Brain Tumours-Treatment options and outcomes

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ADVANCED NEUROSURGERY

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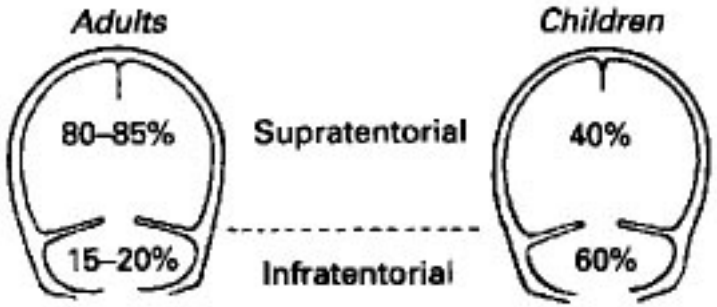
WHO Classification

- Neuroepithelial tissue
- Cranial and paraspinal nerves
- Meninges
- Lymphomas and haematopoetic
- Germ cell
- Sellar region
- Metastatic

Primary brain tumours

- Incidence 24.6/100000 adults in US
- One third malignant
- Less in children but more malignant
- Ranked 19th in incidence for cancer in Australia, but 4th in person years lost to 75



Adults (11/12)	Children (1/12)
Supratentorial 80-85%	Infratentorial 60%
Gliomas 50% Meningiomas 15% Metastases 15% Pituitary 8% Acoustic neuroma 8%	Pilocytic astrocytomas 27% Medulloblastomas 27% Brain stem gliomas 28% Ependymoma

Presentation

- Raised ICP
- Progressive neurological deficit e.g. motor weakness
- Headache
- Seizure
- Mental state change
- TIA like sx
- Endocrinopathies

Aetiology

- Familial syndromes eg NF 1 optic glioma
- Genetics eg. p53 loss in glioblastoma
- Radiation eg. meningioma, Glioblastoma
- Immuosuppression eg. Lymphoma
- Weak evidence: trauma & meningioma
- Unproven: power lines/mobile phones

Glioma

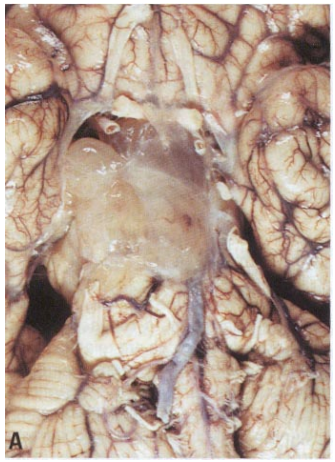
- Half of brain tumours are gliomas
- 2/3 are high grade astrocytomas (ie GBM)
- Types
  - Astrocytomas
  - Oligodendroglial tumours
  - Mixed gliomas
  - Ependymomal tumours
  - Choroid plexus tumours
  - Glial tumours of uncertain origin

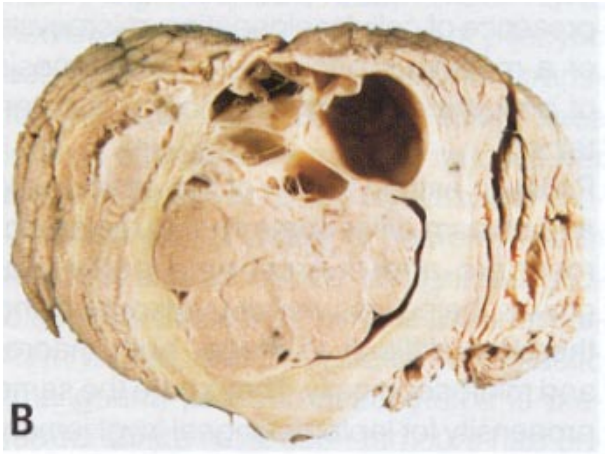
Astrocytoma

- WHO grade I: Pilocytic astrocytoma
- WHO grade II: Diffuse astrocytoma
- WHO grade III: Anaplastic astrocytoma
- WHO grade IV: Glioblastoma multiforme
  - Diffusely infiltrating astrocytomas = WHO grade II, III & IV

