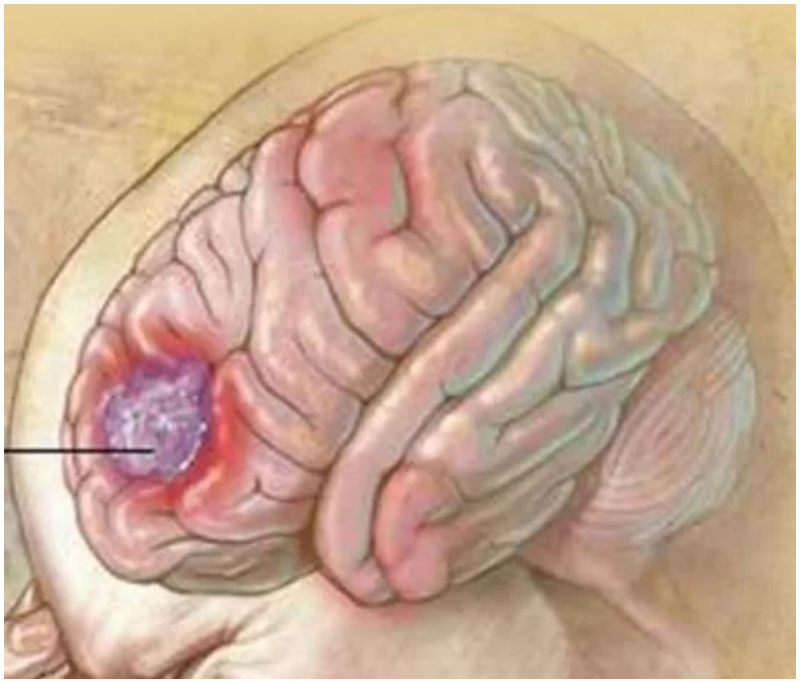
BRAIN TUMORS (II): TOPOGRAPHICAL SYNDROMES, CLINICAL FEATURES, DIAGNOSIS AND TREATMENT



34484 Pathology of the nervous system

Neurosurgery

Topic 20

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Key concepts

- General aspects of brain tumours
  - *Epidemiology*
  - *Clinical picture*
  - *Diagnosis*
    - *Neuroimaging*
    - *Tumour markers*
  - *General treatment*
- Types (classification)
- Brain metastasis
- Meningeal carcinomatosis
- Gliomas
- **Brain lymphoma**
- **Meningiomas**
- **Schwannomas**
- **Tumours of the glands (pituitary and pineal)**
- **Craniopharyngioma**
- **Medulloblastoma and ETMR**
- **Phacomatosis**

Simple teaching classification

REMEMBER?

1. **Metastases and meningeal carcinomatosis**
2. **Glia:** *astrocytoma, oligodendroglioma, primary lymphoma, ependymoma*
3. **Meninges:** *meningiomas*
4. **Nerve sheath:** *cranial nerve schwannomas, paraspinal*
5. **Neurons:** *gangliogangliomа, neurocytoma*
6. **Glands:** *sellar region (hypophysis), pineal region*
7. **Choroid plexus:** *choroid plexus papilloma*
8. **Mesenchymal:** *glomus tumour, chordoma, solitary fibrous tumour (before hemangiopericytoma)*
9. **Embryonal remnants:** *craniopharyngioma*, *medulloblastoma, ETMR (embryonal tumour with multilayered rosettes, previously PNET)*

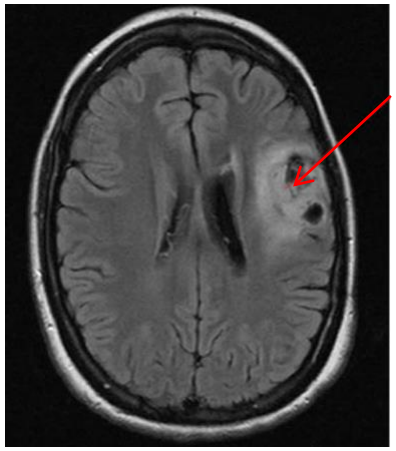
GLIAL TYPE TUMORS

REMEMBER?

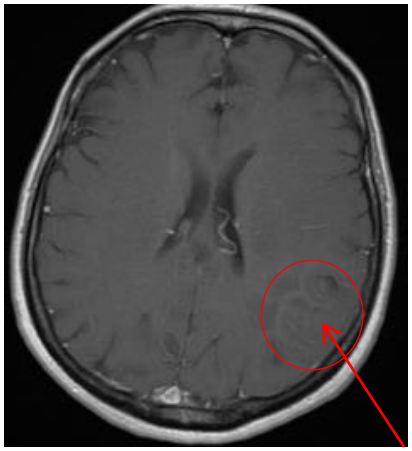
- Cell types

Astrocytes	→	astrocytomas
Oligodendrocytes	→	oligodendrogliomas
Microglia	→	primary brain lymphoma
Ependymocytes	→	ependymomas

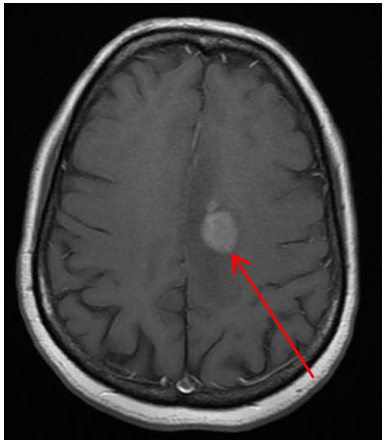
Axial T1 C+
Astrocytoma



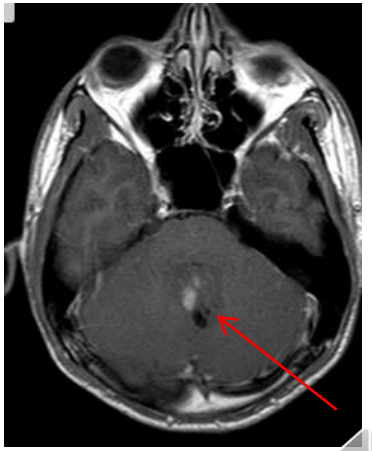
Axial T1 C+
Oligodendroglioma



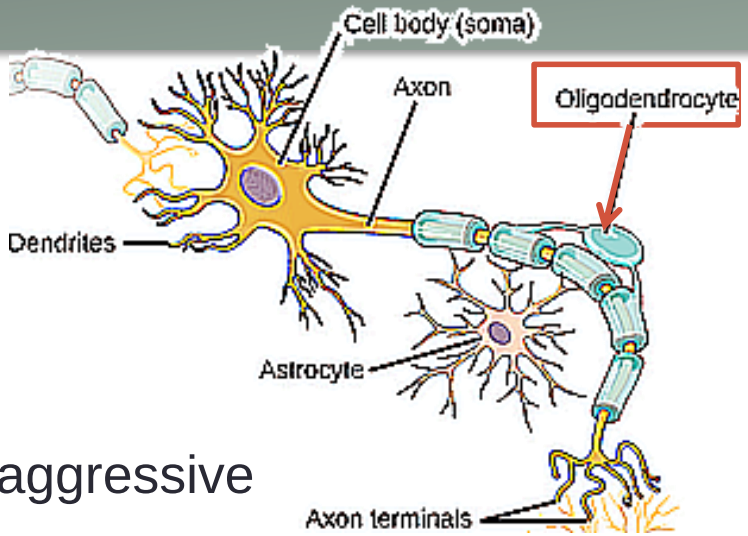
Axial T1 C+
Primary lymphoma



Axial T1 C+
Ependymoma



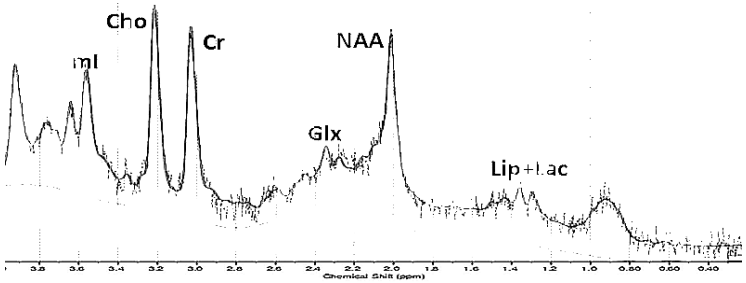
2. Oligodendroglioma

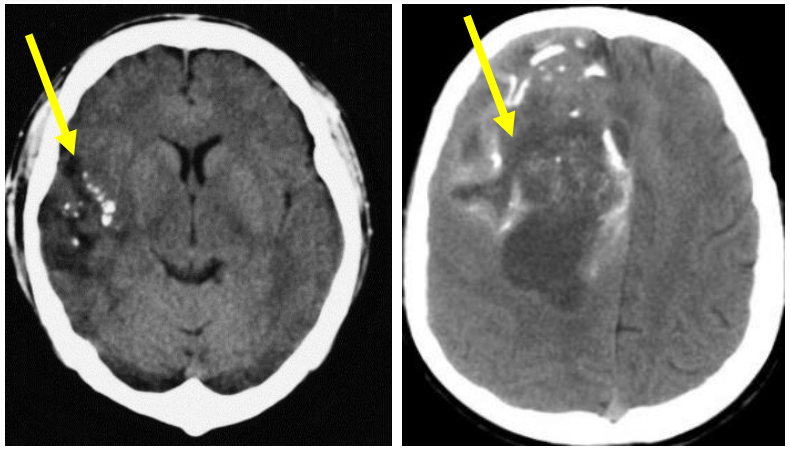


- Origin: oligodendroglia
- Epidemiology
  - Rare (4% tumours, 5-15% gliomas)
  - Male ~ 40 years
  - Supratentorial 90 % (frontal), not very aggressive (grades I-II)
- Symptoms
  - Epilepsy (initial and most frequent symptom) 90 %
  - Neurological deficit 30 %
  - Late symptoms (>7-8 years): headache and papilledema (raised intracranial pressure)

2. Oligodendroglioma

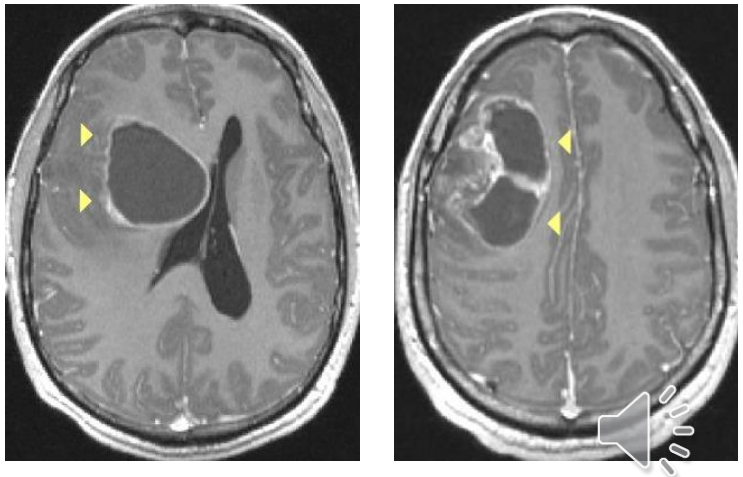
- Neuroimaging
  - CT = hypodense SOL, cystic areas, calcifications (70 %)
  - MRI = large SOL, delimited, without edema, low C+ uptake (low aggressiveness)
  - MRI-spectroscopy = aggressive and mixed type cases
- Treatment
  - Radical excision
  - Radiotherapy / chemotherapy depending on aggressiveness





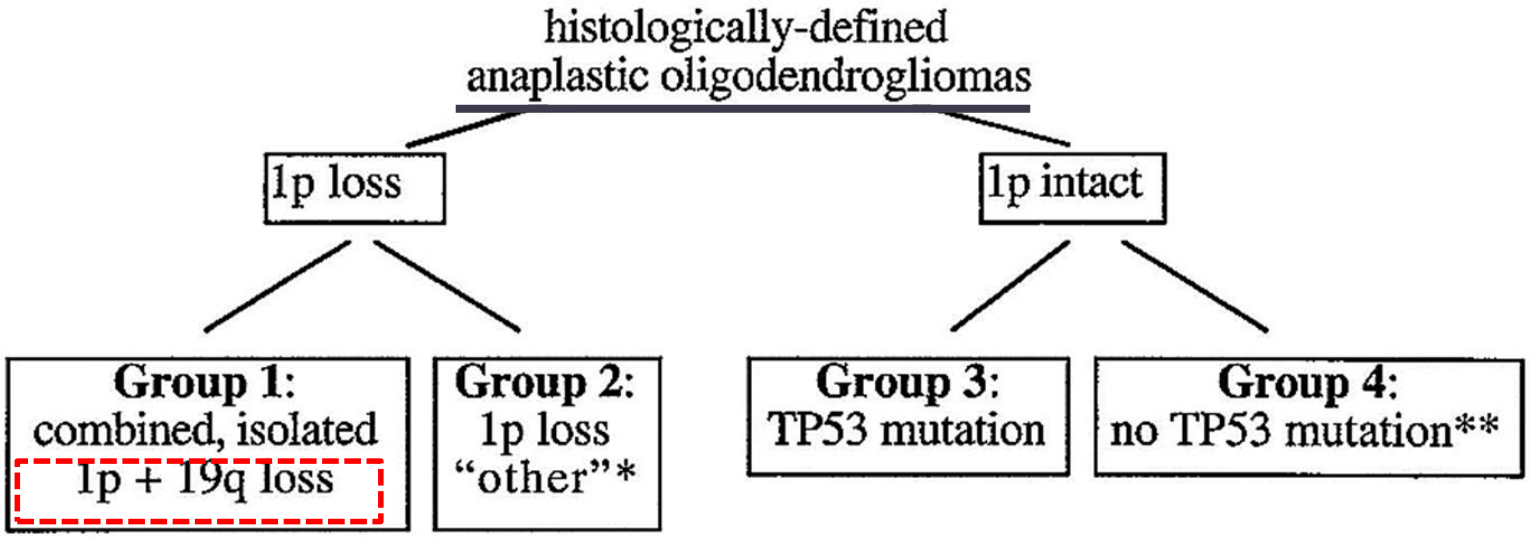
CT C+ (calcifications, low C+ uptake)

MRI axial T1 C+
(jelly cyst, delimited, low C+ uptake)



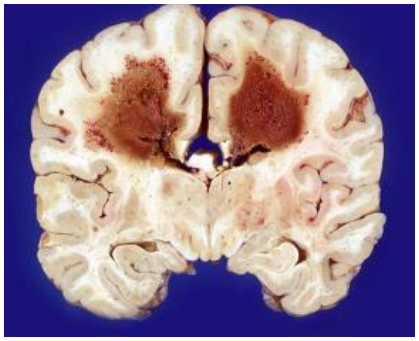
2. Oligodendroglioma

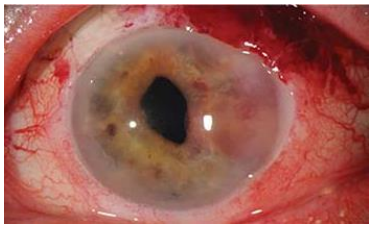
- Prognosis
  - Codeletion 1p/19q → Better prognosis and response to chemotherapy (alkylating agents)
  - Mixed tumours: oligoastrocytomas → prognosis = that of astrocytoma



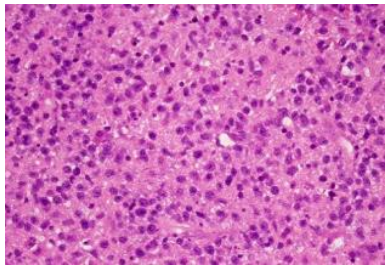
	Group 1	Group 2	Group 3	Group 4
age	43	51	30	52
response rate	(100%)	(100%)	(33%)	(18%)
duration response	>31 months	11 months	7 months	5 months
survival from dx	>123 months	71 months	71 months	16 months

3. Primary brain lymphoma





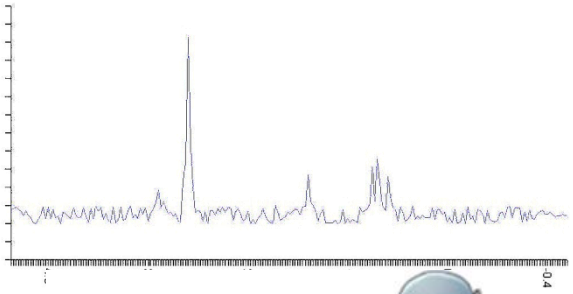
- Brain lymphoma (B cells)
  - **Primary** = Arises from microglia
  - Secondary to systemic lymphoma (more frequent than primary)

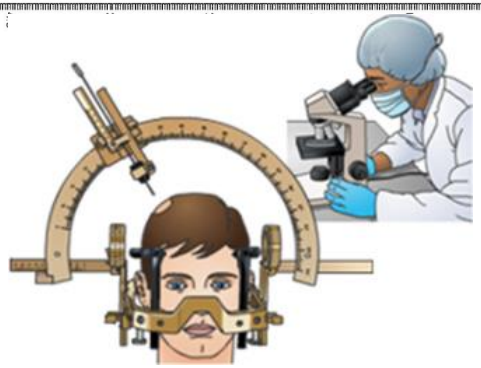


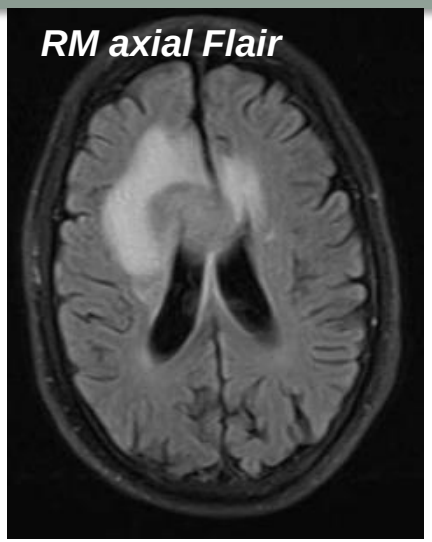
- Epidemiology
  - Rare (1% brain tumours)
  - Male ~ 40-50 years → 50-70 years
  - Immunocompromised (AIDS –EBV infection–, transplanted, elderly)
- Symptoms
  - Supratentorial SOL: cognitive alt, diplopia, dysphagia, vertigo…
  - Corticosteroids → Very marked but TRANSIENT response (“phantom tumour”)

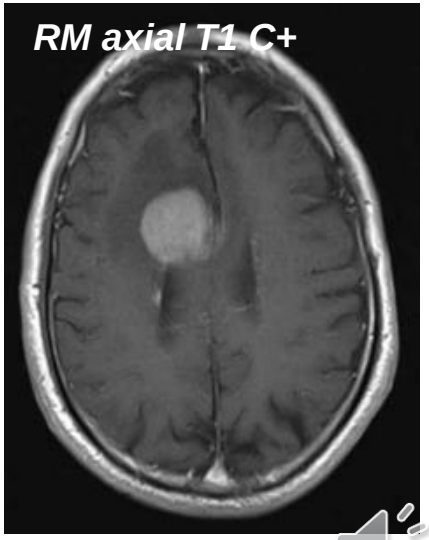
3. Primary brain lymphoma

- Neuroimage
  - Dense lesion, single or multiple (40 %, especially AIDS), periventricular white matter
  - Perilesional edema, ring uptake C+ (depends on malignancy)
  - MRI-spectroscopy
- CSF: ↑proteins and ↓glucose
- Treatment
  - Confirm etiology → Stereotactic biopsy
  - Protocols of hematology
  - Chemotherapy + radiotherapy

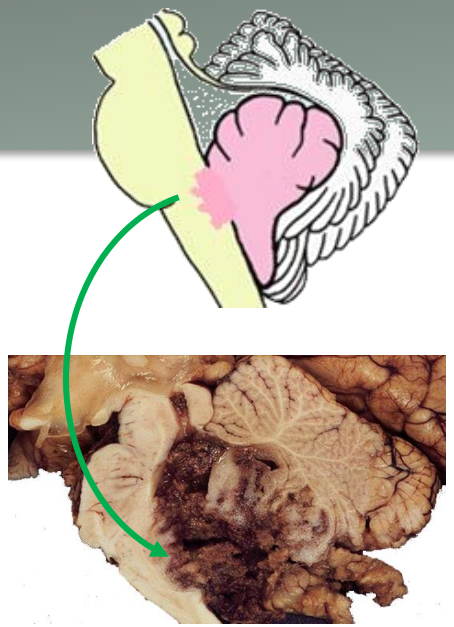




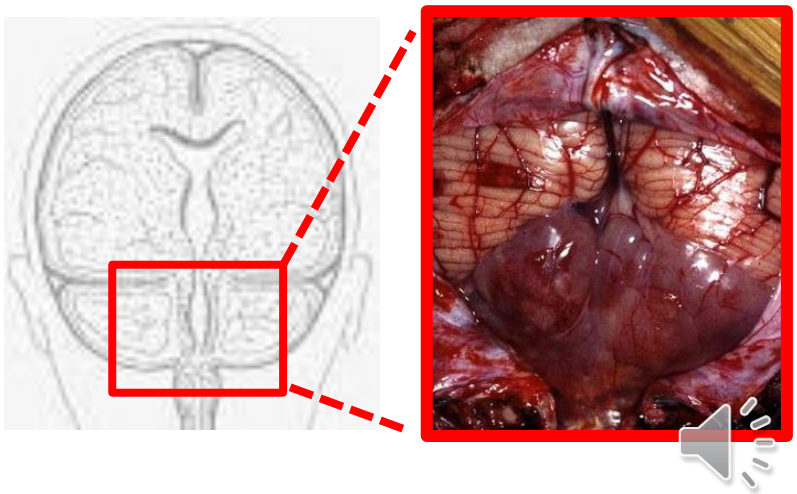




4. Ependymoma



- Origin: ependymal cells
  - Ventricles = young children < 20 years → fourth ventricle
  - Spinal canal = Adults → filum teminale
    - *Most frequent, most benign, best prognosis*
- Epidemiology
  - 5 % of gliomas (3% brain tumours)
- Symptoms
  - Raised intracranial pressure (12-18 months) - hydrocephalus: headache, vomiting, ataxia, vertigo
  - Invasion of brainstem
  - Seeding through CSF



