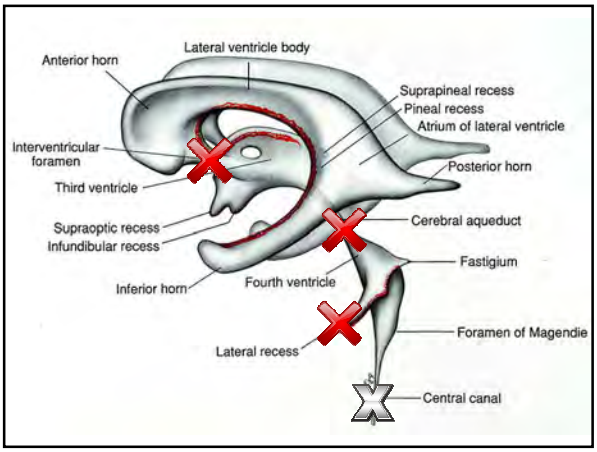
Cerebral Ventricles

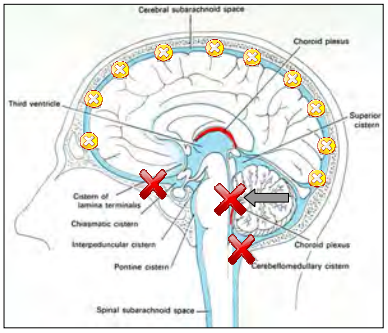




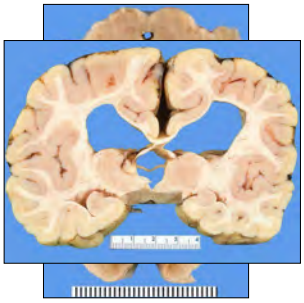
Tube Blockage Doctrine

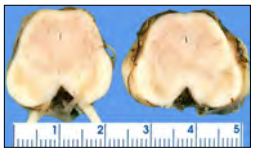
- Something pressing on the tube
  - Tumour
  - Brain swelling
  - Hematoma
- Something in the wall of the tube
  - Tumour
  - Congenital abnormality
- Something in the tube
  - Hematoma
  - Tumour

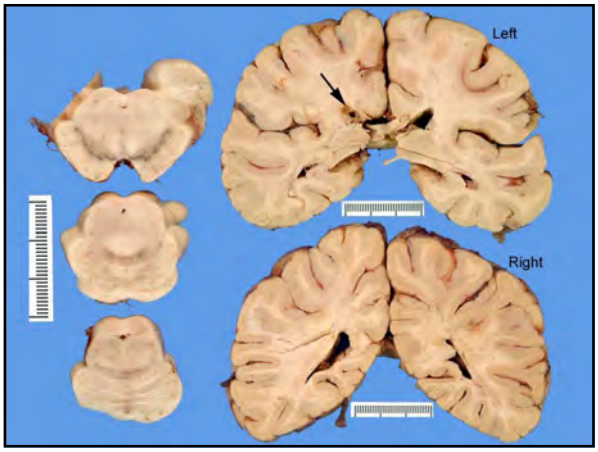




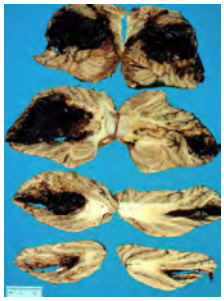
Aqueduct Stenosis

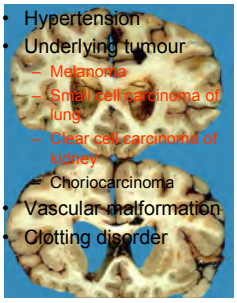






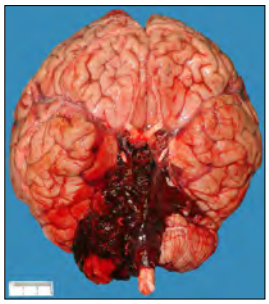
Acute Cerebellar Haemorrhage

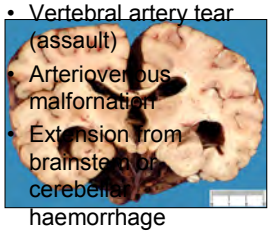




- Hypertension
- Underlying tumour
  - Melanoma
  - Small cell carcinoma of lung
  - Clear cell carcinoma of kidney
  - Choriocarcinoma
- Vascular malformation
- Clotting disorder