Pilocytic astrocytoma

- Children, young adult
- 1/3 PCA have NF1
- Preferred sites:
  - Optic nerve
  - Chiasmal/hypothalamic
  - Thalamus/basal ganglia
  - Cerebellar hemisphere
  - Brainstem
  - Spinal cord





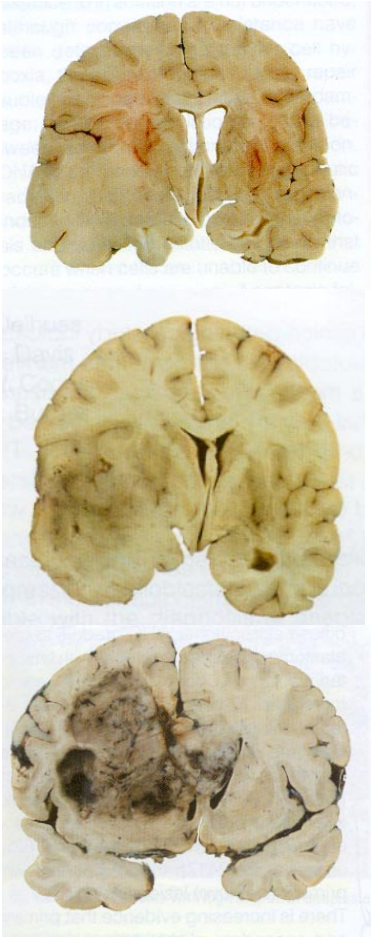
Pilocytic astrocytoma

- Occasionally seed the neuraxis
- Surgical cure if total removal
- Better prognosis: 10 yr survival 94%
- May recur later in life
- May undergo malignant degeneration?RTX
- RTX for inoperable recurrence
- Chemo preferred over RTX in children

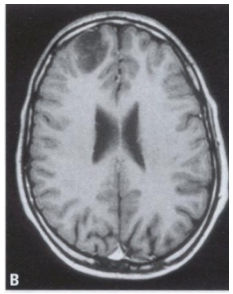
Difusely infiltrating astrocytoma

- >60% primary brain tumours
- Adults
- Cerebral hemisphere

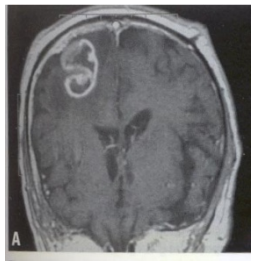
Diffusely infiltrating astrocytoma



Diffuse astrocytoma (DA)

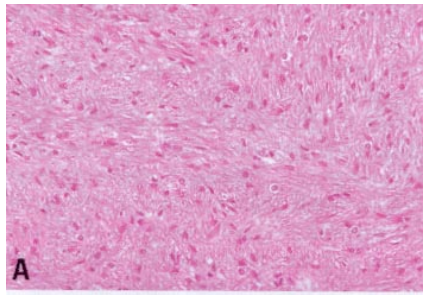


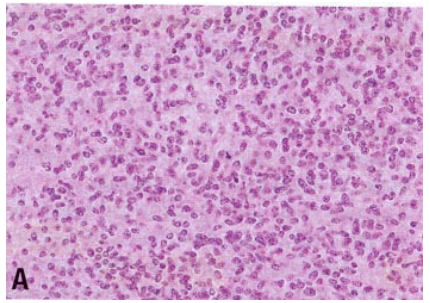
Anaplastic astrocytoma (AA)

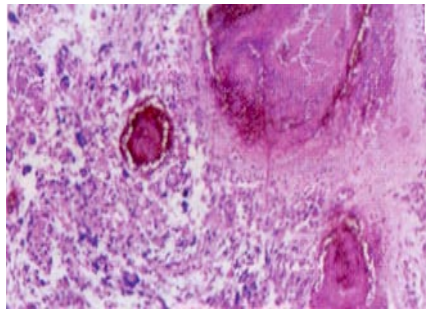


Glioblastoma (GBM)