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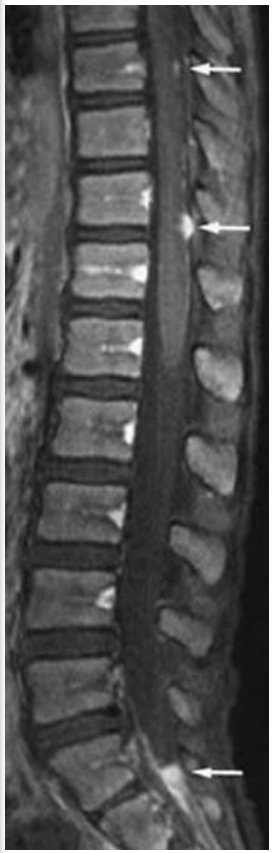
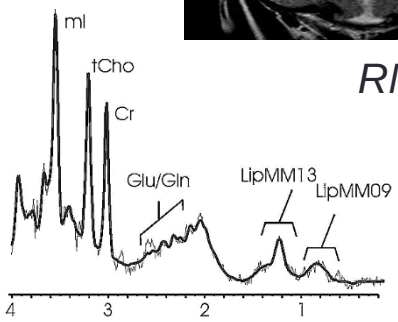
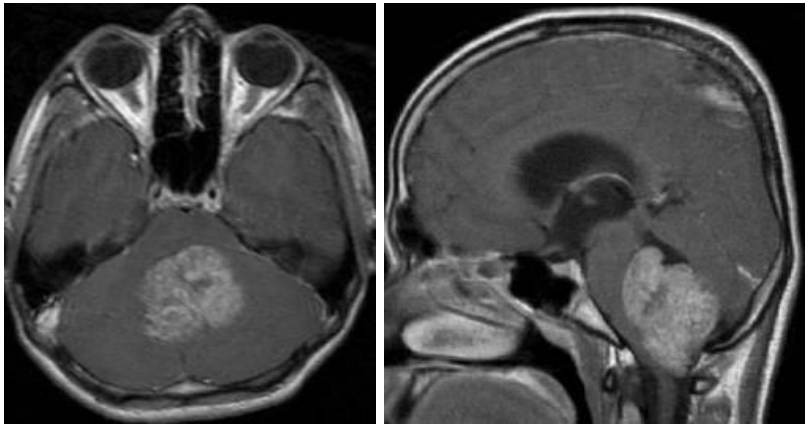


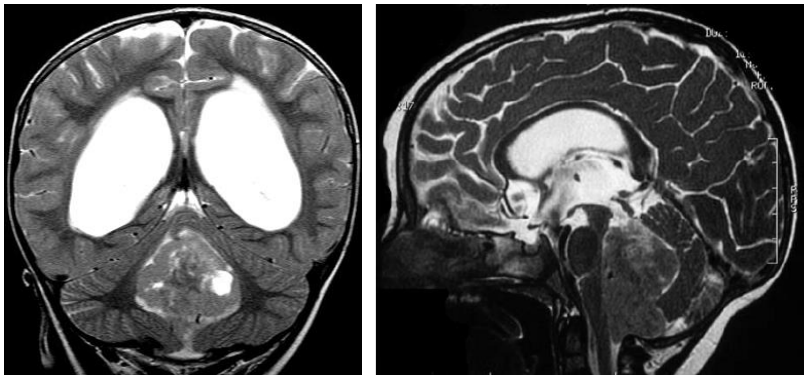
Metastasis Neuroaxis

- Diagnosis
  - Brain MRI
    - *Intraventricular tumour, homogeneous limits, content non-homogeneous*
    - *Obstructive hydrocephalus, with ↑ ventricular size depending on location of tumour*
  - Spinal cord MRI (C+D+L)
  - MRI-spectroscopy



RM T1 axial and sagittal

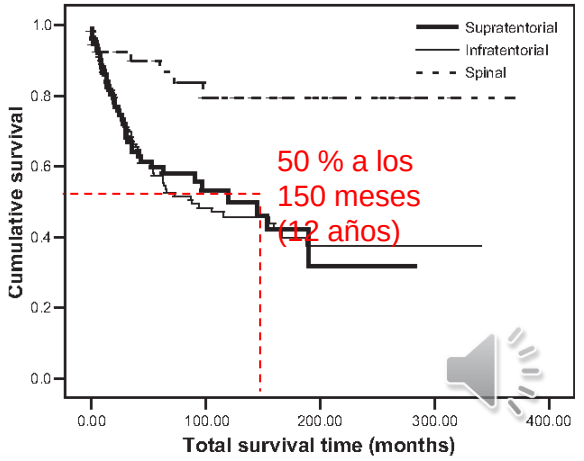




RM T2 coronal and sagittal

4. Ependymoma

- Pathology
  - Grade I – subependymoma, mixopapillary ependymoma
  - Grade II – ependymoma (papillary, clear cells…)
  - Grade III – anaplastic ependymoma
- Treatment
  - Surgery + radiotherapy ENTIRE NEUROAXIS + chemotherapy depending on aggressiveness.
    - *Radiotherapy children → psychomotor retardation (especially < 6 years)*
  - Hydrocephalus → ventricleperitoneal shunt / ventriculostomy
- Prognosis
  - 5-year survival 80 %
  - Recurrency 33 % in children
  - Better prognosis if complete excision
  - Worse if dissemination through neuroaxis



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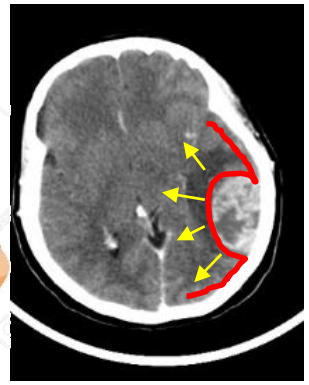
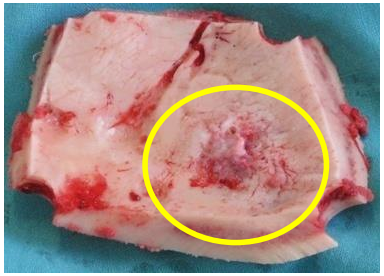
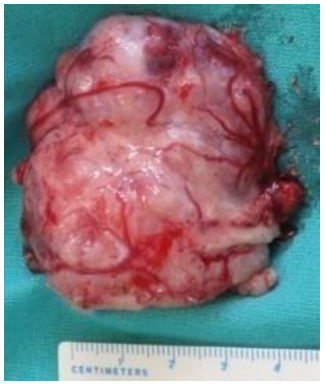
MENINGIOMAS

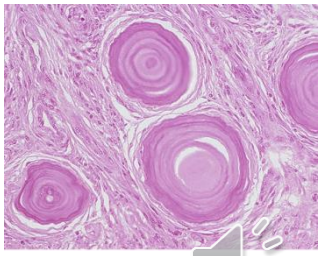
- Origin: arachnoid (arachnoid granulations)
- Epidemiology
  - 2nd most common intracranial tumor (20 %)
    - *Most common extraparenchymal tumour*
  - Female (2:1) age 40-60 years



- Characteristics
  - Benign (95 %) → Most commonly found in autopsies
    - *Complete resection = healing*
  - Slow expansive growth
    - *Encapsulated*
    - *Invades skull (not brain) and adjacent dura (dural tail)*
    - *Calcification (psammoma bodies)*

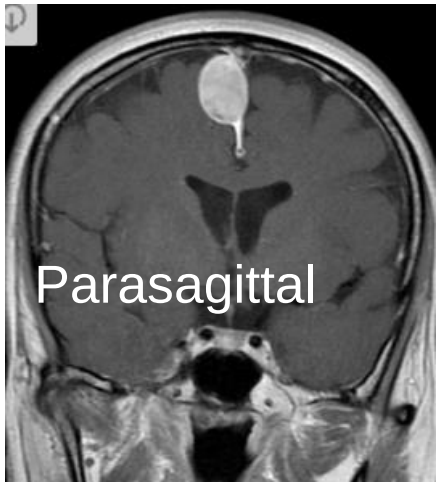


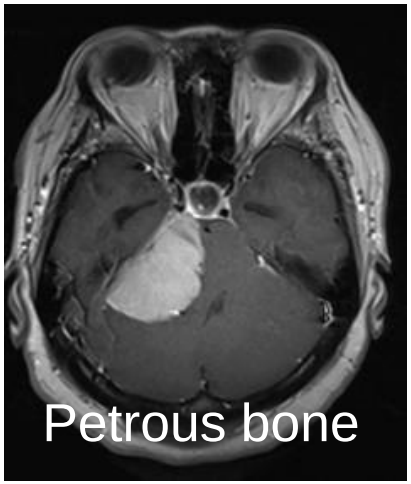




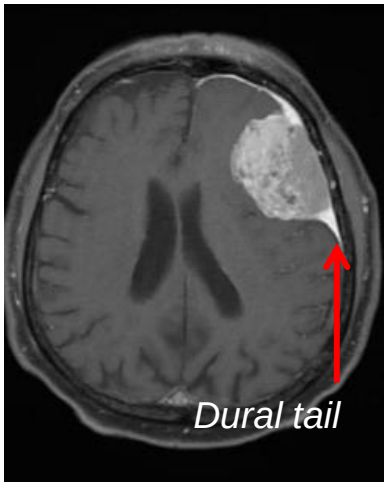
Meningiomas

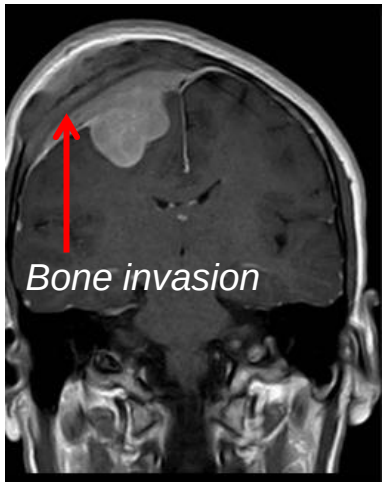
- Location

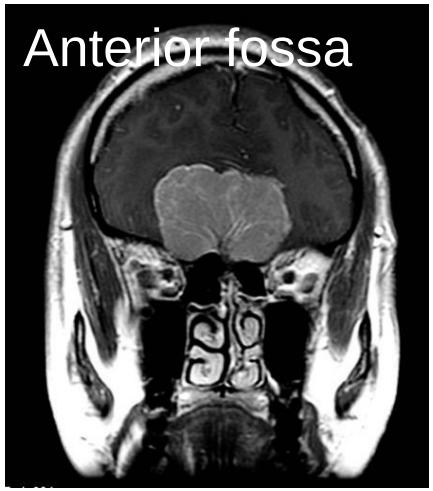


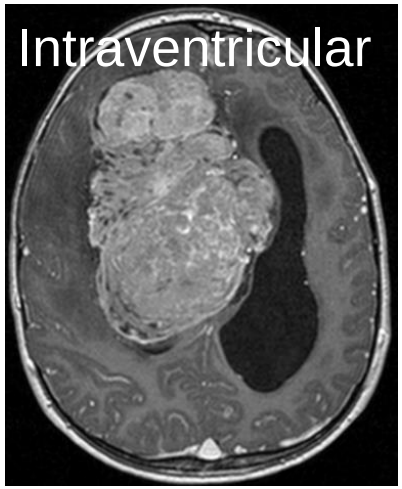


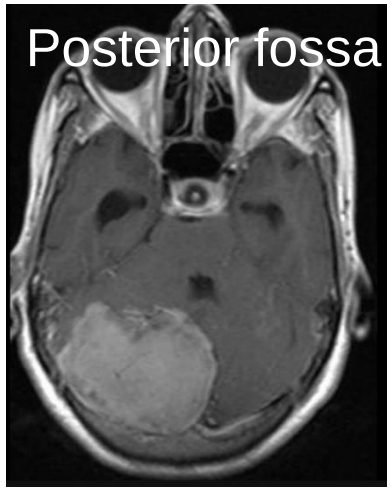
Convexity

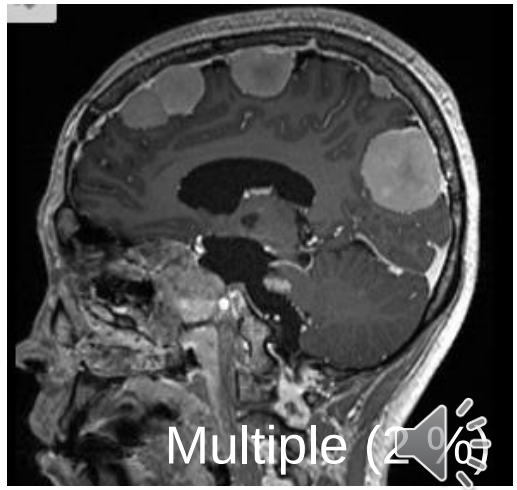






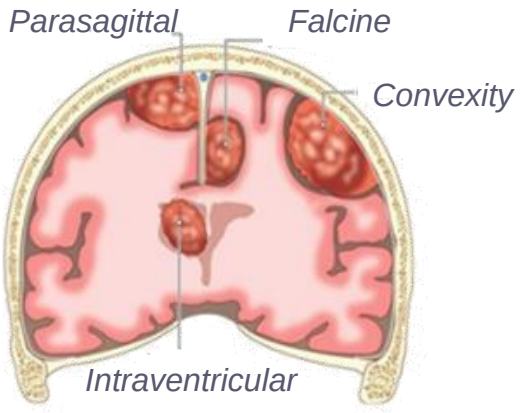


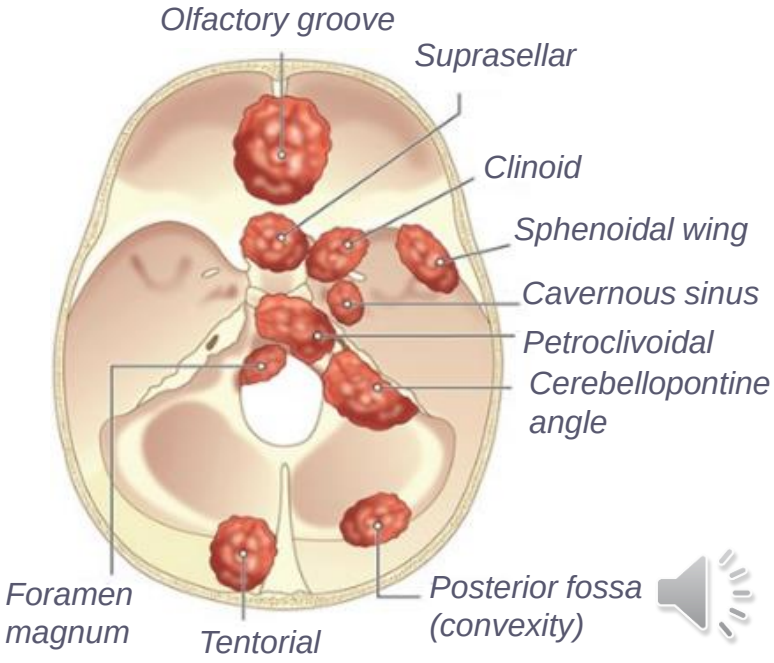




Meningiomas

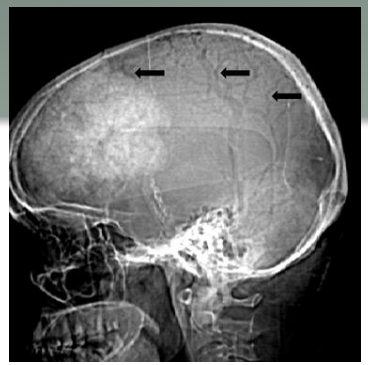
- Symptoms: depend on location
  - Compression adjacent structures
    - *Focal epilepsy, frontal syndrome (alterations behaviour)*
    - *Paresthesia or hypoesthesia*
    - *Hemianopsia*
    - *Cranial nerves involvement*
  - Lesser sphenoidal wing or olfactory groove → Foster-Kennedy syndrome (anosmia + homolateral optic atrophy + contralateral papilledema)
  - Foramen magnum → differential diagnosis with amyotrophic lateral sclerosis



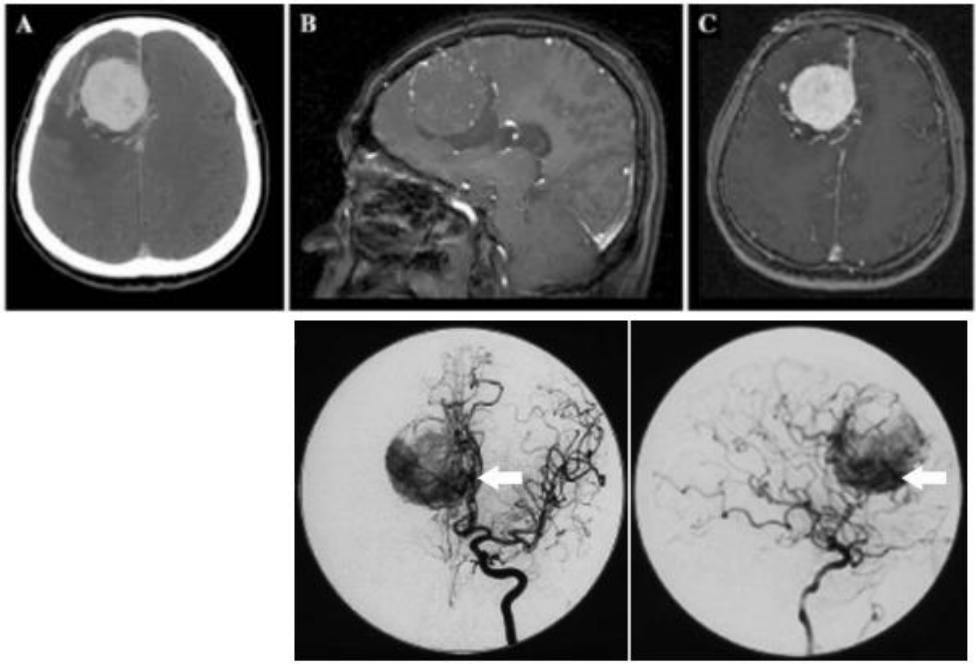


Meningiomas

- Diagnosis
  - Neuroimage → well-limited lesion, iso- or hyperintense
    - *Extra-axial tumour base in dura, homogeneous C+ uptake*
    - *Spectroscopy*
  - Vascular study
    - *Diagnostic or therapeutic angiography (vascular supply from internal carotid – meningeal artery)*
    - *Embolization*
  - Marker EMA *(epithelial membrane antigen)*

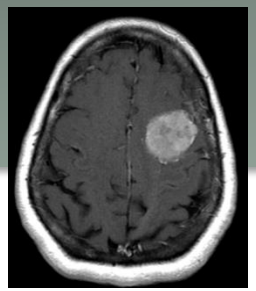
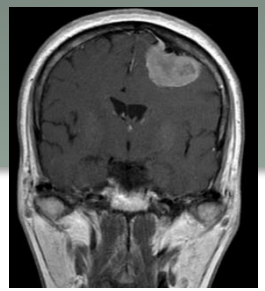


Simple Rx: giant frontal meningioma

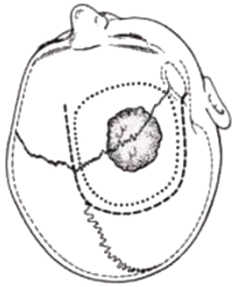
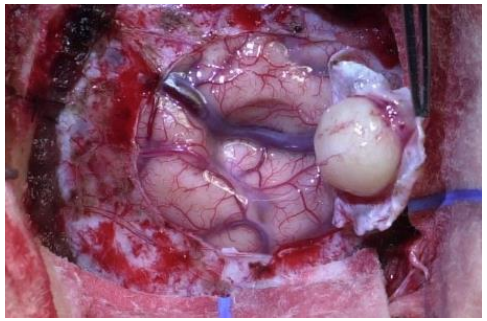


Falcian meningioma – MRI and angiography of vascular supply

Meningiomas

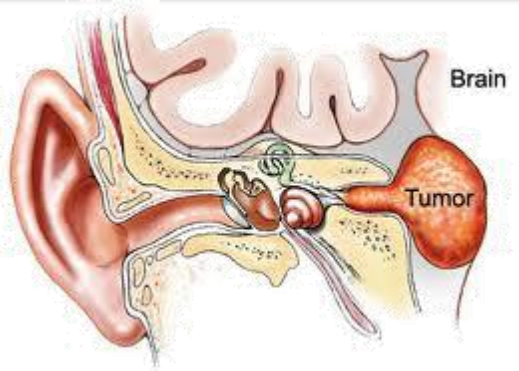



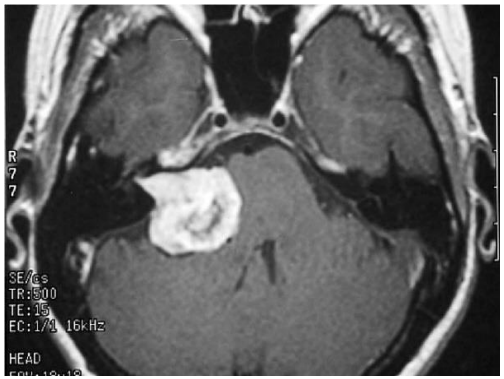
- Treatment
  - Expectant: observation
    - *Lineal progressive growth 4.94 cc/year (≈ ↑∅ 0.37 cm/year)*
    - *23 % do not grow*
    - *Patients in poor physical status, elderly, ∅ < 1 cm and asymptomatic, refusal to undergo surgery*
  - Complete resection = tumour + infiltrated dura and bone
    - *Survival > 90 % at 5 years*
    - *Recurrence 11-15 % at 5 years*
  - Partial resection or atypical (malignant)
    - *Fractional radiotherapy*
    - *Radiosurgery (if remainder < 3 cm)*
    - ➢ *Recurrence 37-85 % at 5 years*