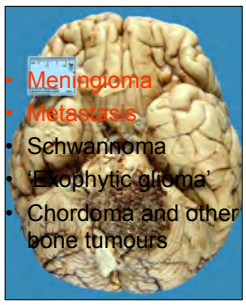
Acute Basilar Subarachnoid Haemorrhage



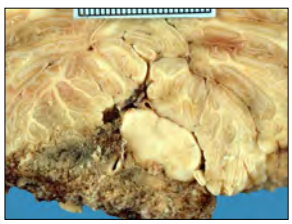


- Berry aneurysm
- Vertebral artery tear (assault)
- Arteriovenous malformation
- Extension from brainstem or cerebellar haemorrhage

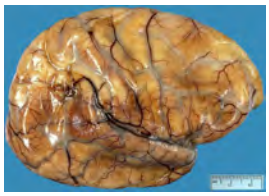
Skull or Brain Base Tumour

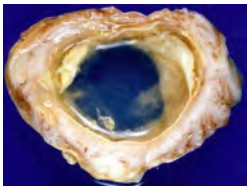


- Meningioma
- Metastasis
- Schwannoma
- 'Exophytic glioma'
- Chordoma and other bone tumours



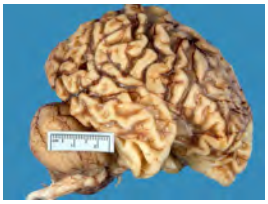
Acute Bacterial Meningitis in an Infant





Compensatory ('ex vacuo') Hydrocephalus

(Niemann-Pick Disease)

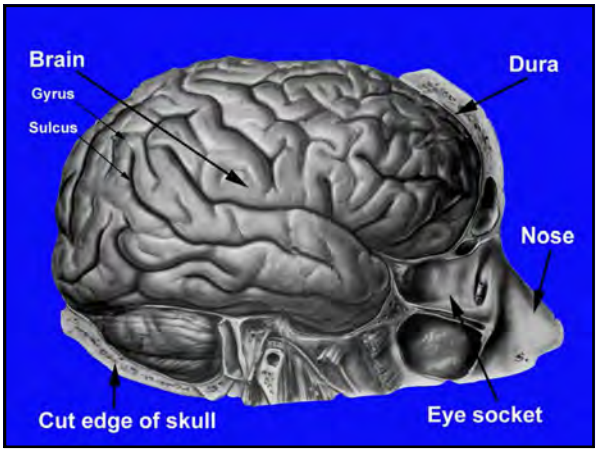


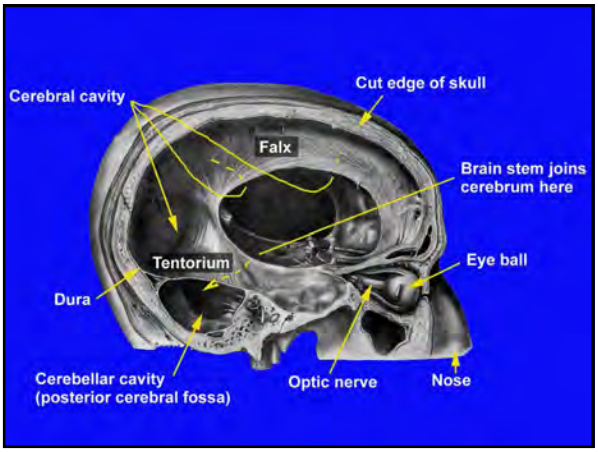
Ex Vacuo Hydrocephalus

Alzheimer's disease

Niemann-Pick's disease

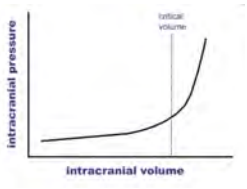
Some Aspects of the Effects of 'Space Occupancy' on the Central Nervous System