Increasing degrees of malignancy







Diffusely infiltrating astrocytoma

WHO designation	**DA**	**AA**	**GBM**
WHO grading	II	III	IV
Mean age	34	41	53
% of astrocytomas	10-15%	35-40%	50-60%
Incidence	1.4/million/yr		2-3/100,000/yr
Clinical	Seizures	Deficits	Increased ICP
	Subtle deficits	Seizures	Deficits
		Increased ICP	Seizures
Imaging	CT: low density		
	no enhancement	complex enhancement	ring enhancement
Median survival (optimal Rx)	7-10 years	3 years	12-14 months

LGG

- WHO 2 astrocytoma
- Oligodendroglioma
- Oligoastrocytoma
- 15% of all primary brain tumours
- Younger age
- Seizures in 80%
- Predilection for insula and supplementary motor area


Suspected LGG (anatomic MRI)
Diffuse with poorly defined margins or multilobar/gliomatosis
Physiologic MRI (MRS/CBV/ADC)
Frameless biopsy of higher grade region based on physiologic MRI
High-grade glioma
Radiation and chemotherapy
Low-grade glioma
Temozolomide * (regardless of 1p/19q status)
Progression
Repeat biopsy w/ physiologic imaging
High-grade glioma
Radiation + chemotherapy
Low-grade glioma
Radiation therapy or mTOR inhibitor
Non-diffuse (i.e: focal)
Physiologic imaging (MRS/CBV/ADC) to identify high-grade components
+
Functional imaging (fMRI or MEG) to define eloquence
+
DTI tractography for subcortical pathways
Medically-refractory seizures
Seizures controlled with AEDs or occasional breakthrough seizures
Surgery with ECog
Surgery w/o ECog
If eloquent in location
Functional imaging data allows for > 50% resection
Functional imaging data does not allow > 50% resection
Surgery w/ intraoperative mapping
Frameless biopsy w/ physiologic mapping
GTR
STR (not limited by function)
STR (limited by function)
High-grade glioma
Low-grade glioma
Observe
Reoperation
Temozolomide * (regardless of 1p/19q)
Radiation + chemotherapy
Temozolomide * (regardless of 1p/19q)
GTR on postop MRI
STR on postop MRI
Progression
Observe
Temozolomide (regardless of 1p/19q)
Progression
Repeat biopsy with physiologic imaging
High-grade glioma
Low-grade glioma
Radiation + chemotherapy
Radiation therapy or mTOR inhibitor

Management of LGG

- Controversial
- Options:
  - Serial exams & imaging investigations
  - Surgery
    - Biopsy
    - Partial resection
    - Total resection
  - Radiotherapy (early vs late)
  - Chemotherapy
- Diffuse vs focal
- Extent of resection
- 1p19q status (oligo)

AA/GBM (HGG)

- Older age
- Mental state changes more common
- Poor prognosis

Treatment of HGG

- Issues:
  - Age (70)
  - Histology
  - Karnofsky score (70)
  - Location: deep/lobar
  - Patient's wishes
  - Presenting features
- Good evidence for extent of resection
- Stupp protocol: concurrent temozolamide + RTX

Treatment (AA & GBM)

- Biopsy versus cytoreductive surgery
  - NOT cure
  - Aim: prolong quality survival

Options	Median survival (months)
Biopsy	3-4
Resection	6
Biopsy + RadioRx	6-8
Resection + RadioRx	9-10
Resection + RTx + chemo	15-18

Newer Technologies

- Functional MRI
- DTI fibre tracking
- 5-ALA assisted resection

Meningioma

- 14-19% primary brain tumour
- Extrinsic
- Origin : arachnoid cap cells
- Peak age 45
- F>M=1.8:1
- Excellent prognosis