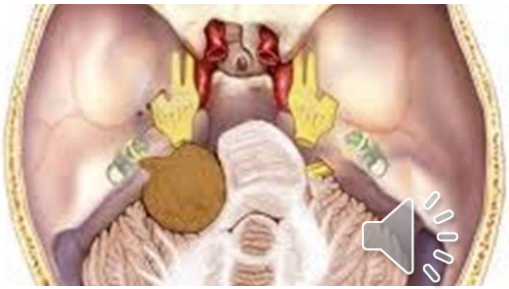




SCHWANNOMAS (~~neurinoma~~)

- Origin: Schwann cells of nerve roots
  - Any nerve root or cranial nerve EXCEPT the second (with oligodendroglia, not Schwann cells!)
  - Most common in eighth > fifth> seventh
    - *"Acoustic neurinoma", but it is vestibular branch*
- Most common CPA tumour
  - Differential diagnosis: cranial base meningioma, epidermoid
- Epidemiology
  - 8 % intracranial tumours
  - Benign slow growth
  - Female, middle-aged (> 30 years)
  - When bilateral (< 40 years) = diagnostic criterion NF-II

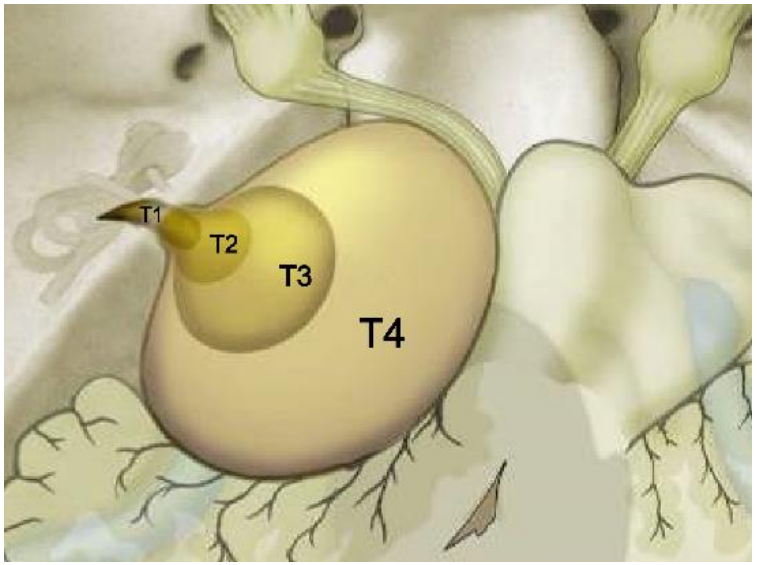


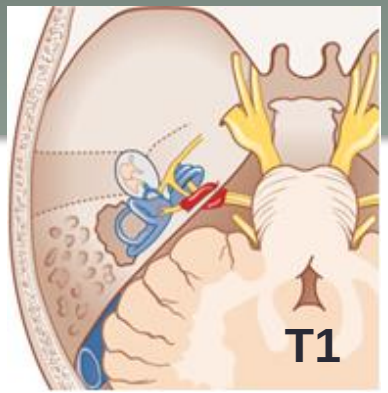


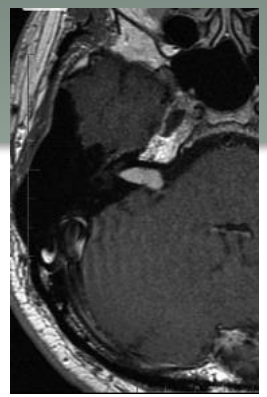


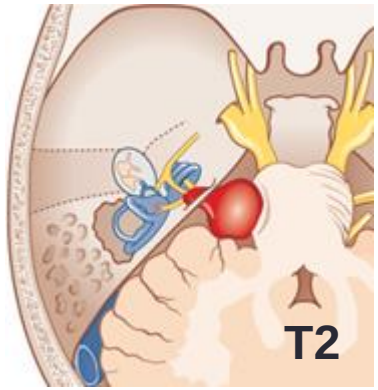
Schwannomas

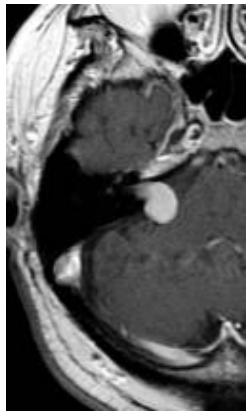
- Symptoms (eighth > fifth > seventh)
  - Tinnitus (98 %)
  - Neurosensorial hearing loss (70 %)
  - Balance disturbance (67 %)
  - Headache, facial paresthesia (30 %)
  - Facial paresis, diplopia (10 %)

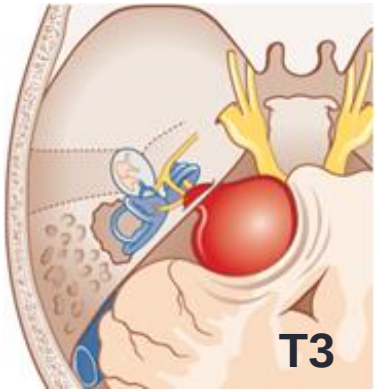


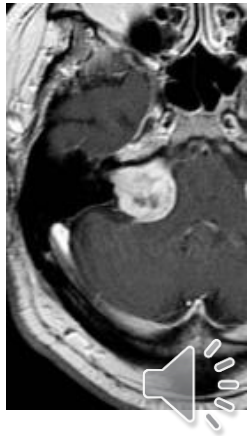






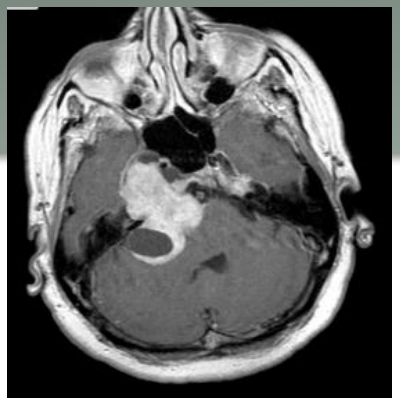




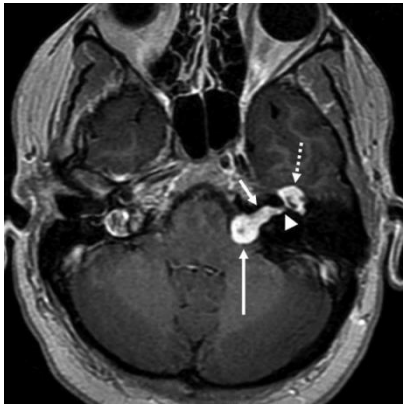


Schwannomas

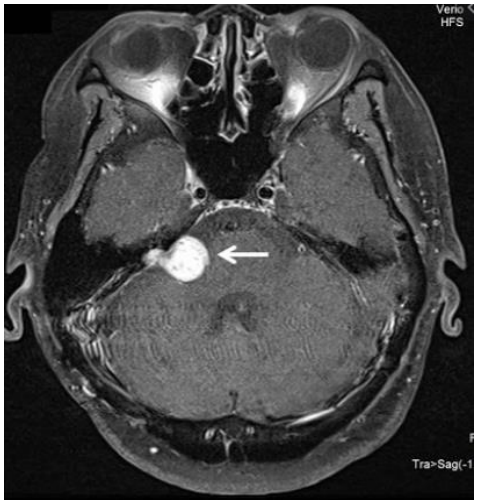
- Diagnosis: MRI *(isodense CT)*
  - T1 isointense, but T1 C+ good uptake
  - T2 sequences
- Screening NF-II
  - Autosomal dominant
  - Loss of function of NF2 tumour suppressor gene in 22q12.2.



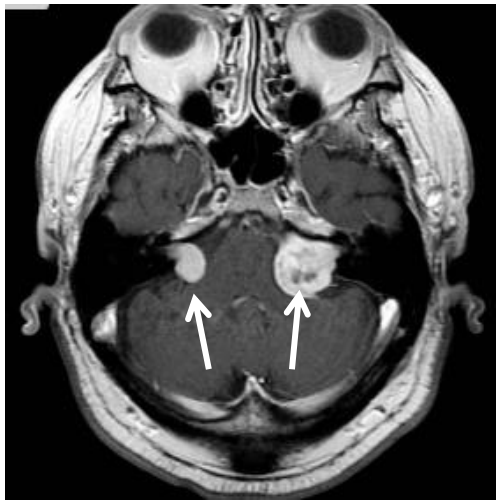
(2º) Trigeminal



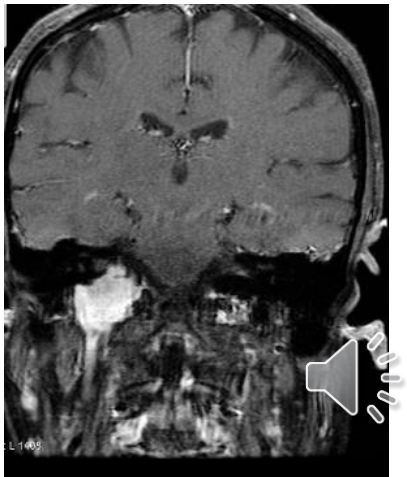
(3º) Facial



(1º) Vestibular

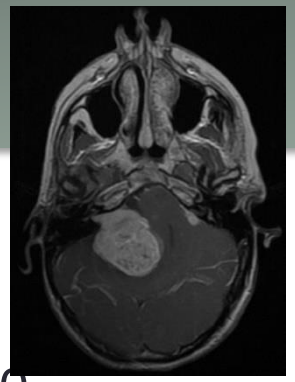


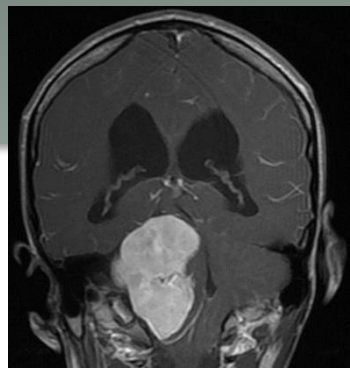
Vestibular bilateral



(4º) Jugular foramen (IX, X, XI)

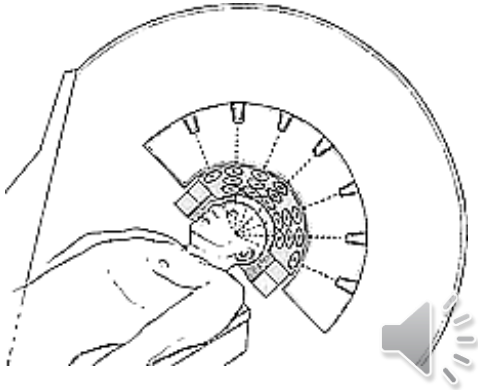
Schwannomas



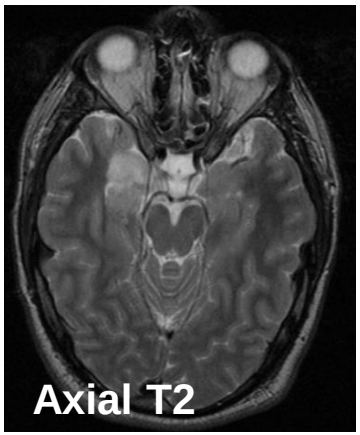


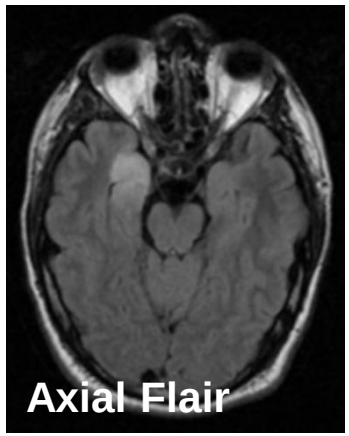
- Treatment = “surgery, and if it is not possible, radiotherapy”. BUT:
  - Tumour ∅ < 2cm asymptomatic and age > 70 years → control growth (RM)
  - Tumour ∅ 2-3 cm or bilateral → radiosurgery
  - Tumour ∅ > 3 cm → surgical resection
    - *Tumour remnants → radiosurgery*

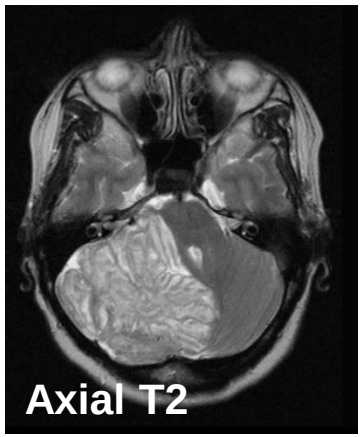
- Malignant schwannoma:
  - MPNST = *malignant peripheral nerve sheath tumour (*peripheral nerve neurofibrosarcomas)
  - Associated with NF-I (Von Recklinghausen)
  - Consider chemotherapy (Bevacizumab in study)

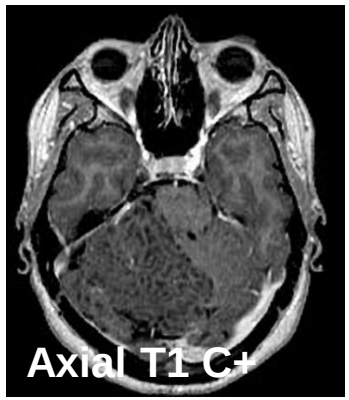


NEURONAL TUMORS









- Gangliocytomas and gangliogliomas
  - Mixed neuronal + glial cells
    - *Glial determine aggressiveness*
  - Rare (1 %), children-young adults
  - Location
    - *Temporal → Resistant epilepsy*
    - *Cerebellum: Lhermitte-Duclos Disease*
  - Diagnosis: MRI
    - *Looks like low grade astrocytoma, but no edema + no C+ uptake*
  - Treatment = surgery
    - *+ radiotherapy if remnants or malignant*

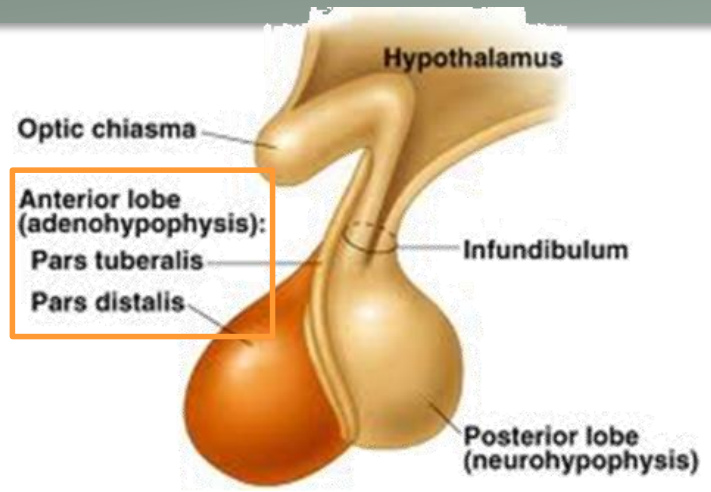
Simple teaching classification

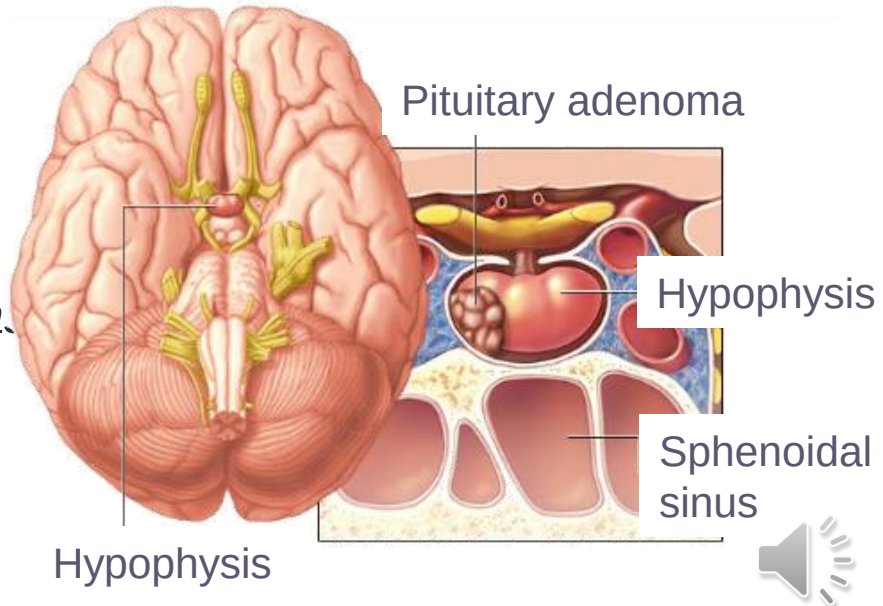
REMEMBER?

1. **Metastases and meningeal carcinomatosis**
2. **Glia:** *astrocytoma, oligodendroglioma, primary lymphoma, ependymoma*
3. **Meninges:** *meningiomas*
4. **Nerve sheath:** *cranial nerves schwannomas, paraspinal*
5. **Neurons:** *gangliogangliomа, neurocytoma*
6. **Glands:** *sellar region (hypophysis), pineal region*
7. **Choroid plexus:** *choroid plexus papilloma*
8. **Mesenchymal:** *glomus tumour, chordoma, solitary fibrous tumour (before hemangiopericytoma)*
9. **Embryonal remnants:** *craniopharyngioma*, *medulloblastoma, ETMR (embryonal tumour with multilayered rosettes, previously PNET)*

SELLAR REGION TUMOURS

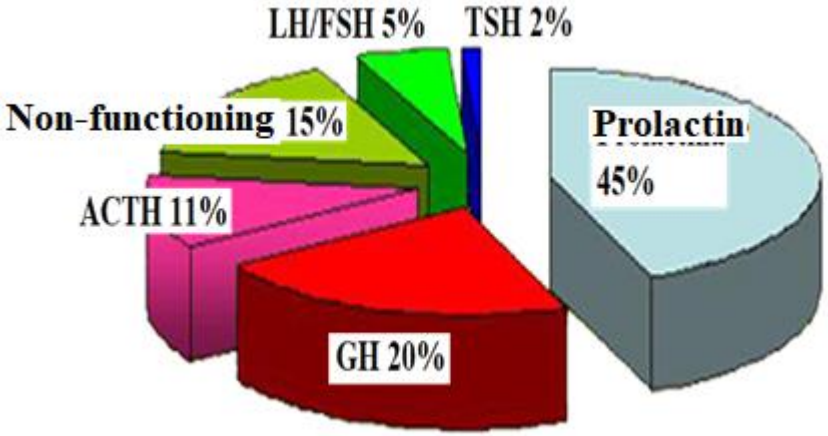
- Adenohypophysis (>>> neurohypophysis)
  - Benign (>>> malignant, 0.5%)
  - Involve the sella turcica
    - *NOT meningioma & craniopharyngioma*
- Incidence
  - 10 % primary brain tumours
  - Women 20-40 years old
  - Incidental finding in 25 % cases
  - MEN-I *(multiple endocrine neopla… type I)*
    - *Parathyroid gland, pancreas and pituitary adenomas (40-50 years)*
    - *Autosomal dominant 11q13*



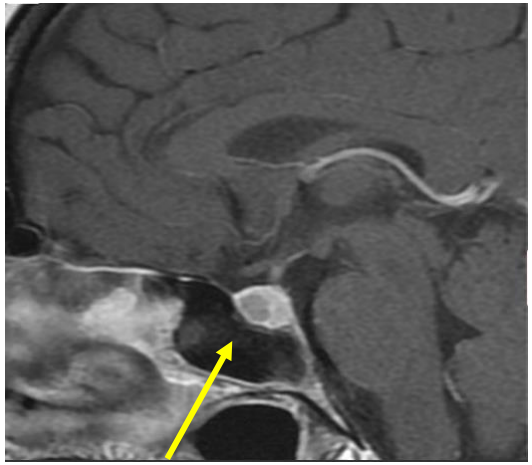


SELLAR REGION TUMORS

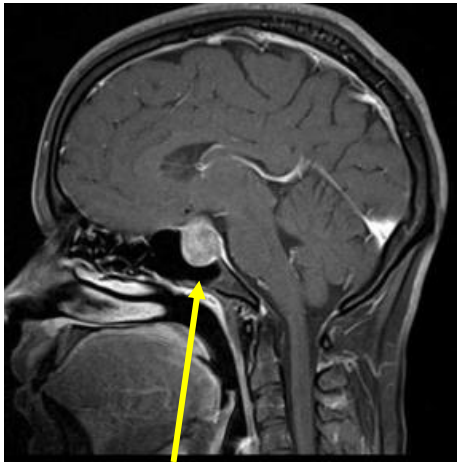
- According to secretion
  - Secreting or functioning (> 70 %)
    - *PRL > GH*
    - *Mixed PRL-GH*
    - *ACTH*
    - *Other hormones*
  - Non-secreting (chromophobes)



- According to size
  - Microadenoma (< 1 cm)
  - Macroadenoma (> 1-2 cm)