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

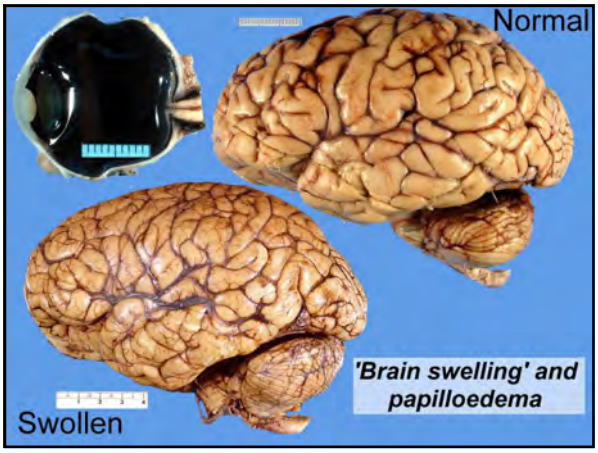
- Phase 1: 'Leeway' space is used up (sulci, ventricles become narrow)
- Phase 2: Localised areas of brain move ('herniate') into other intracranial compartments
- Phase 3: Caudalward displacement of the brainstem.
- Phase 4: Intracranial pressure exceeds blood pressure and cerebral perfusion stops.

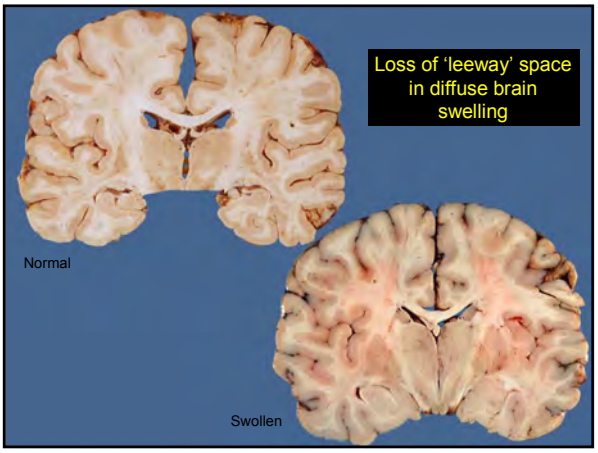
Neuropathological Features of Intracranial Space Occupancy

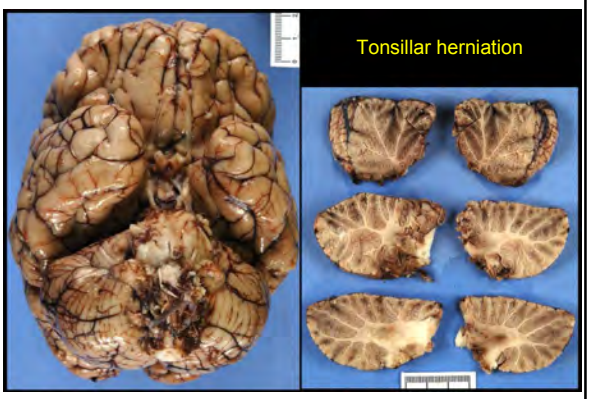
- Differ depending on the cause and the rate of increase in space occupancy
- ➢ Diffuse brain swelling as a result of a severe hypoxic ischaemic encephalopathy
- ➢ Localised (supratentorial) space occupancy
- ➢ Obstructive hydrocephalus

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.