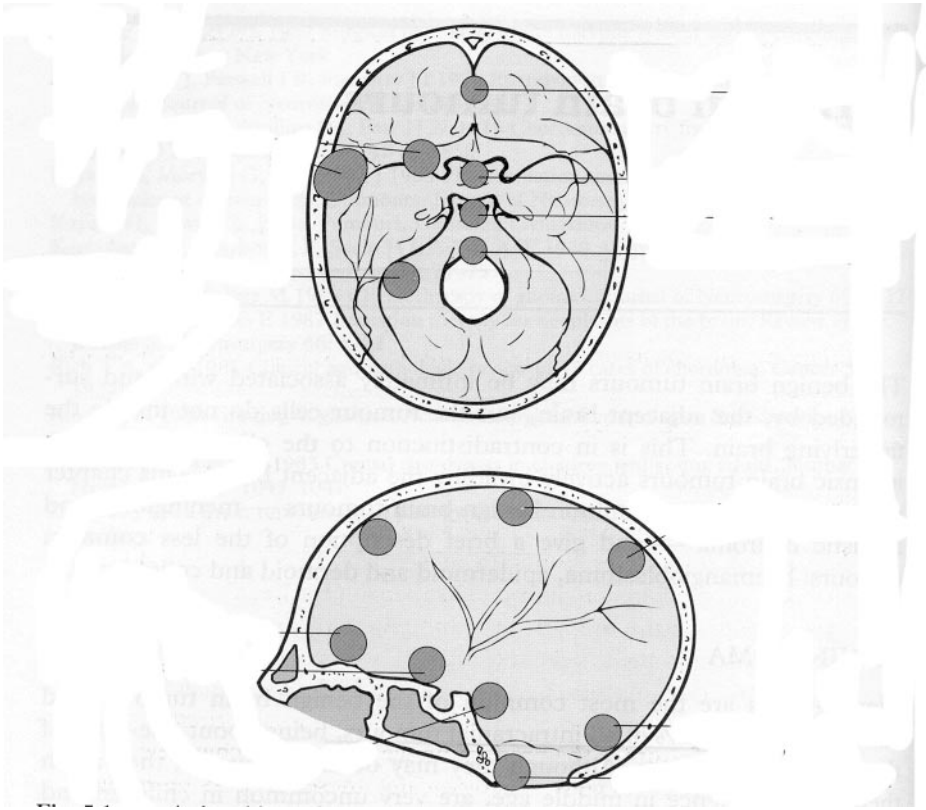
Meningioma

- Mostly benign, slow growing (WHO grade I)

- Greater likelihood of recurrence and aggressive behaviour
  - Atypical meningioma (WHO grade II)
  - Anaplastic meningioma (WHO grade III)

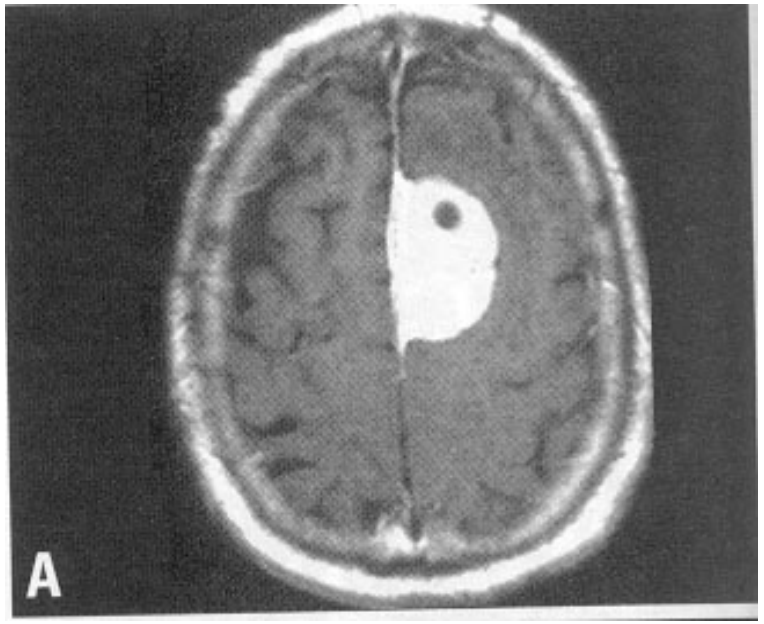
Sites

- Convexity
- Parafalcine/parasagittal
- Olfactory groove
- Sphenoidal ridge
- Parasellar
- Optic sheath
- Tentorium cerebelli
- CPA
- Intraventricular
- Foramen magnum
- Spinal



CT/MRI

- Well-circumscribed, extrinsic, durally-based
- Homogenous enhancement
- Dural tail
- +/- oedema
- +/- hyperostosis
- +/-calcification
- Occa en-plaque