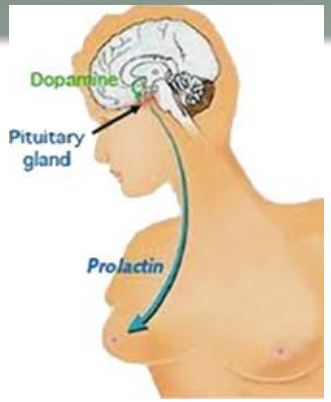
Microadenoma

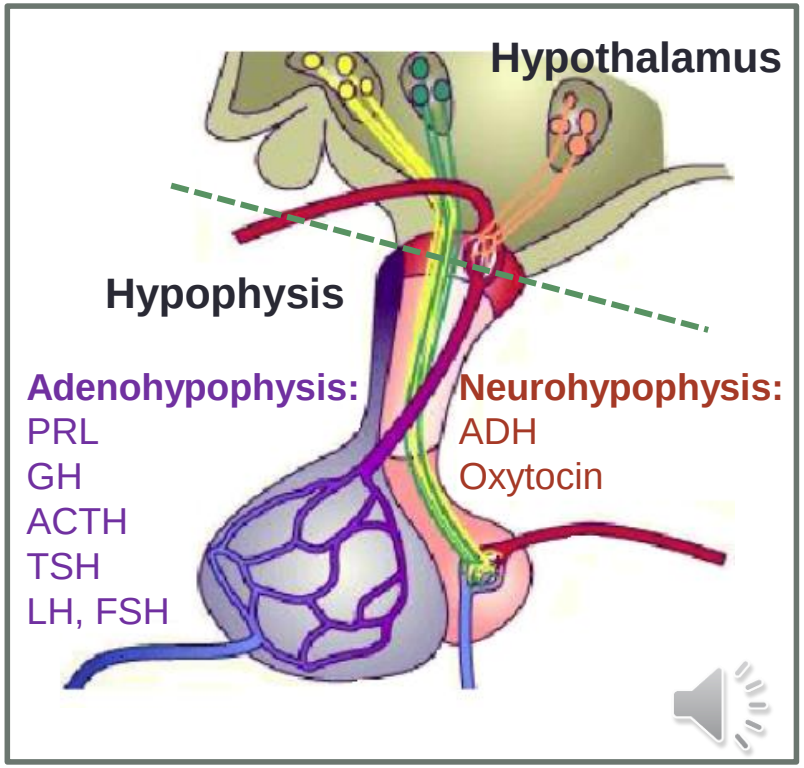


Macroadenoma

SELLAR REGION TUMOURS

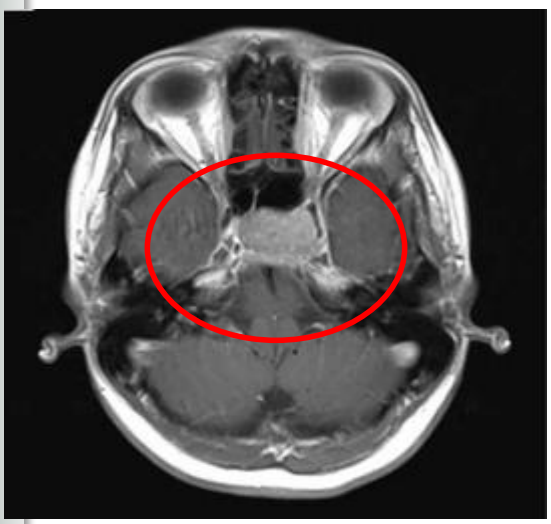
- Endocrine symptoms
  - Endocrine hyperfunction
    - *Amenorrhea-galactorrhea (♂sexual impotence), infertility*
    - *Gigantism (children) / acromegaly (adults)*
    - *Cushing's syndrome caused by ↑ACTH (= Cushing's disease)*
    - *Thyrotoxicosis*
  - Pituitary insufficiency (compression)
    - *FSH-LH → TSH → remainder*
    - *Hypopituitarism*
    - *Children: dwarfism*
    - *Pituitary apoplexy (rare)*

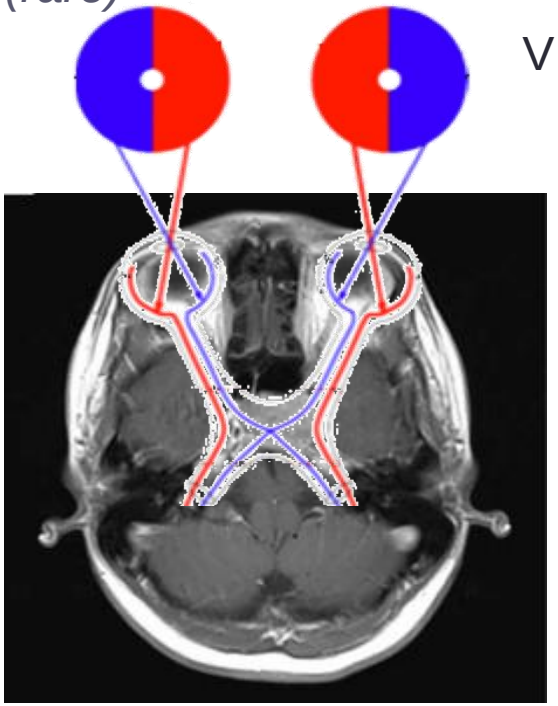


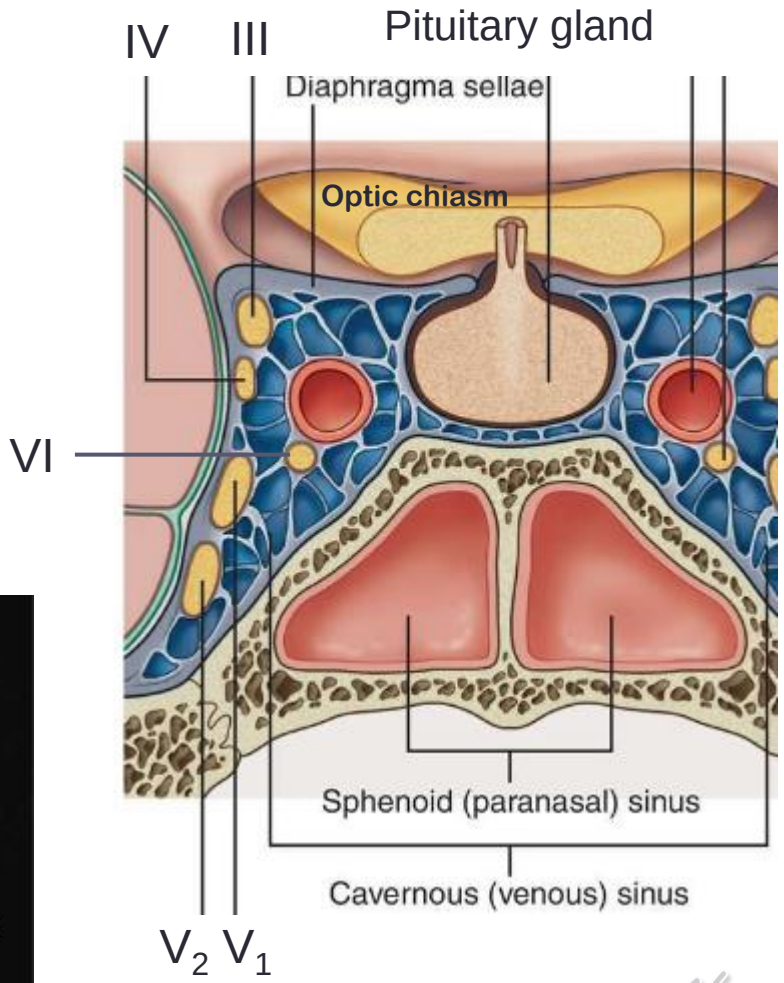


SELLAR REGION TUMOURS

- Symptoms due to mass effect
  - Visual loss due to chiasm compression
    - *Bitemporal hemianopia*
  - Other symptoms
    - *Cavernous sinus → third, fourth, fifth, and sixth cranial nerves*
    - *Rhinoliquorrhea (rare)*

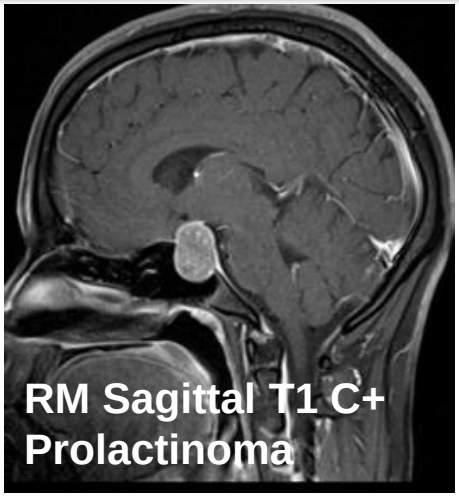






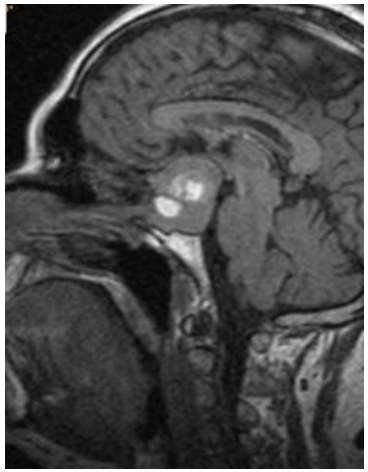
SELLAR REGION TUMOURS

- Diagnosis + response to treatment
  - Endocrine evaluation
    - *Hormonal involvement*
    - *Response to treatment, relapses*
  - Campimetry
  - Neuroimaging
    - *CT sella turcica → enlargement, erosion, peritumoral calcification*
    - ***Brain and pituitary MRI** → boundaries and extent, necrosis, haemorrhage*
    - ➢ *Microadenoma: angiography → petrosal sinus catheterization*

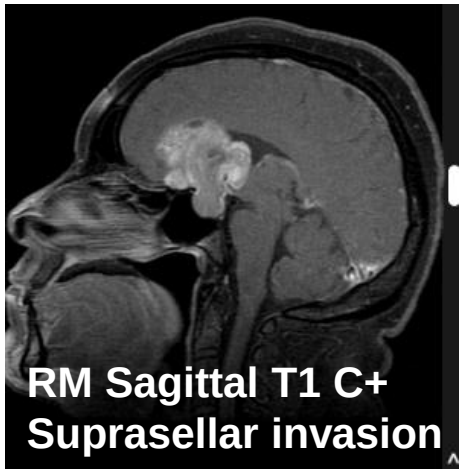


RM Sagittal T1 C+
Prolactinoma

RM Sagittal T1 C+
Sphenoid invasion



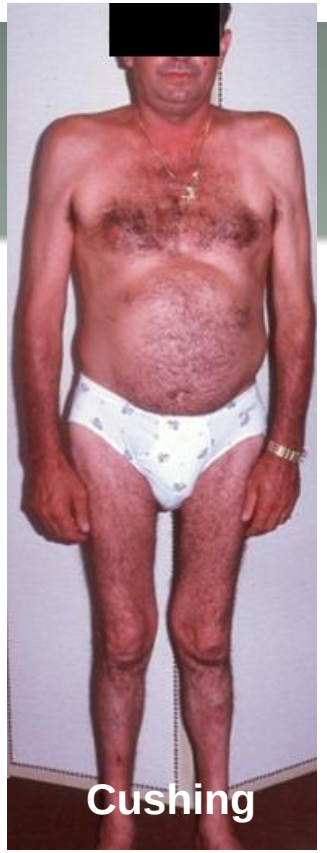
RM Sagittal T1
Intratumoral
haemorrhage

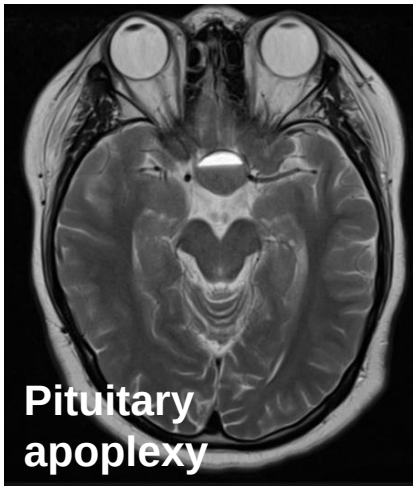


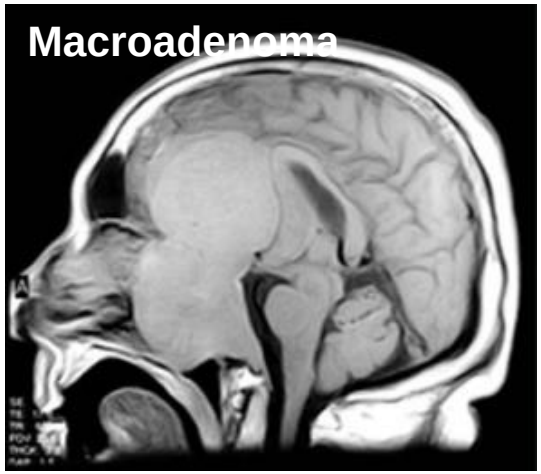
RM Sagittal T1 C+
Suprasellar invasion

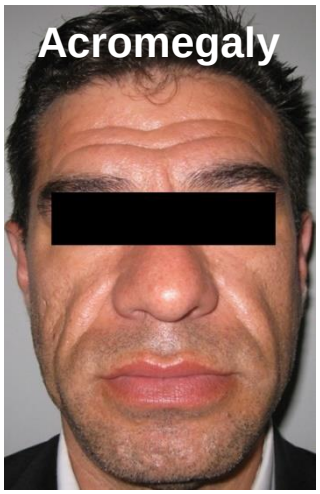
SELLAR REGION TUMOURS

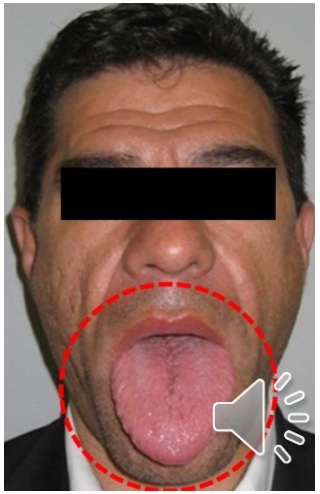
- Indication for surgical treatment
  - Pituitary apoplexy → URGENT
  - Macroadenoma with progressive mass effect
    - *Except prolactinoma: good response to medical treatment*
  - Hyperfunctioning
    - *Acromegaly, Cushing's, secondary hyperthyroidism*
  - Failure of hormonal medical treatment
  - Obtain histological diagnosis (non-functioning)





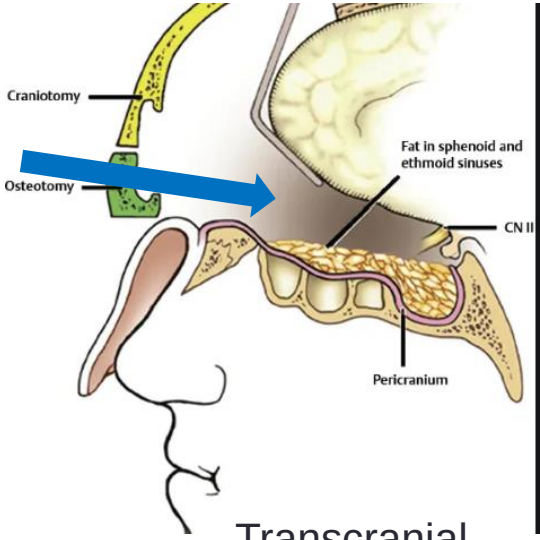




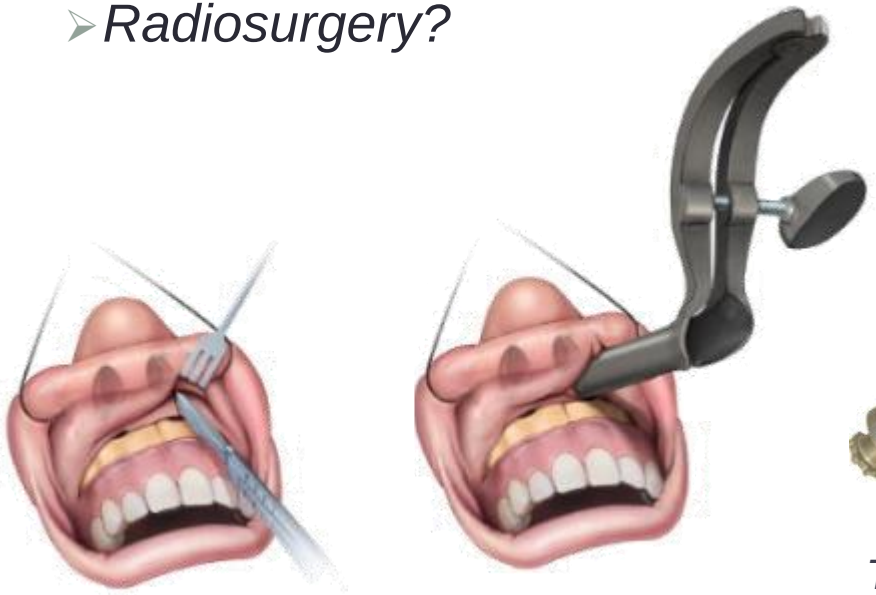


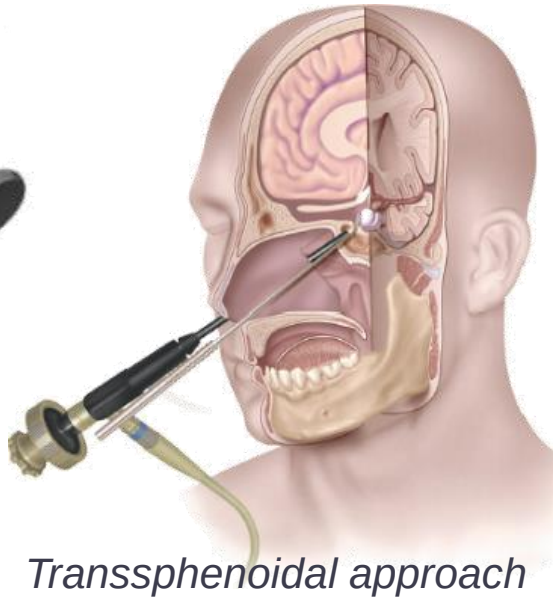
SELLAR REGION TUMORS

- Surgical treatment
  - Transnasal endoscopic route (transsphenoidal)
  - Craniotomy if large extrasellar invasion
- Radiotherapy - indications:
  - Giant tumours
  - Subtotal resection
  - *Radiosurgery?*



Transcranial approach

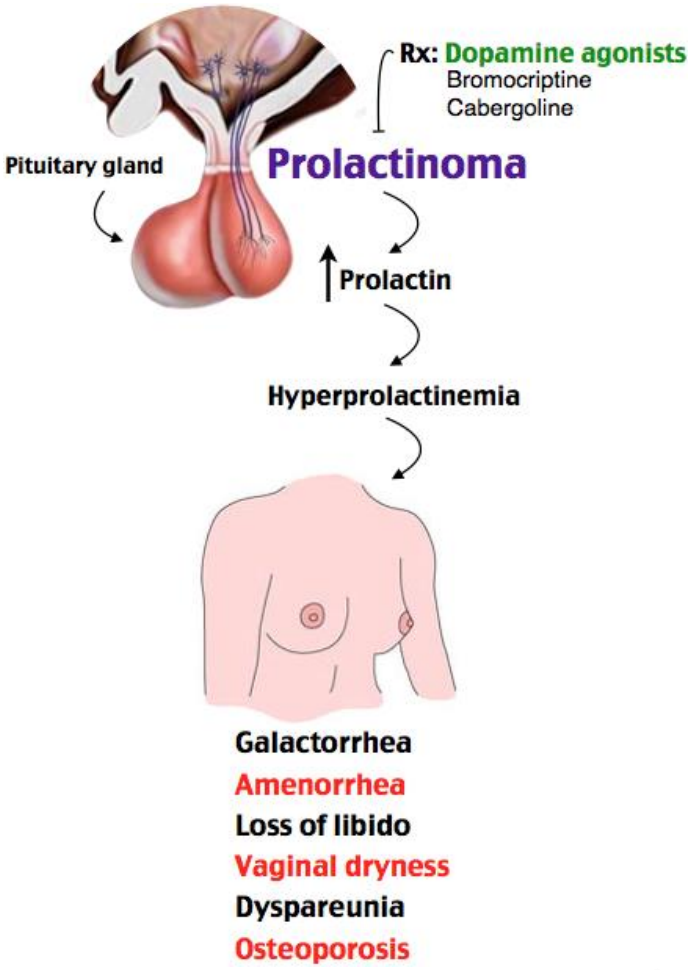




Transsphenoidal approach

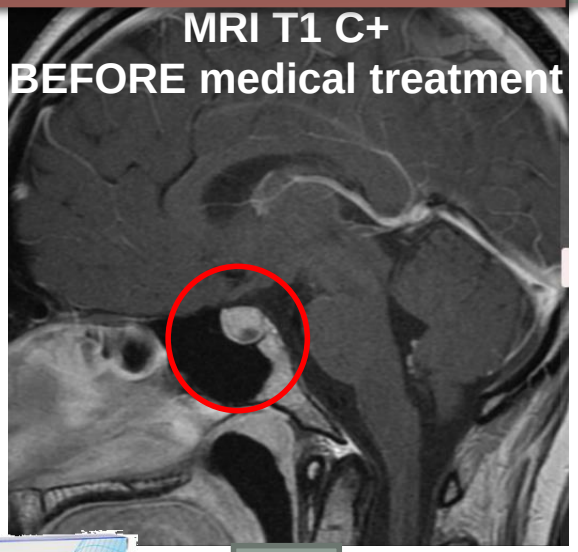
SELLAR REGION TUMORS

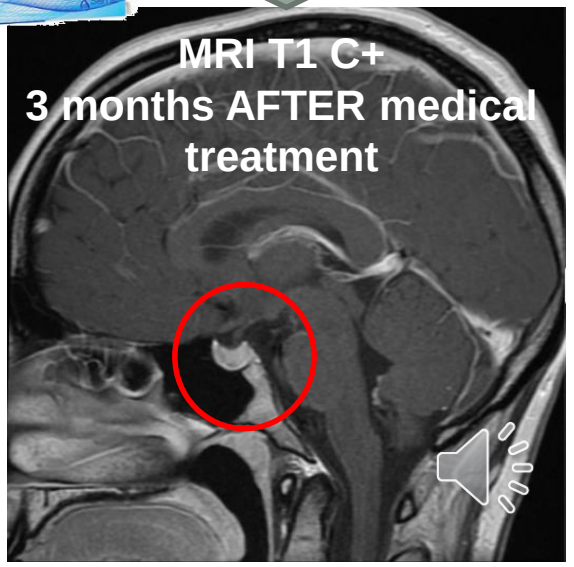
- Case 1: Prolactinoma
- Case 2: GH-secreting tumour
- Case 3: ACTH-secreting tumour
  - *Cushing's disease*
- Case 4: Non-functioning adenomas
- Case 5: Pituitary apoplexy