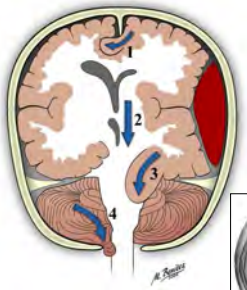




General Effects of Focal Intracranial Space Occupancy

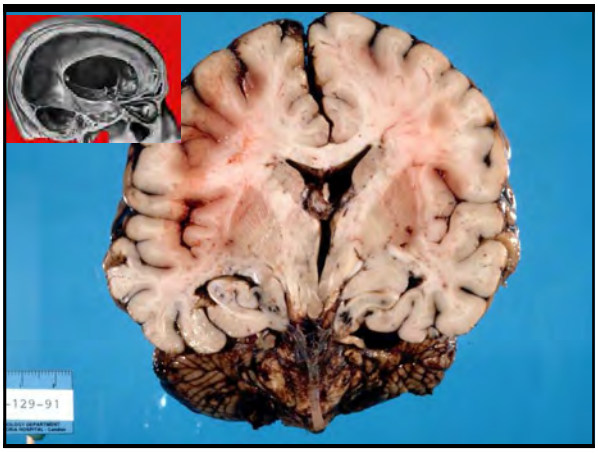
- Phase 1: Gyral crests are flat and sulci are effaced. Lateral ventricles are narrow
  - Paradoxical contralateral lateral ventricular dilatation may occur.
- Phase 2: Herniation:
  - Subfalcine herniation away from the lesion
  - Uncal herniation with oculomotor nerve compression (dilated pupil) and 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.

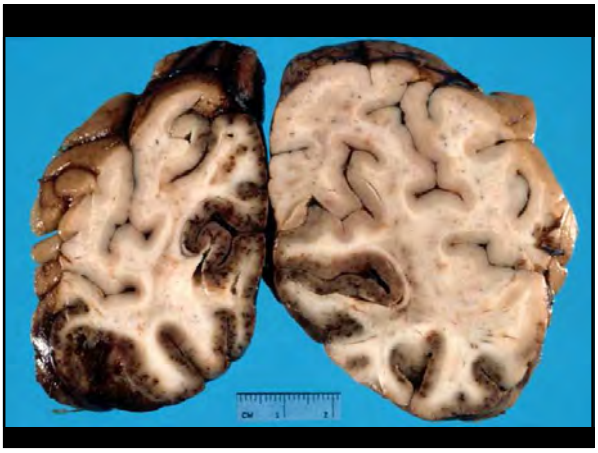
General Effects of Asymmetric Intracranial 'Space Occupancy'