Management

- Surgery
  - Aim for complete removal of tumour and its dural origin
  - Simpson grading
  - Sinus involvement
- Radiotherapy:
  - Unhelpful
  - For grade III meningioma
- 5 year survival 92%

Pituitary adenoma

- 10% intracranial tumours
- Anterior lobe of pituitary gland
- Usually benign
- 20-40s
- M=F
- MEN
- Microadenoma, <1cm
- Macroadenoma, ≥ 1cm

Classification (Histology)

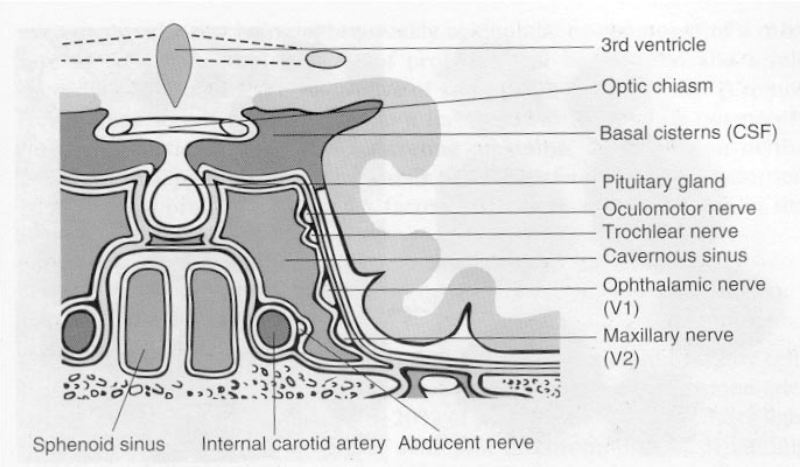
- Histology
  - Chromophobe, acidophil, basophil
- Endocrine function
  - Endocrine-active tumours
    - Prolactinoma
    - ACTH-secreting tumours
    - GH-secreting tumours
    - Thyrotropin-secreting tumours
    - Gonadotropin-secreting tumours
  - Endocrine-inactive tumours
    - Null-cell adenoma
    - Oncocytoma
    - others

Presentation

- Endocrinological disturbance: over or underproduction of hormones
- Mass effect (more common with non-functioning tumours):
  optic chiasm
  3rd ventricle (hydrocephalus)
  cavernous sinus (cranial nerves)
- Apoplexy
- CSF rhinorrhea
- Headache
- incidental

Clinical- Local mass effect

- Headache
- Visual field defects
  - Sup temp quadrantanopia
  - Bitemporal hemianopia
- Cavernous sinus compession
  - CNIII, IV, V1, V2, VI palsies
  - Proptosis, chemosis
  - ICA encasement
- Vertical extension
  - Hydrocephalus
  - Hypothalamic compression
- Inferior extension
  - CSF rhinorrhoea



Evaluation: Hx & O/E

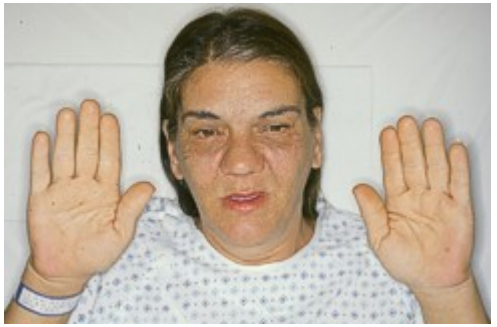
- Signs/symptoms of endocrine hyperfunction