SELLAR REGION TUMOURS

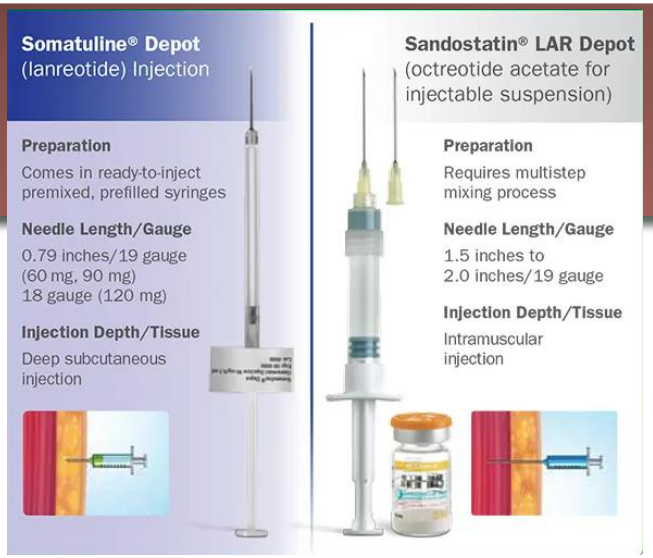
- Case 1: Prolactinoma
  - Medical treatment= Dopamine agonists (Bromocriptine, cabergoline)
    - *Reverses symptoms, but some do not respond*
    - *Once started cannot stop*
    - *Microprolactinoma → fertility 85 % cases*
    - *Macroprolactinoma → adjuvant treatment to surgical removal*
  - Pregnancy
    - *Not teratogen*
    - *↑tumour ∅ in 5-15 % cases*
  - Surgical treatment if mass effect
    - *Microadenomas → 88 % cure*
    - *Macroadenoma → 28 % cure*

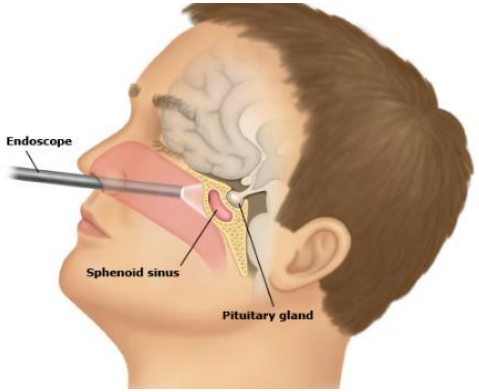


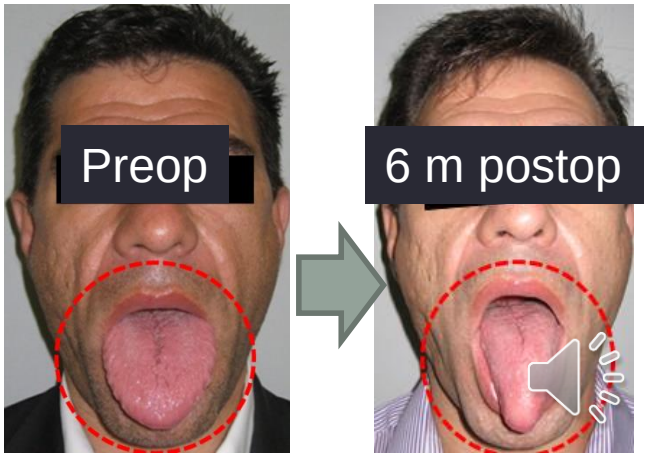


SELLAR REGION TUMOURS

- Case 2: GH-secreting tumour
  - Medical treatment = somatostatin analogues (octreotid, lanreotid)
    - *Antiproliferative effect, ↓GH, ↓tumour ∅*
    - *Dopamine analogues → Bromocriptine, cabergoline)*
    - *GH receptor antagonist → Pegvisomant*
  - Surgical treatment
    - *Microadenomas → curative treatment*
    - *Macroadenomas → maximum cytoreduction + medical treatment (relapses)*
  - Radiotherapy
    - *As an adjunct to surgery*
    - *Slows growth ~ 10 years*
    - *RADIOSURGERY*



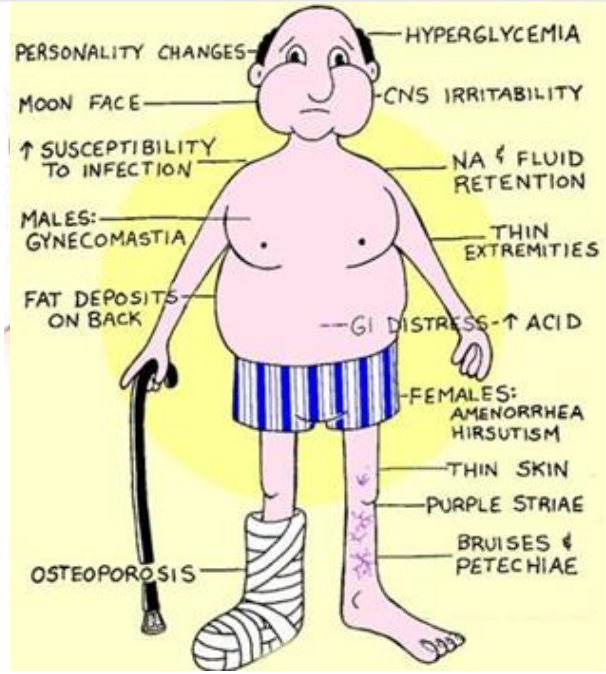


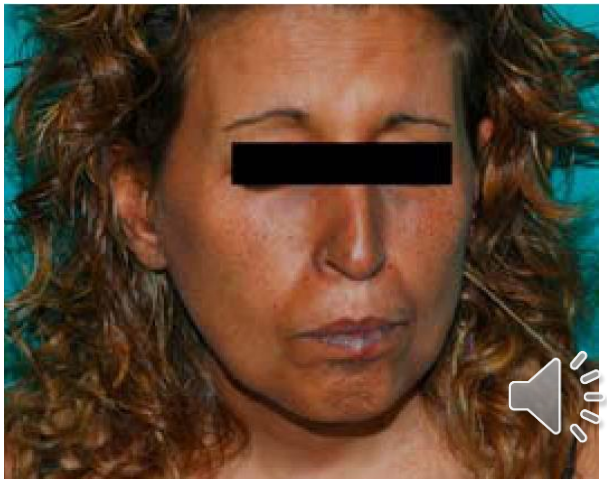


SELLAR REGION TUMOURS

- Case 3: ACTH secreting tumor
  - Cushing's syndrome features
  - Treatment = surgical
    - *Great improvement, 12 % relapses*
  - If surgical treatment fails:
    - *Radiotherapy ± radiosurgery*
    - *Palliative medical treatment*
      - Serotonin antagonists (↓ACTH synthesis)
      - Adrenal blockers
      - Glucagon antagonists
  - Last resort = bilateral adrenalectomy
    - *Nelson syndrome → corticotropic adenoma growth after adrenalectomy (skin hyperpigmentation)*

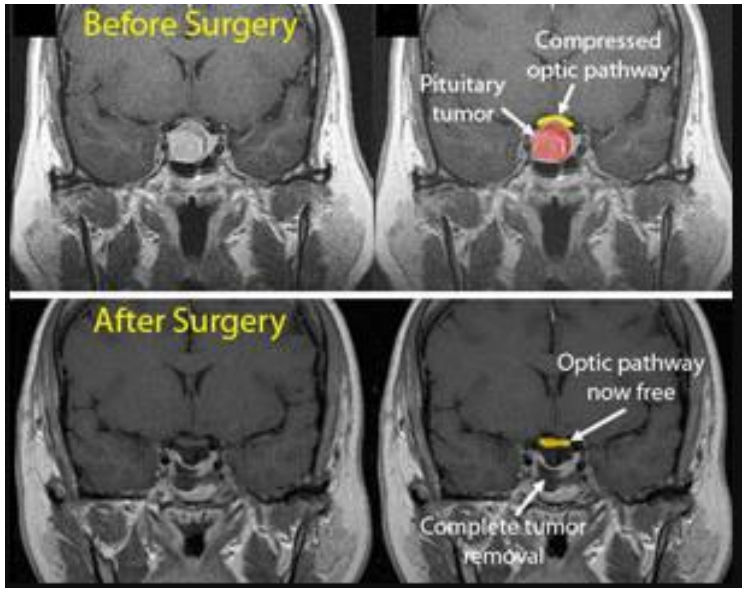
↑ACTH = Cushing's disease

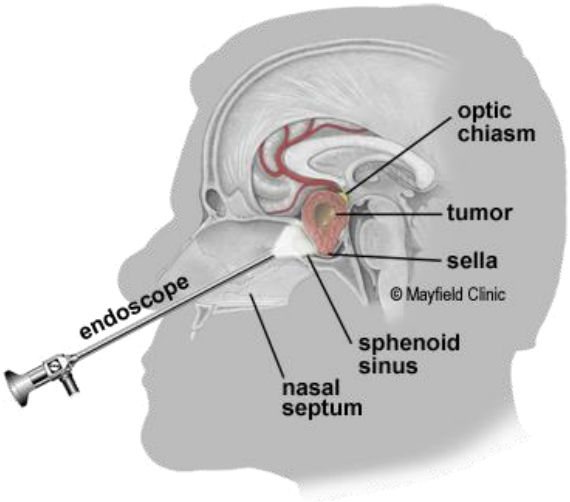




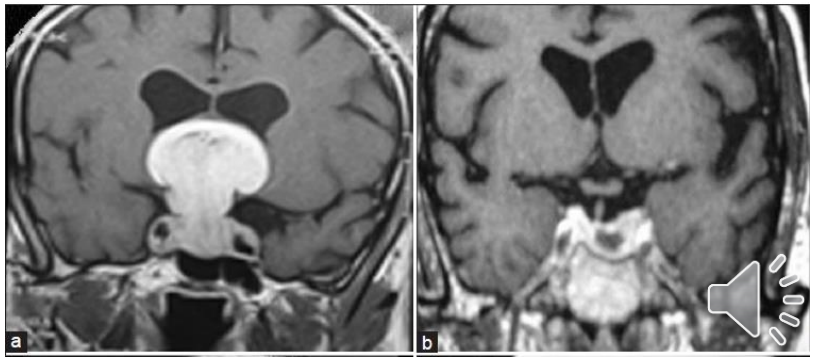
SELLAR REGION TUMORS

- Case 4: Non-functioning adenomas
  - 25 % pituitary adenomas
  - Many are macroadenomas (35 %)
    - *Headache, visual disturbance, mild hyper-PRL, hypopituitarism, ↓libido*
  - Treatment = surgical
    - *Radiotherapy only if rapid progression*
  - Result: rarely recur



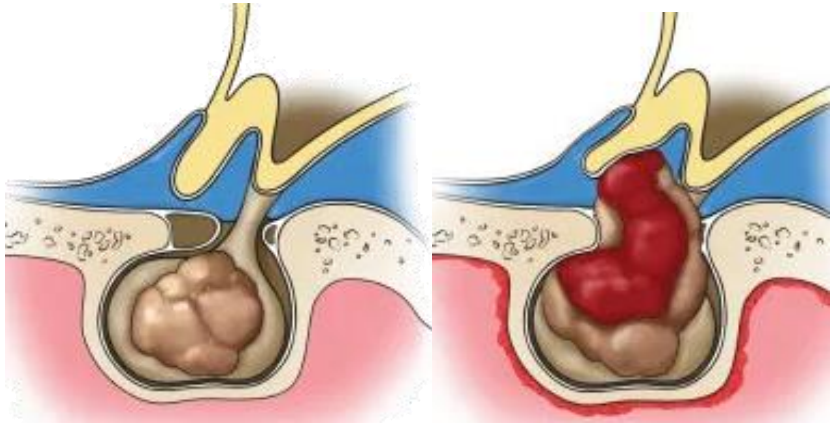


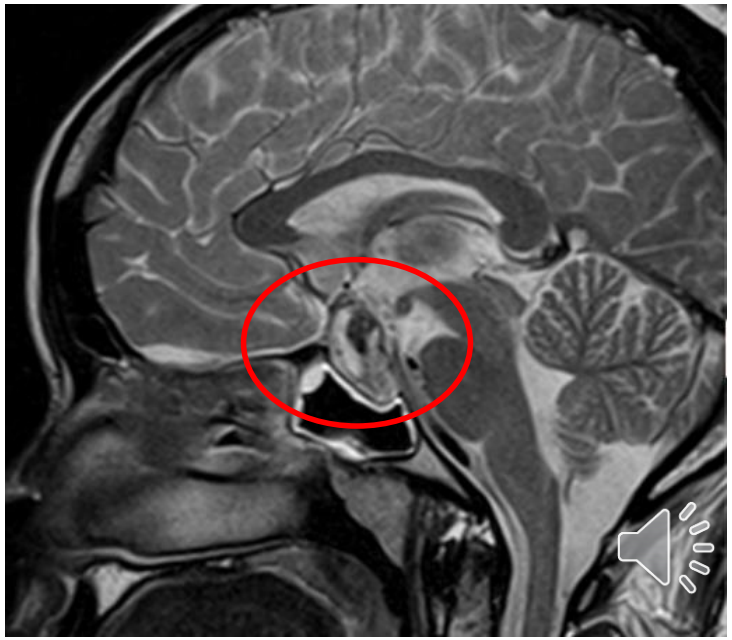
Preop *Postop*



SELLAR REGION TUMOURS

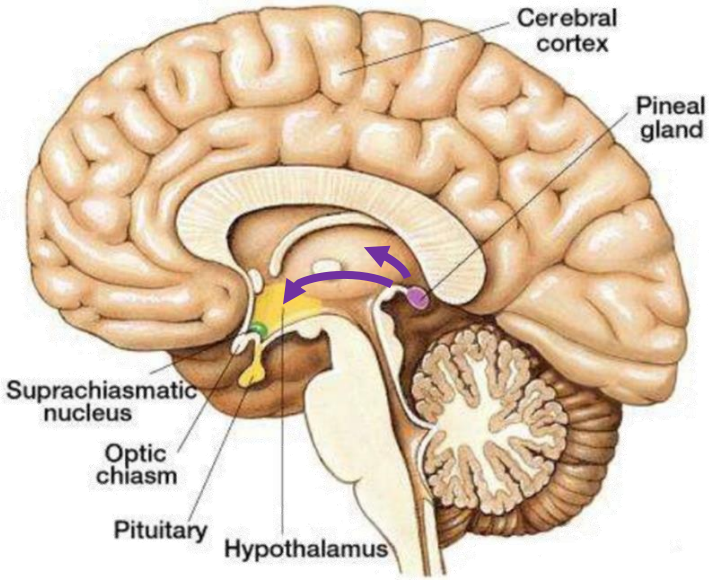
- Case 5: Pituitary apoplexy
  - Haemorrhagic infarction in pituitary adenoma
  - Clinic: acute headache
    - *Meningismus, visual disturbance, ophthalmoplegia*
    - *Consciousness impairment*
    - *Hypopituitarism*
  - **Neurosurgical emergency**
    - *Vital to make diagnosis*
    - *Glucocorticoid replacement*
    - ***Urgent surgical decompression***

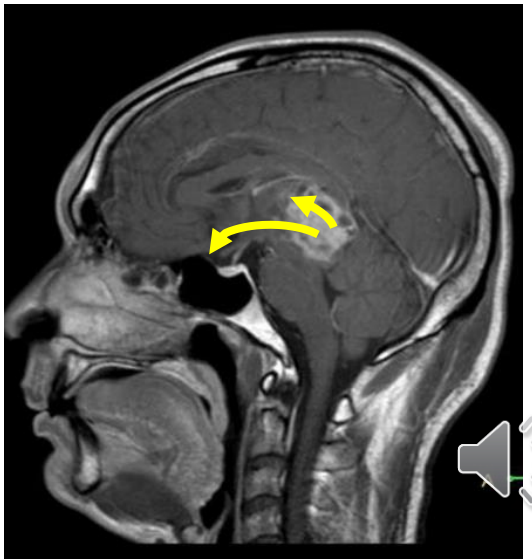




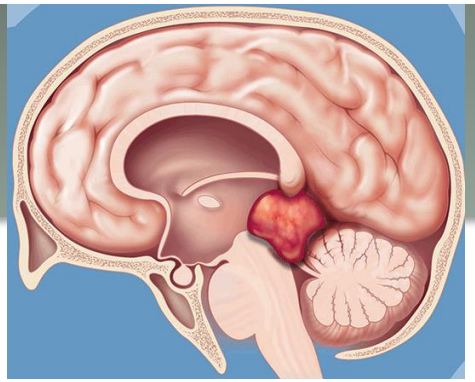
PINEAL REGION TUMOURS

- Most common in children-adolescents
- Clinical symptoms
  - Intracranial hypertension due to obstructive hydrocephalus → most frequent form of presentation (obstruction of the third ventricle / aqueduct Silvius)
  - Oculomotor disorder due to midbrain involvement
    - *Parinaud's sign = upward gaze paralysis*
  - Neuroendocrine symptoms → Precocious puberty, hypothalamic dysfunction
  - Cerebellar disorders, spinal cord involvement (cerebrospinal fluid)



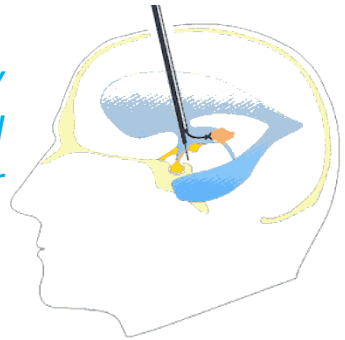


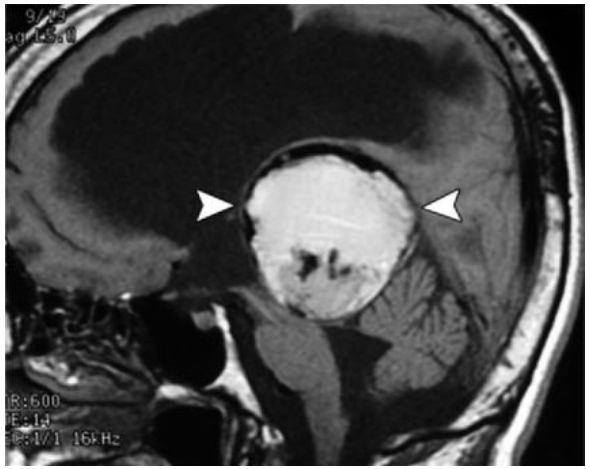
Pineal region tumors

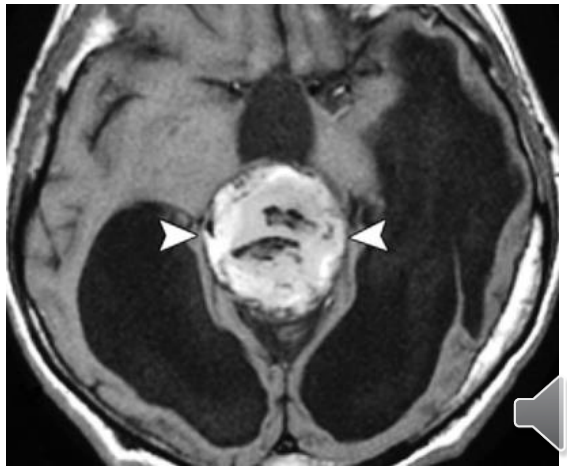


- Diagnosis
  - CSF tumour markers: not always present
    - *α fetoprotein → endodermal sinus tumour, embryonal carcinoma, teratoma*
    - *β hCG → choriocarcinoma, germinoma (10 %)*
    - *CEA (carcinoembryonic antigen)*
  - Neuroimaging
    - *Size-related malignancy, inhomogeneity, imprecise limits, high contrast uptake (highly vascularized)*
    - *Look for seeds (complete medullary MRI)*
  - BIOPSY