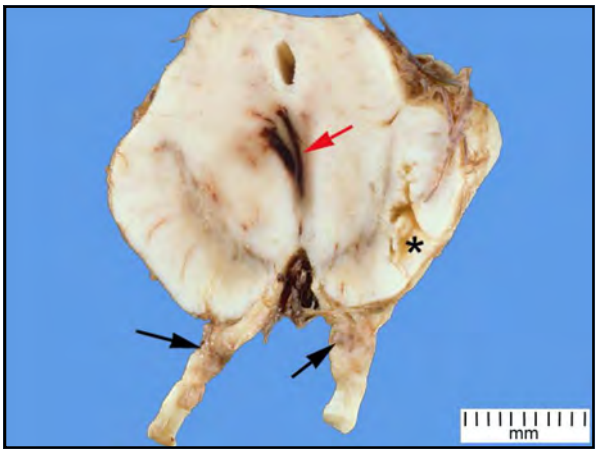


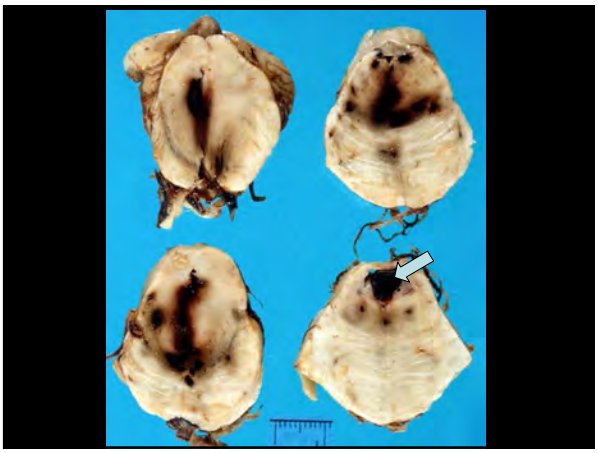
Displacement effects

1. Subfalcine herniation
2. Central herniation
3. Transtentorial herniation
4. Cerebellar Tonsillar herniation





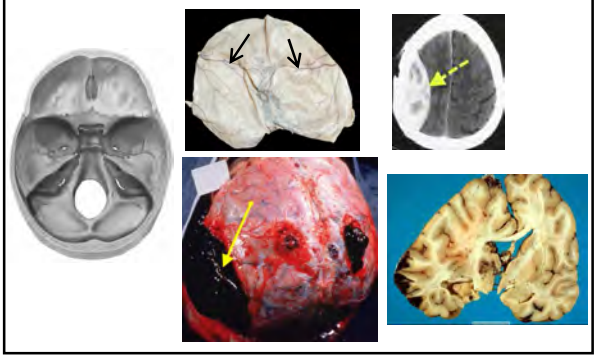




Examples of Intracranial Asymmetric Space Occupancy

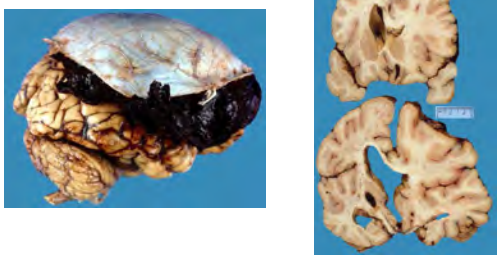
Epidural Hematomas

Very fast space occupancy



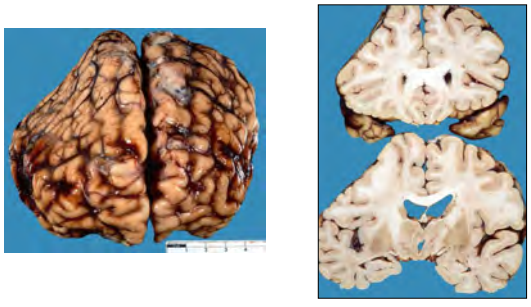
Acute Subdural Hematoma

(Fast Space-Occupancy)

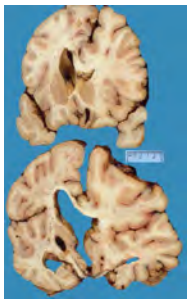


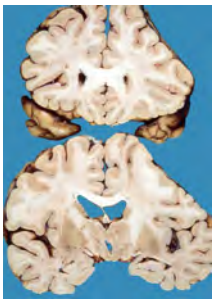
Chronic Subdural Hematoma

(Slow Space-Occupancy)



Effects of Acute and Chronic Subdural Hemtomas Compared

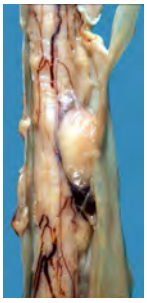




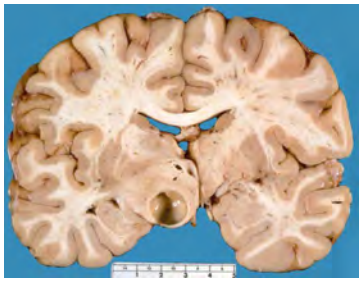
Cases

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

Some Other Space-Occupying Phenomena

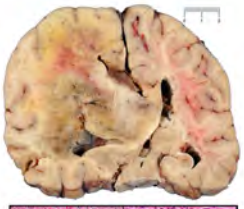


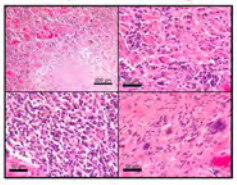
Spinal meningioma



Thalamic pilocytic astrocytoma

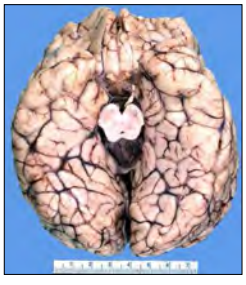
Glioblastoma

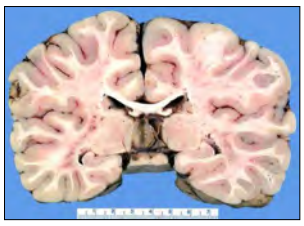




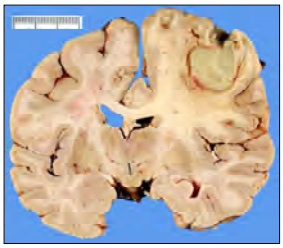
- Smooth brain profile ('helmet brain')
- Left to right subfalcine herniation
- Effacement of ventricle
- 'Paradoxical' ventricular dilatation
- Grade 4 WHO brain tumour
- Common in middle aged and elderly
- Life expectancy 6m to 3y, depending on age