prolactin: amenorrhea, nipple discharge, impotence

thyroid: heat intolerance, anxiety,palpitations

GH: acromegaly/gigantism

cortisol: hyperpigmentation, Cushing's syndrome



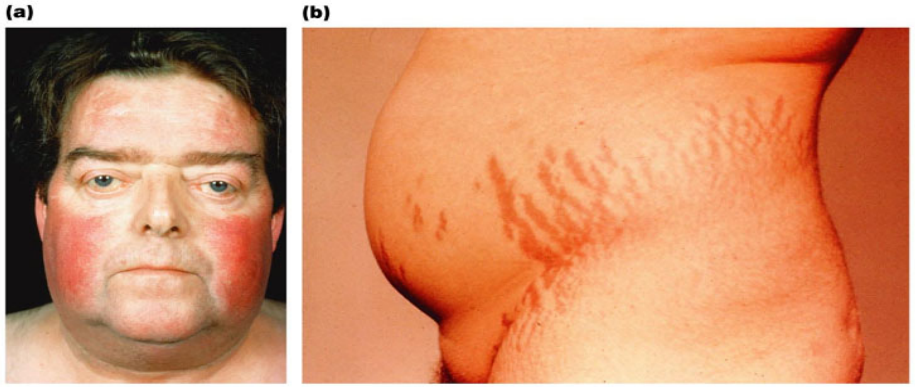


Fig. 23-5

Evaluation: Hx & O/E

- Endocrine deficits (in order of likelihood):

GH: growth delay, metabolic syndrome

LH/FSH: hypogonadism, amenorrhea, low libido, infertility

Thyroid: myxedema, cold intolerance, weight gain

ACTH: orthostatic hypotension, easy fatigability

DI: almost never seen pre-operatively

Pituitary apoplexy

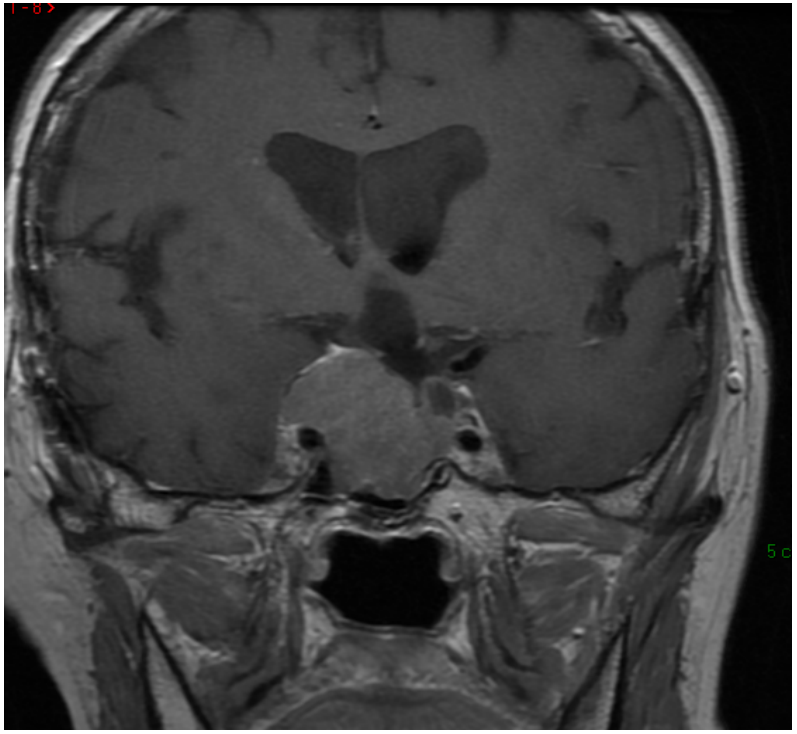
- Acute H/A
- Rapid progressive visual loss
- Extraocular nerve palsies
- Acute pituitary insufficiency
- Mx:
  - Steroid
  - Urgent decompression