Biopsy pineal tumor

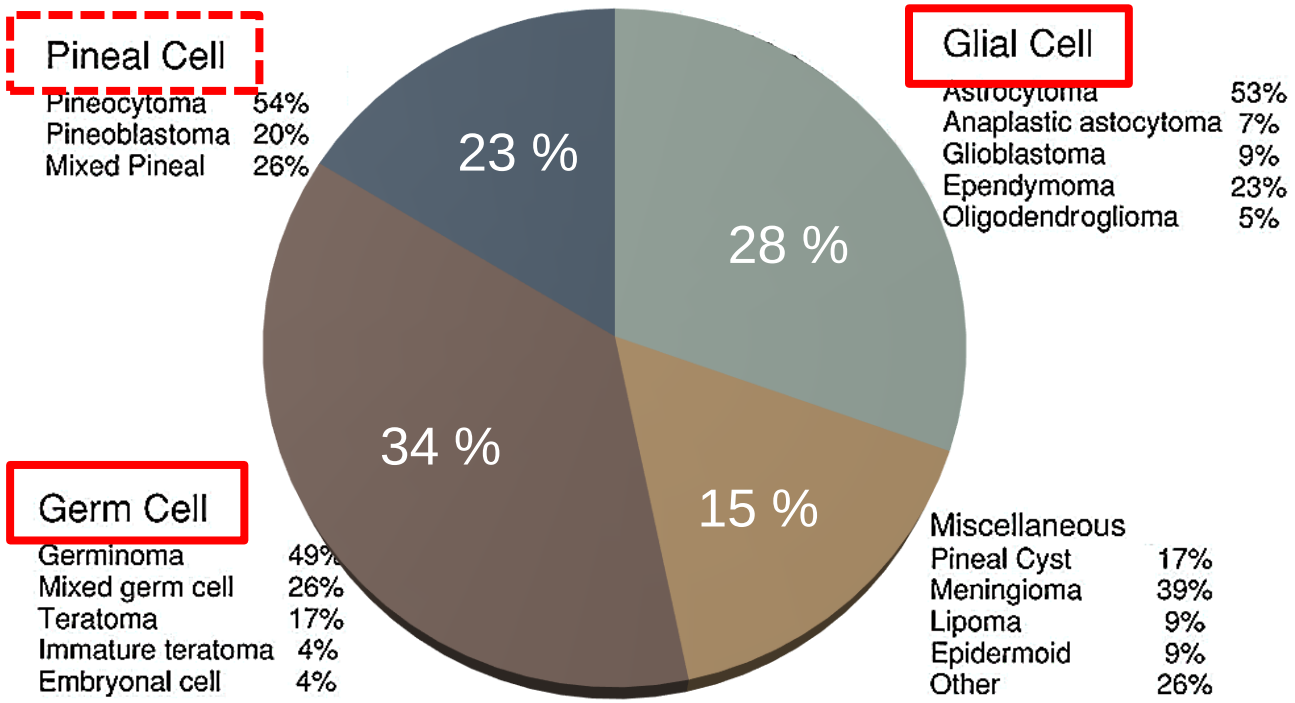




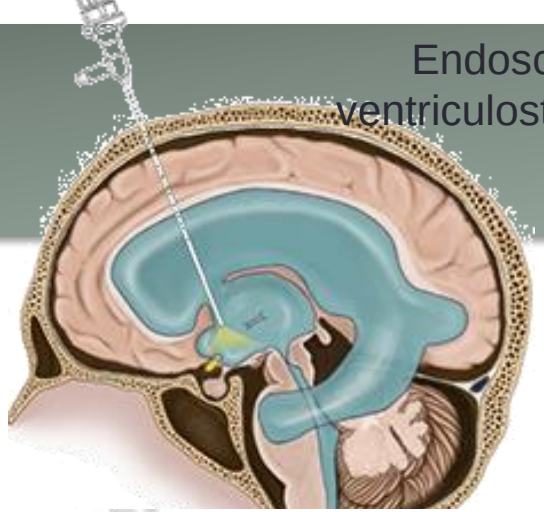


Pineal region tumours

- High histologic variation
  - GERMINOMAS> astrocytomas, pineocytomas, pineoblastomas, non-germinomatous tumours (teratomas)

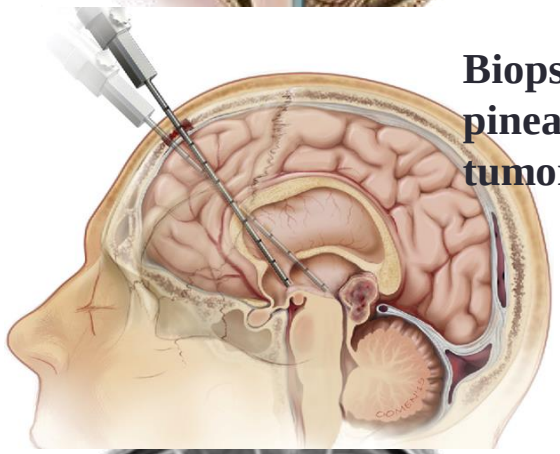


Pineal region tumours

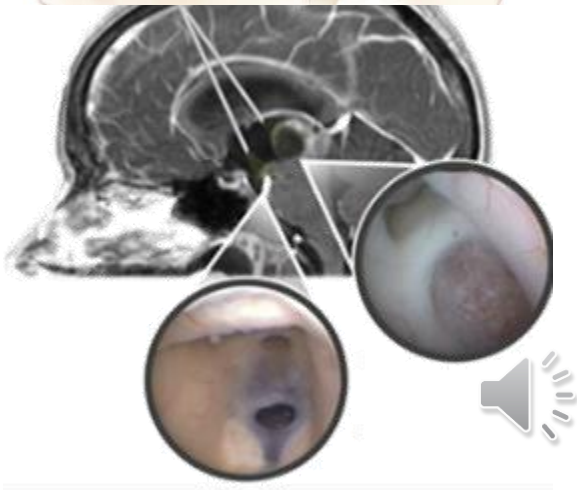


Endoscopic ventriculostomy

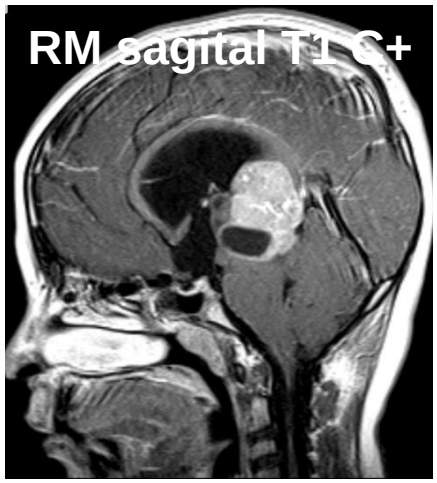
- Treatment
  - Hydrocephalus → endoscopic Ventriculostomy (+ biopsy)
  - Tumour = radio + chemotherapy (± surgery)
    - *If it is a germinoma, "it is sensitive to radio + chemotherapy" (other germ cells?)*
    - *Non-germ: surgery + radiotherapy + chemotherapy*
    - *Protocols variable according to hospital*
- Prognostic
  - Average survival 5-6 years, but it is highly variable
  - Better in germinal tumours (they respond to radiotherapy)

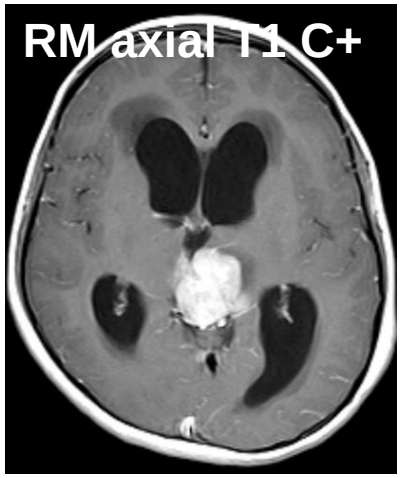


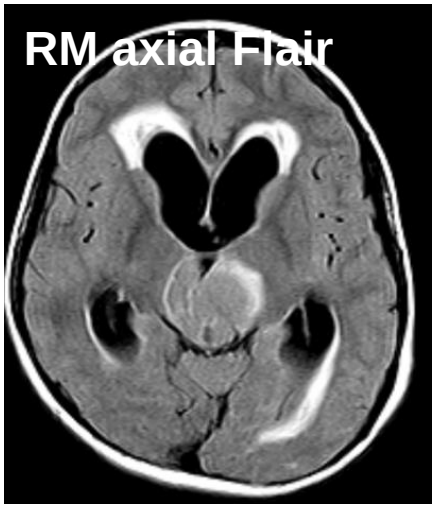
Biopsy pineal tumor

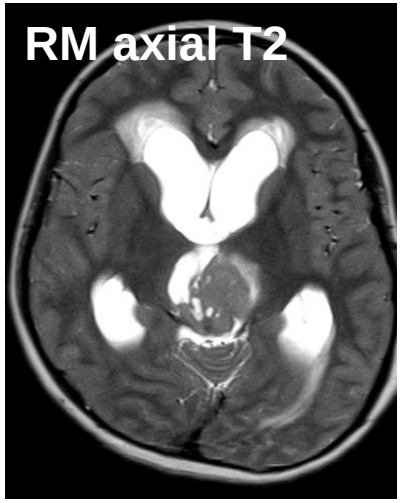


Pineal region tumours









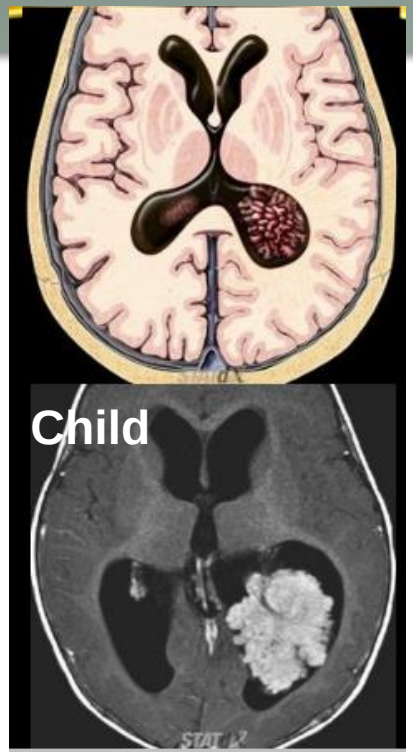
- GERMINOMA
  - Germinal cell tumours
  - Adolescents (2nd decade)
  - Third ventricle or pineal region
  - Possible aggressive and invasive
  - Clinical features:
    - *Possible hypothalamic dysfunction (diabetes insipidus)*
    - *Visual field disturbance, hydrocephalus*
  - Sensitive to radio and chemotherapy
  - 85% 5-year survival

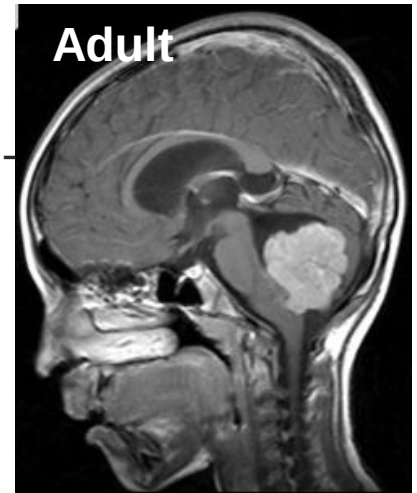
Teaching classification

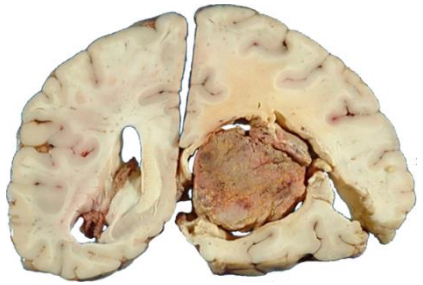
1. **Metastasis and meningeal carcinomatosis**
2. **Glia: astrocytoma, oligodendroglioma, primary lymphoma, ependymoma**
3. **Meninges: meningiomas**
4. **Nerve sheaths: cranial and paraspinal nerve schwannomas**
5. **Neurons: gangliogánglioma, neurocytoma**
6. **Glands: sellar region (Pituitary tumours), pineal region**
7. **Choroid plexus:** choroid plexus papilloma
8. **Mesenchymal:** glomus tumour, chordoma, solitary fibrous tumour (formerly hemangiopericytoma)
9. **Embryonic remains:** craniopharyngioma, medulloblastoma, ETMR (embryonal tumour with multilayered rosettes, formerly PNET)

CHOROID PLEXUS TUMOUR

- Choroid plexus papilloma
  - Plexuses grow without invading parenchyma
    - Obstructive hydrocephalus
    - ↑ CSF production
    - Possibility of hemorrhages
  - Rarely malignant (carcinoma) but may have CSF seeding
- Incidence
  - 0.5 % intracranial tumours
  - Schoolchildren <12 years
- Location
  - Children → lateral ventricles – left side
  - Adults → fourth ventricles (50 %)
- Treatment = surgery
  - If anaplastic→ + radiotherapy

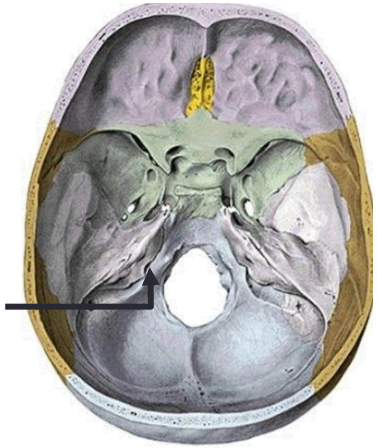




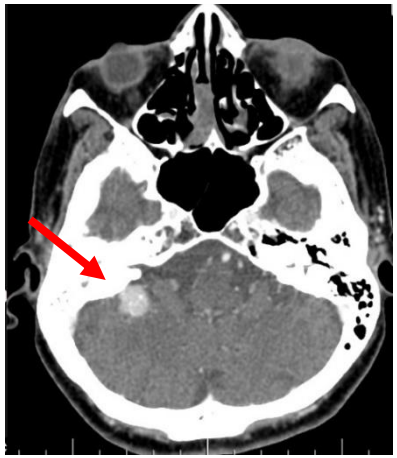


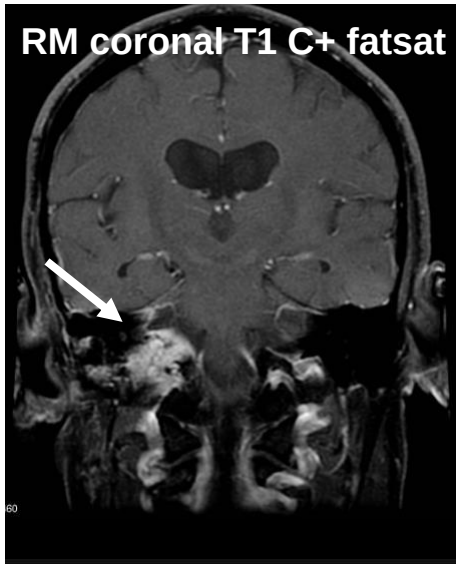
MESENCHYMAL TUMOURS

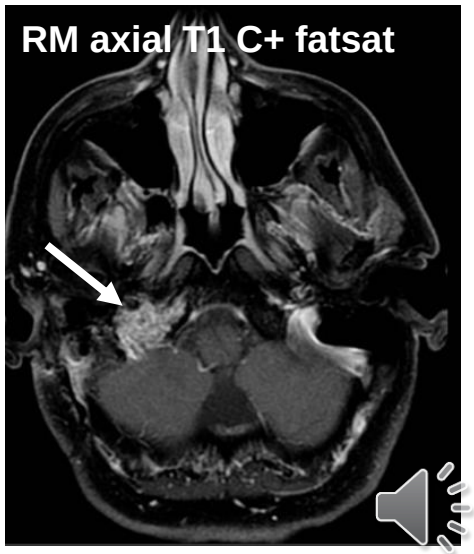
- Glomus tumour
  - Glomus jugular tumour
  - Benign, well vascularized paraganglioma
  - Jugular foramen→ IX-X-XI
  - Hearing loss, tinnitus, difficulty swallowing
  - Surgical treatment
- Chordoma
- Hemangiopericytoma



CT C+ late

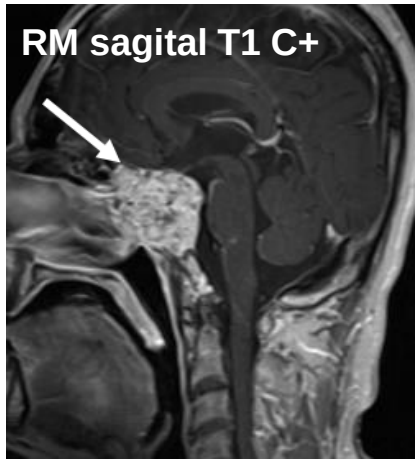


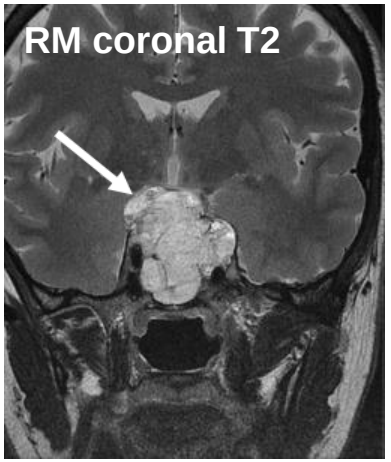


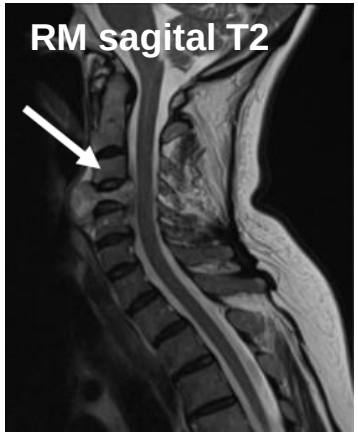


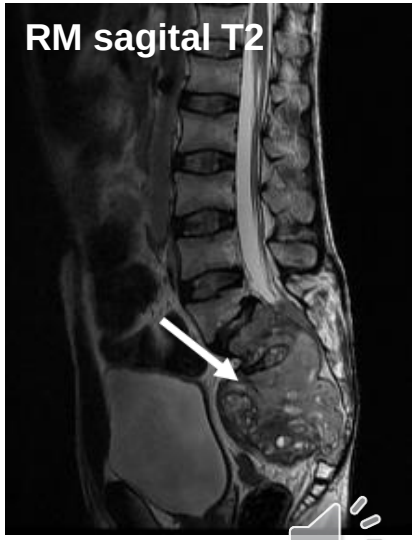
Mesenchymal tumours

- Glomus tumour
- Chordoma
  - Derived from notochord remnants
  - Clivus (25 %, ~ 35 years), sacrum (60 %, ~ 50 years) > other spinal areas
  - Aggressive, but slow growing
  - Age 50-60 years
  - Headache, fourth nerve involvement
  - Destruction clivus or parasellar region
  - Surgical treatment + radiotherapy / radiosurgery
  - Bad prognosis
- Hemangiopericytoma



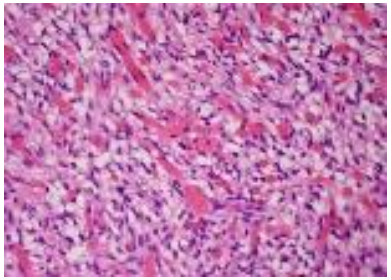


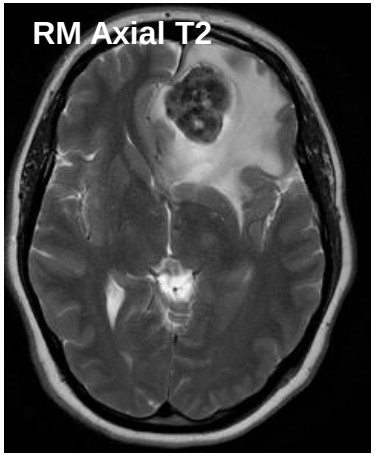


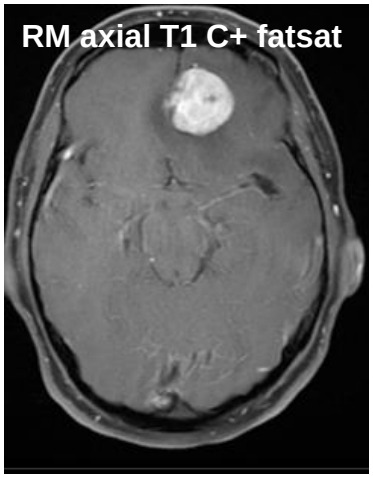


Mesenchymal tumours

- Glomus tumour
- Chordoma
- Solitary fibrous tumour
  - *Previously known as "hemangiopericytoma"*
  - Age 45-55 years without gender predilection
  - Pathology = spindle cells
  - Grade I → Some grade II-III (= the ones previously known as hemangiopericytoma)
  - Similar to meningioma, rounder and firmer
  - Diagnosis = MRI
    - *Less intense signal on T2 than meningioma*
  - Treatment = surgical removal







EMBRYONARY REMNANT TUMOUR

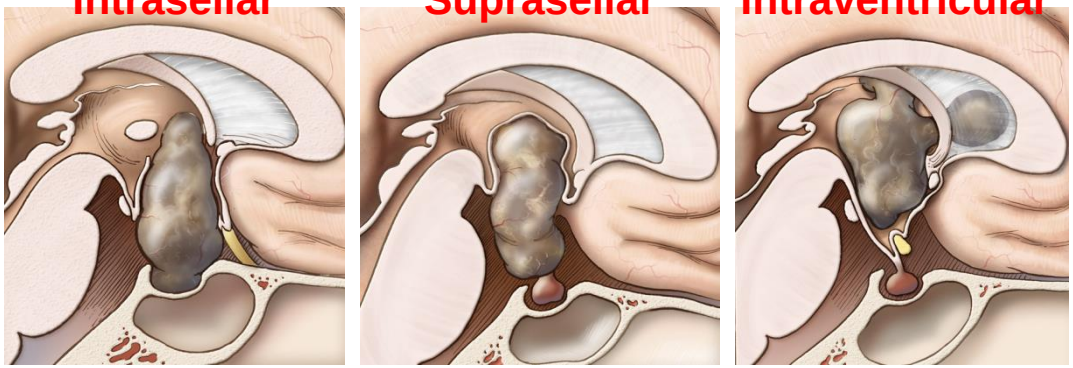
- Tumours of dysembryoplastic origin
  - **Craniopharyngioma**
  - Colloid cyst third ventricle
    - *Benign tumour with content PAS (+)*
    - *Acute intermittent hydrocephalus due to Monro foramen blockage*
  - Corpus callosum lipoma
  - Dermoid and epidermoid tumours (cholesteatoma) → ENT