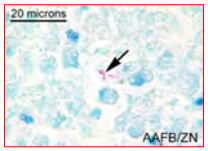
Pineal Cyst without Obstruction





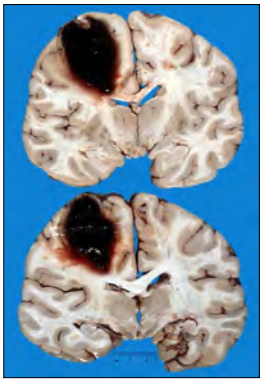
Tuberculous abscess





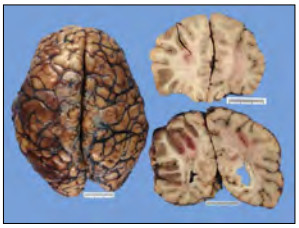
- Right to left subfalcine herniation
- Effacement of right lateral ventricle
- Mild right uncal herniation
- 'Tuberculoma'
- Usually multiple
- Basilar meningitis commoner with AAFB
- Immune-suppressed
- 'Rare' organisms

Lobar Hematoma



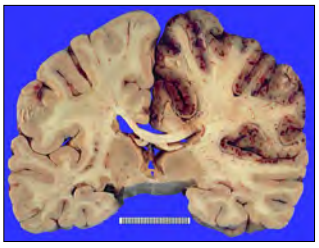
- Minimal uncal and left to right subfalcine herniation
- Narrowing of left lateral ventricle
- Hypertension and cerebral amyloid angiopathy commonest causes
- Remember differential diagnosis provided for cerebellar hematoma

Acute 'Bland' Left Middle Cerebellar Artery Territory Infarct



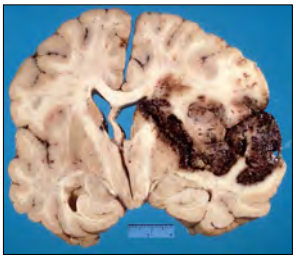
- Smooth brain profile
- Left to right subfalcine herniation
- Left ventricular effacement
- Thrombotic occlusion at site of atheroma commonest cause
- 50% of embolic infarcts are bland because embolus lodges 'permanently'

Haemorrhagic Infarct of Right Anterior (ACA) and Middle Cerebral (MCA) Arteries



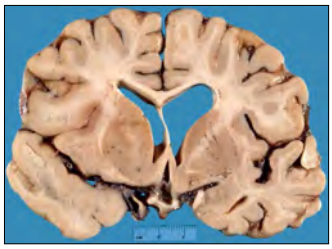
- Mild effacement of right lateral ventricle
- Embolic infarct
- Mixed ACA and MCA territory means:
  - One embolus to each of the vessels
  - Occlusion of right Internal carotid artery
  - Circle of Willis variant with common origin of right ACA and MCA

Haemorrhagic Infarct in Territory of Major Branch of Right Middle Cerebral Artery



- Smooth brain profile
- Right to left subfalcine herniation
- Early uncal herniation
- Temporary embolic occlusion of right middle cerebral artery (and recurrent artery of Heubner)
- Emboli arise from complicated atheroma in great vessels or heart
  - Valve disease
  - Chamber thrombus (atrial fibrillation)

Acute Bland Infarct of Left Middle Cerebral Artery



- Slight narrowing of left lateral ventricle
- Discolouration of grey matter of basal ganglia and part of right hemisphere
- Atheroma of left internal and middle cerebral arteries