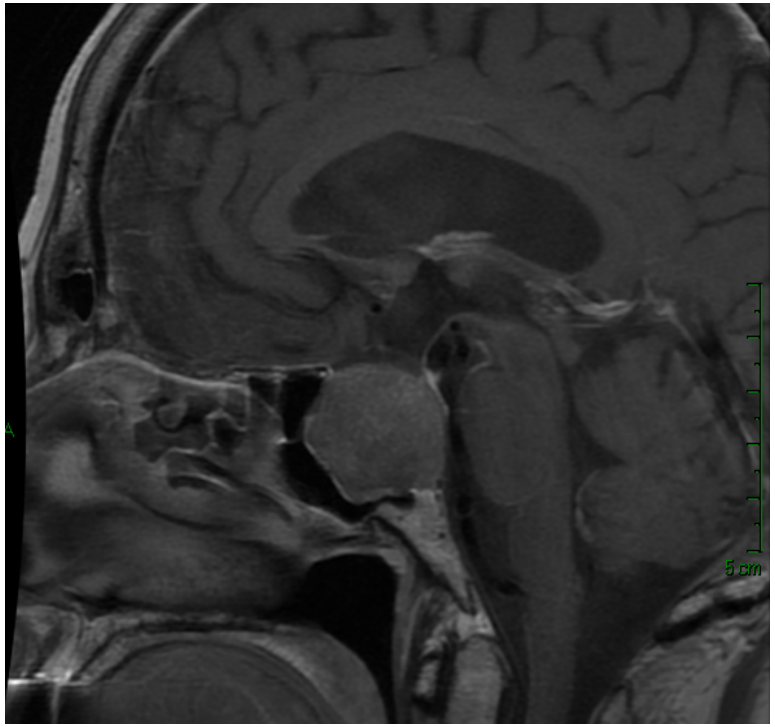
Endocrine screening

- 8am cortisol & 24 hr urine free cortisol
- Free T4, TSH
- PRL
- FSH, LH, sex steroids
- IGF-1
- Fasting BSL

Imaging

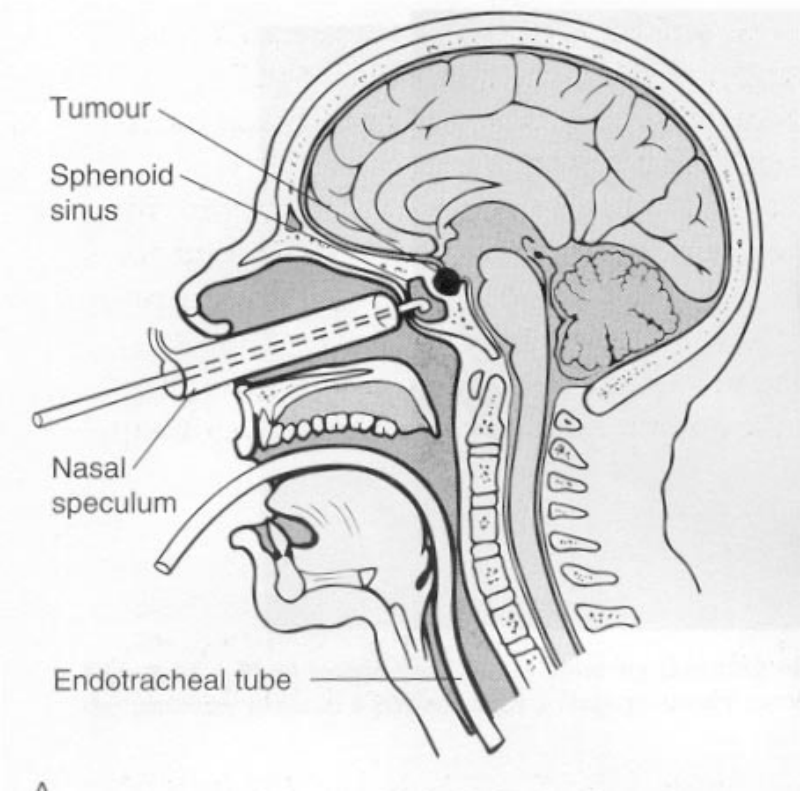
- MRI
- CT (stereotaxis)





Treatment

- If prolactinoma, medical treatment with bromocriptine, cabergolide
- Operative aproaches:
  - Transsphenoidal
  - Craniotomy
- (Radiotherapy)



When to operate: hormonally inactive macroadenomas

- Apoplexy: rapid visual/neurological deterioration: an emergency
- Tumours causing mass effect: visual field deficit / panhypopituitarism
- Tumours elevating chiasm even without signs/symptoms
- To obtain tissue in questionable cases
- Nelson's syndrome (hyperpigmentation, raised ACTH, progression of pituitary tumour after bilateral adrenalectomies)

Outcomes

- Generally good, especially
- Endocrinological cure in 25% PRL and 20% GH tumours
- ACTH tumour: 85% cure for microadenomas
- Recurrence rate : 12%