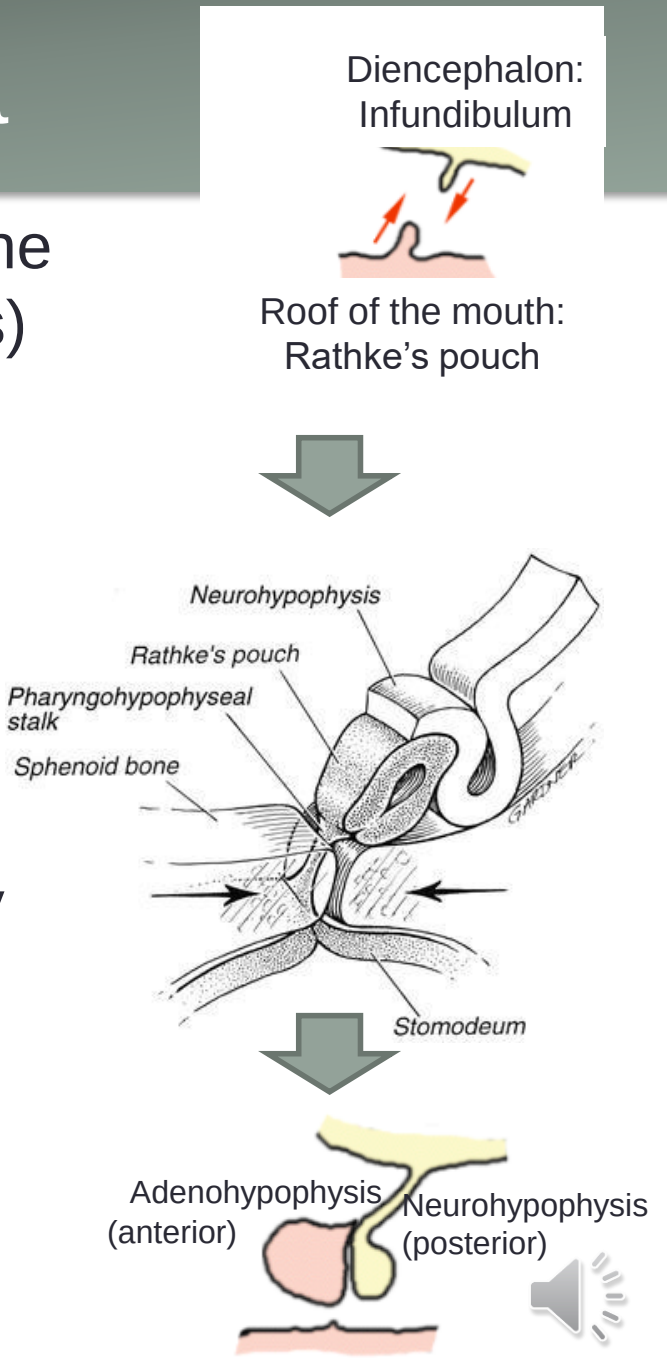
PAS = PAS = periodic acid Schiff

- Tumours of embryonic remains (neural precursor cells)
  - **Medulloblastoma** → Posterior fossa
  - **ETMR** (*embryonal tumour with multilayered rosettes*, previously known as PNEembryonalT) → supratentorial
  - Other tumours: neuroblastoma and estesioneuroblastoma

1. Craniopharyngioma

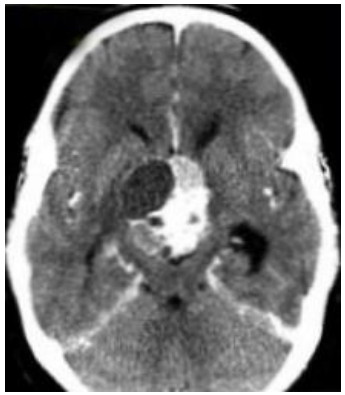
- Tumour of dysembryoplastic origin of the suprasellar region (2-4% brain tumours)
  - Origen = Rathke's pouch remnants and craniopharyngeal duct
  - Suprasellar 75 % > sellar and parasellar
- Features
  - Children and adolescents ♂
  - Grade I (seldom become malignant)
  - Calcifications and cystic component with oily content

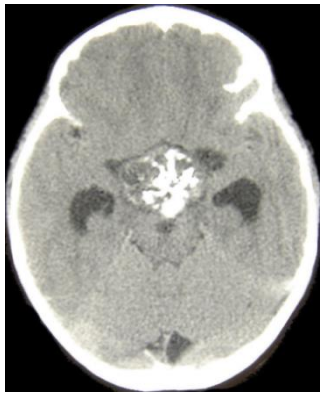


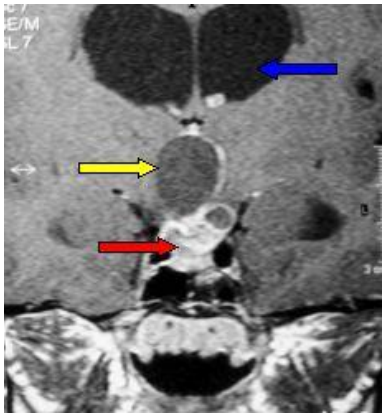


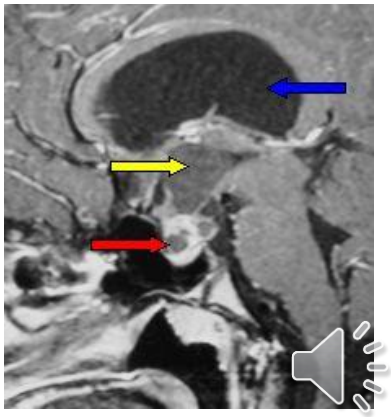
1. Craniopharyngioma

- Clinical picture
  - Neuroendocrine dysfunction
    - *Growth retardation, short stature, obesity*
  - Visual field impairment: chiasm compression from above
    - *Bitemporal hemianopia from the LOWER quadrants*
  - Raised intracranial pressure
    - *Cognitive disorder, hydrocephalus*
- Diagnosis = imaging
  - Cysts, calcifications, hydrocephalus
- Treatment = surgical removal
  - Adjuvant radiotherapy
  - ± radiosurgery

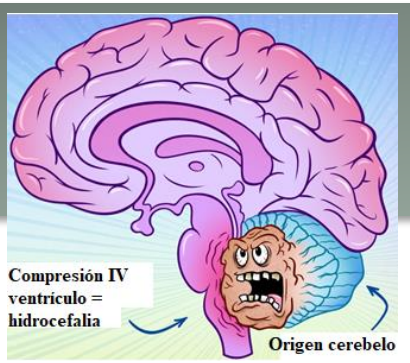




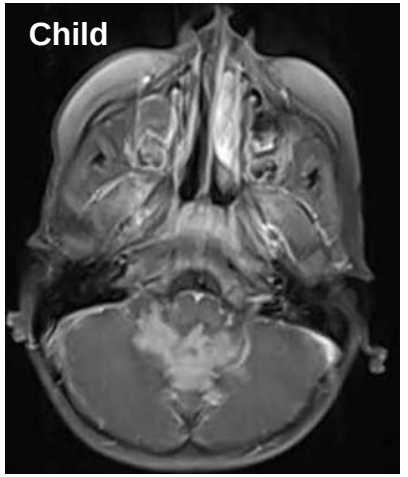




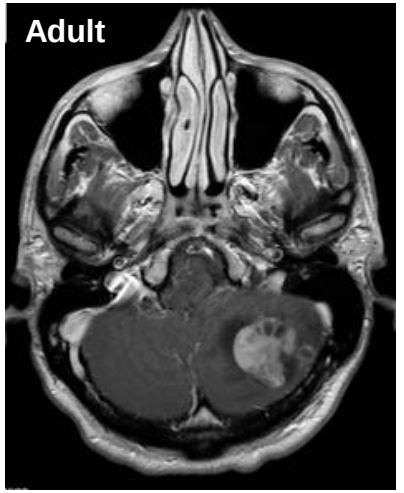
2. Medulloblastoma



- The most common paediatric tumour
  - 20-30 % childhood brain tumours
    - *"Most common tumour in young children (<6 years)"*
  - Poorly differentiated, aggressive embryonal tumour
  - Tendency to spread through CSF
  - More frequent ♂
  - Markers: 17p deletion
  - Associated with Gorlin and Turcot syndromes (gliomapolyposis)
- Location
  - Children (60 %)→Vermis cerebellum + roof fourth ventricle
  - Adults 20 – 25 years→ Cerebellar hemispheres
- Clinical picture
  - Midline cerebellar syndrome (ataxia, dysmetria) + raised intracranial pressure

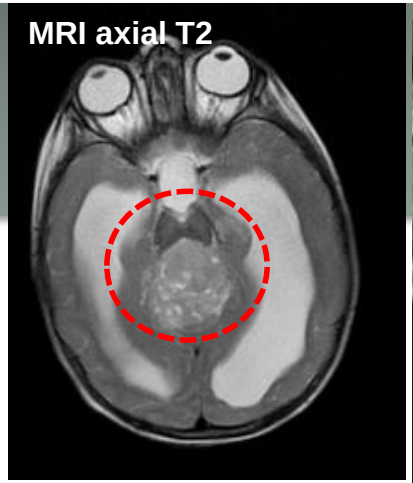


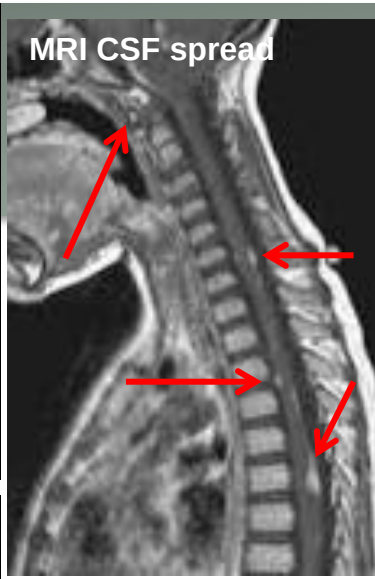
RM series T1 C+

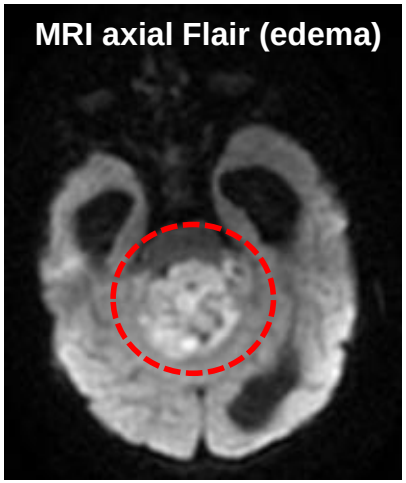


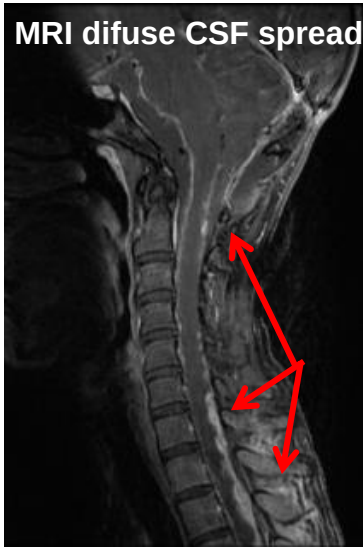
2. Medulloblastoma

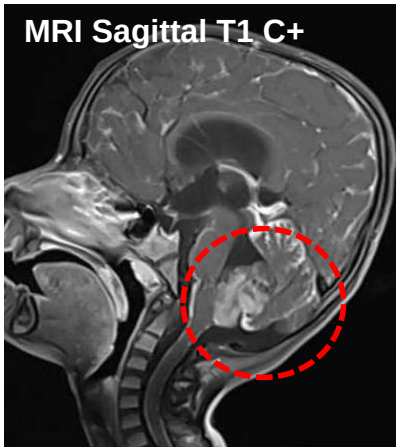
- Diagnosis = MRI
  - MRI CR → Tumour mass with homogeneous borders with hypodense areas (necrosis) and surrounding edema
  - MRI neuraxis (brain & spina cord)
  - Vascular study
  - CSF study (rule out CSF dissemination)
- Treatment
  - Excision as complete as possible
  - Radiotherapy fossa posterior + neuraxis
  - Chemotherapy systemic and intrathecal
- Survival
  - 50 % at 3 years
  - > 30 % at 5 years





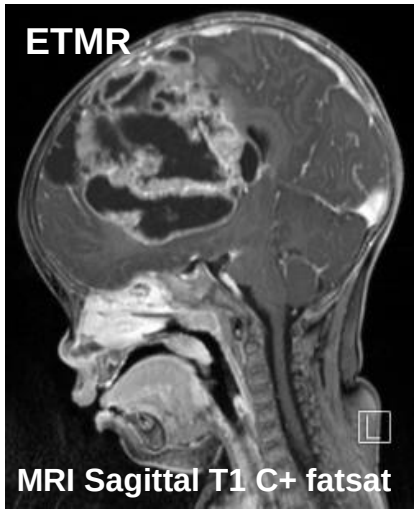






3. Other embryonal tumours

- ETMR = *embryonal tumour with multilayered rosettes*
  - Previously known as PNET (*primitive neuroectodermal tumour)*
  - Similar to medulloblastoma, but supratentorial (suprasellar) and more aggressive (subarachnoid seeding in 35 %)
  - Treatment = surgery + brain and neuroaxis radiation therapy + chemotherapy
  - Survival 75% at 3 years



- Neuroblastoma
  - Adrenal tumour
  - “May appear as a primary CNS tumour”
- Esthesioneuroblastoma
  - It comes from olfactory mucosa embryonic cells

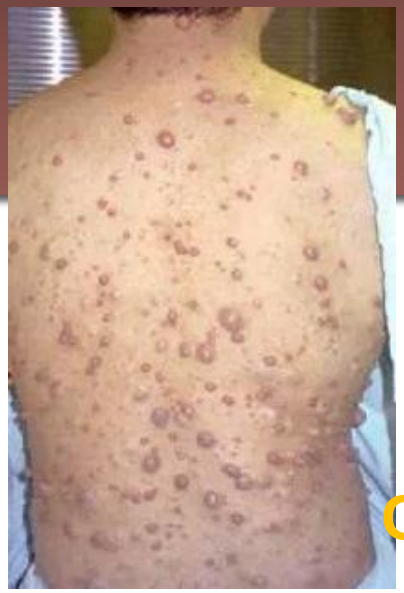
PHACOMATOSIS

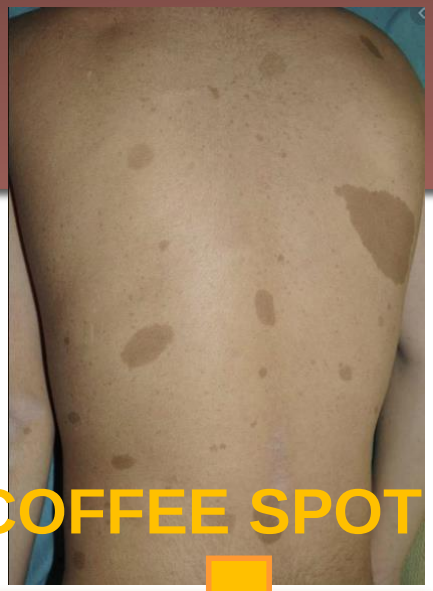
- *Neurocutaneous syndromes*
  - *Autosomal dominant inheritance of variable penetrance*

1. Neurofibromatosis type 1
2. Neurofibromatosis type 2
3. Tuberous sclerosis (Pringle-Bourneville disease)
4. Sturge-Weber syndrome (encephalotrigeminal angiomatosis)
5. Von Hippel-Lindau syndrome
6. Klippel-Trenaunay syndrome
7. Ataxia-telangectasia (Louis-Barr syndrome)

Phacomatosis

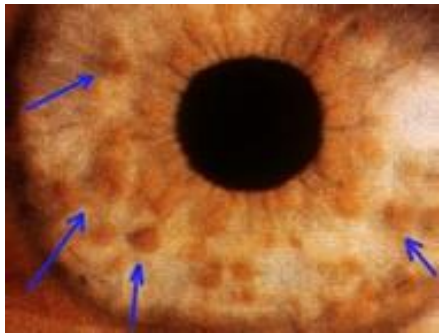
1. Neurofibromatosis type I (NF-I) = Von Recklinghausen disease
   - Skin lesions
     - *Peripheral nerve neurofibromas (benign, mollusca fibrosa)*
     - *Skin pigmentation : +6 café au lait spots ∅ > 1,5 cm = diagnosis of NF-I*
     - ***Axillary ephelides** (freckles, Crowe's sign) = **PATHOGNOMONIC***
     - *Lisch nodules (iris pigmented hamartomas)*
   - Neurological injuries
   - Others

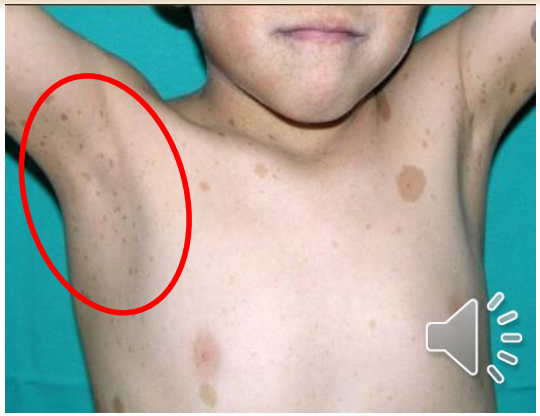




COFFEE SPOT

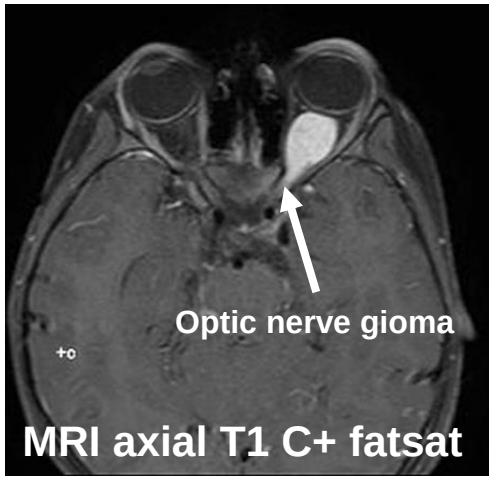
C – café-au-lait spots
A – axillary/inguinal freckling
F – fibroma (neurofibroma +2, plexiform neurofibroma)
E – eye hamartoma (Lisch nodules)
S – skeletal abnormalities
P – positive family history
OT – optic nerve glioma

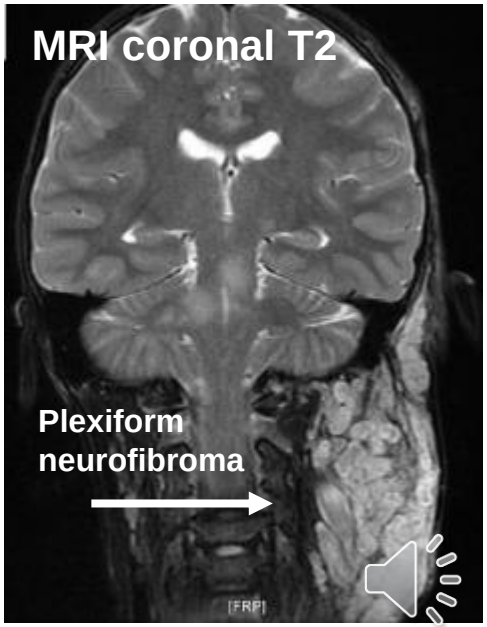




Phacomatosis

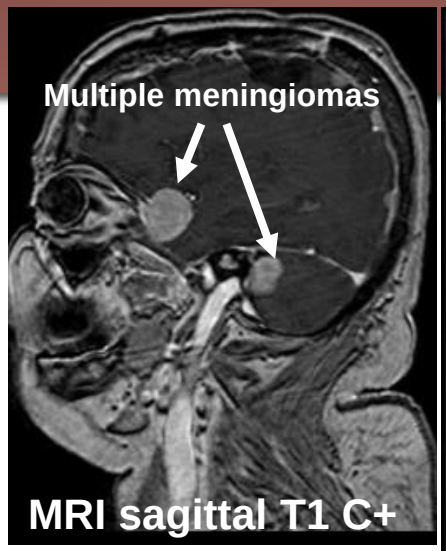
1. Neurofibromatosis type I (NF-I) = Von Recklinghausen disease
   - Skin lesions
   - Neurological injuries
     - *NF1 chromosome 17 gene mutation (17q11.2, encodes neurofibromin, tumour suppressor)*
     - *Risk of nervous system neoplasms → plexiform neurofibromas, optic nerve glioma, pheochromocytoma, ependymoma, meningiomas, astrocytomas*
     - *Neurofibromas of nerve trunks → do not exist at birth. Image in hourglass*
   - Others:
     - *Pseudoarthrosis of the tibia, sphenoid wing dysplasia, kyphoscoliosis, short stature, aqueduct of Silvio stenosis (hydrocephalus), mental retardation (45%), epilepsy, renal artery stenosis, "2nd arterial hypertension to pheochromocytoma", …*

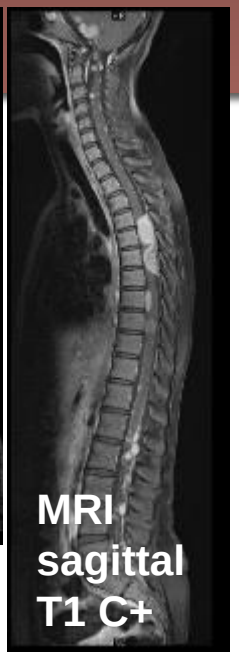


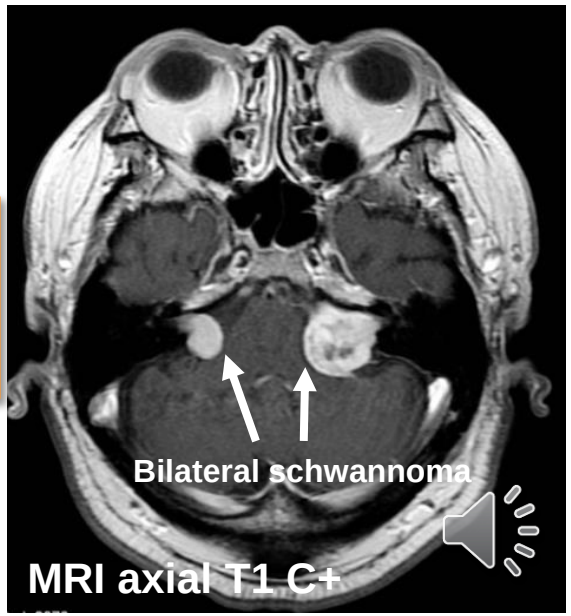


Phacomatosis

2. "Neurofibromatosis" type II (NF-II)
   - Skin lesions= seldom
   - Neurological lesions
     - *NF**2** gene mutation, chromosome **22** (22q12, encodes neurofibromin-2, merlin or schwannomas, tumour suppressor)*
     - ***Bilateral** eighth nerve schwannoma (90% of carriers of the gene) → unilateral onset deafness at **20**-30 years of age*
     - *Meningiomas, gliomas, and schwannomas (cranial and spinal nerves)*
     - ***MISME** = **m**ultiple **i**ntracranial (**i**nherited) **s**chwannomas, **m**eningiomas, **e**pendymomas syndrome (NOT NEUROFIBROMAS)*
   - Others
     - *Syringohydromyelia, cataracts*

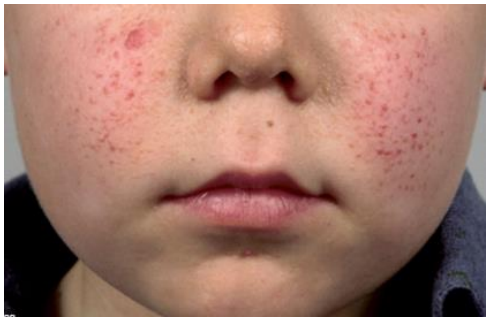


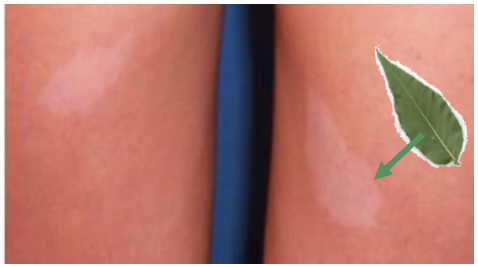




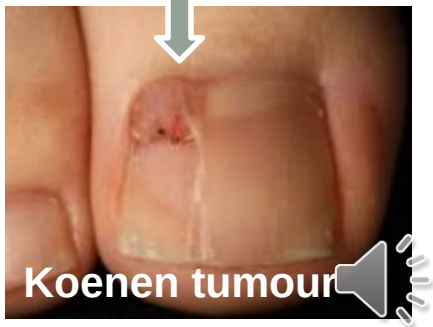
Phacomatosis

3. Tuberous sclerosis = Pringle-Bourneville disease
   - **EPI-LOI-A** (**epi**lepsy, **lo**w **i**ntelligence, **a**ngiofibromas) 30 % patients
     - *Vogt's triad = ASI = angiofibromas, seizures, intellectual disability*
     - *TSC1 (hamartin at 9q32-34) and TSC2 (tuberin at 16p13.3) genes)*
   - Skin lesions
     - *Sebaceous adenomas (facial angiofibromas) = yellowish-pink "butterfly" papules on cheeks (age 3-10 years)*
     - *Hypopigmented spots on ash leaf (age 0-1 years)*
     - *Chagrin patches = lumbosacral skin thickening*
     - *Periungual fibromas (Koenen tumours) = **PATHOGNOMONIC***
   - Neurological lesions
   - Others

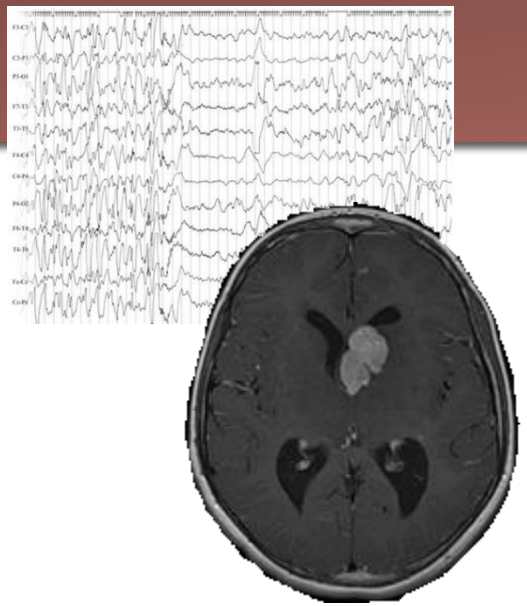




Ash leaf lesion



Phacomatosis



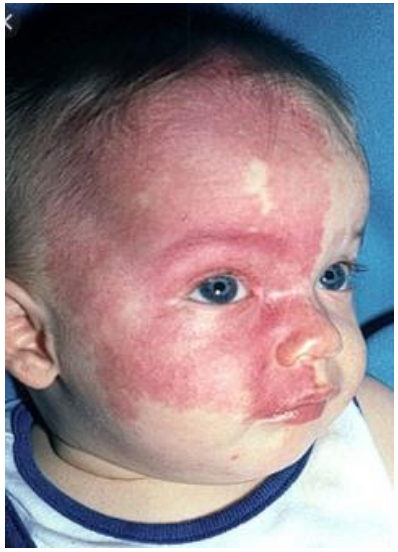
3. Tuberous sclerosis = Pringle-Bourneville disease
   - Skin lesions
   - Neurological lesions → epilepsy (West syndrome), mental retardation, hydrocephalus
     - *Cortical tubers*
     - *Subependymal astrocytoma of giant cells*
     - *Multiple calcified periventricular nodules*
     - *Multiple retinal astrocytomas*
   - Others: Neoplasms
     - *Cardiac rhabdomyomas*
     - *Renal, hepatic, adrenal, pancreatic angiomyomas*
     - *Ependymomas, astrocytomas ("90% subependymal giant cell astrocytomas")*
       - *"Cystic lung disease (honeycomb lung)"*

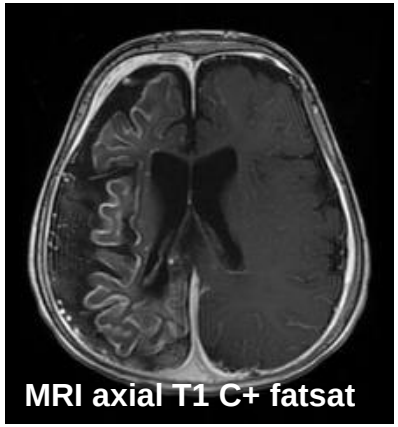
Primary diagnostic criteria (+ angiofibromas and ungual fibromas)

Roberto Sánchez (Román in the film "Campeones")

Phacomatosis

4. Sturge-Weber syndrome (encephalotrigeminal angiomatosis)
   - Sporadic
     - *Embryonic development defect: persistence of vascular plexus in the cephalic portion of the neural tube*
   - V1 facial angioma + ipsilateral occipital leptomeningeal angioma and choroidal angioma
   - Skin lesions
     - *Port wine stain (V1 distribution, one-sided)*
   - Neurological lesions
     - *Leptomeningeal, venous, occipitoparietal angiomatosis*
     - *Epilepsy, intellectual impairment*
     - *Motor deficit (contralateral hemiplegia), homonymous hemianopia (occipital lobe lesion)*
   - Others



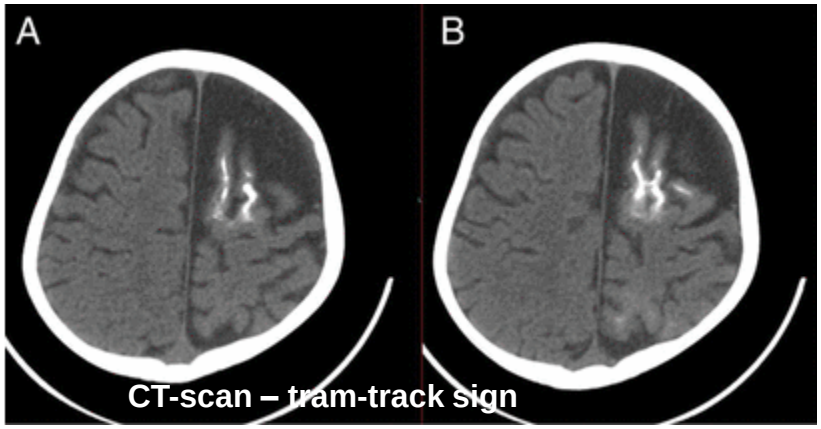


MRI axial T1 C+ fatsat

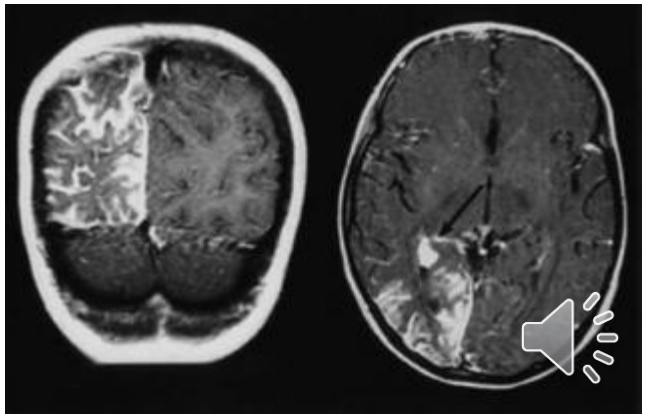
Phacomatosis

4. Sturge-Weber syndrome (encephalotrigeminal angiomatosis)
   - V1 facial angioma + ipsilateral occipital leptomeningeal angioma and choroidal angioma
   - Skin lesions
   - Neurological lesions
   - Others
     - *Choroidal angioma, glaucoma blindness*
     - *Double contour subcortical calcification("tram-track sign")*

MRI T1 C+ (occipital lesion - contralateral homonymous hemianopia)



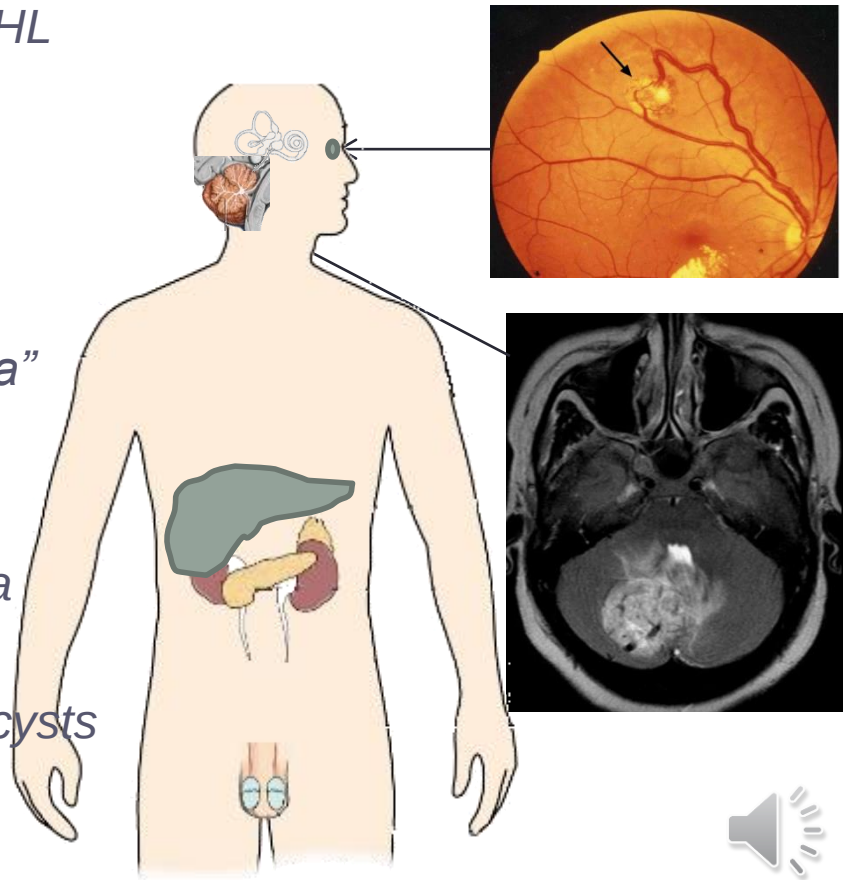
CT-scan – tram-track sign



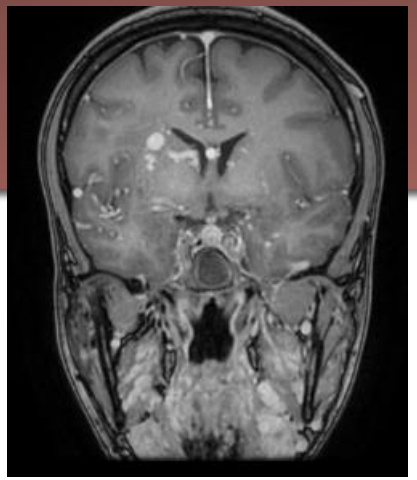
Phacomatosis

H – Hemangioblastoma
I – Increased risk renal cell cancer
P – Pheochromocytoma
P – Pancreatic lesions (cysts, cystadenoma, cystadenocarcinoma)
E – Eye (retinal) hemangioblastoma, Endolymphatic sac tumours
L – Liver, renal, pancreatic, epididimal cysts

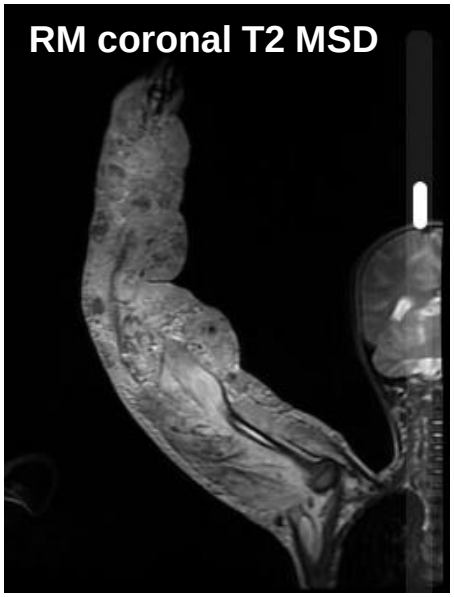
5. Von Hippel-Lindau syndrome
   - Retina malformation and cerebellum alteration. Uncommon skin lesions (5 %)
     - *Tumour suppressor gene mutation VHL (3p25.5)*
   - Clinical features
     - *Retinal angiomas*
     - *Cerebellar hemangioblastoma*
       - ↳ *"Erythropoietin → polycythaemia"*
   - Others
     - *Spinal cord haemangioma*
     - *Hypernephroma, renal cell carcinoma*
     - *Pheochromocytoma*
     - *Kidney, liver, pancreatic, epididymal cysts*

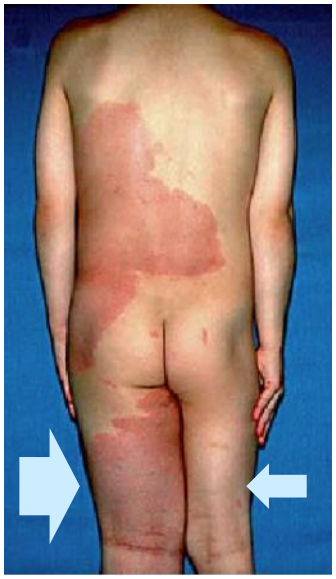


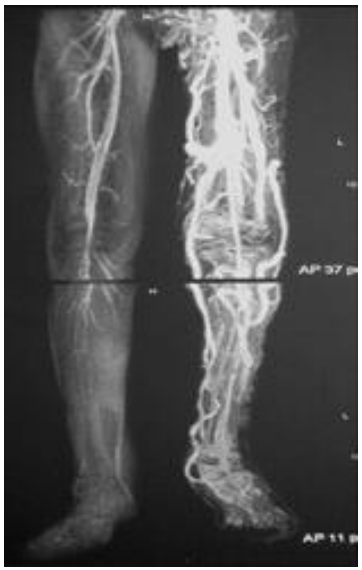
Phacomatosis

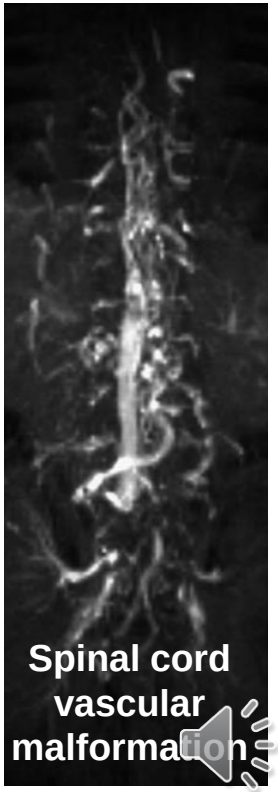


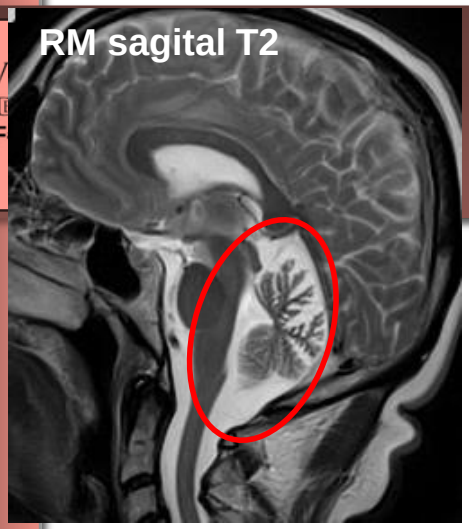
6. Klippel-Trenaunay syndrome (1:100.000)
   - Capillary + venous + lymphatic malformation
     - *+ Arteriovenous fistula = Parkes-Weber syndrome*
   - Trunk and limb hemangiomas
   - Hypertrophy of the affected limb (macromelia, localized gigantism)
   - Spinal cord vascular malformation





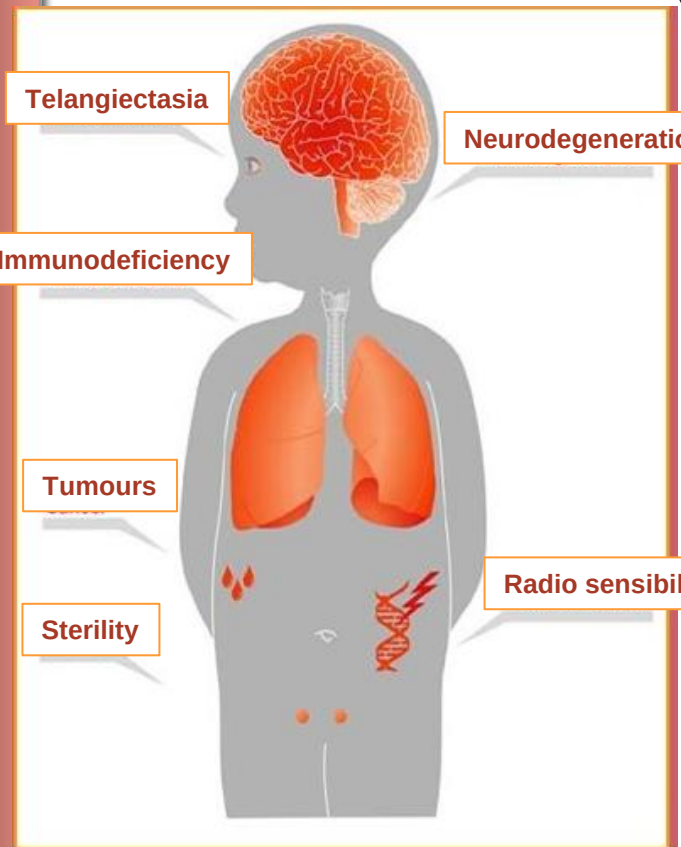






Phacomatosis

7. Ataxia-Telangiectasia (Louis-Barr syndrome)
   - Mutation 11q22-23
   - Affects skin, nervous system, immune
   - Clinical features
     - *Children → progressive cerebellar ataxia, oculomotor apraxia, choreoathetosis*
       - Vermis atrophy and ↑fourth ventricle, possible bleeding
     - *Oculocutaneous telangiectasias (conjunctiva, ear, face)*
     - *Immunodeficiency → Thymus hypoplasia(↓ T cells in blood and lymphoid tissue)*
       - B cells normal, possible ↓IgG
       - Absence IgE and IgA
       - Sinusitis, respiratory infections (bronchiectasis), lymphoreticular tumours
       - ↑ αFP y CEAe



Not to be confused with hereditary hemorrhagic telangiectasia (Rendu Osler-Weber syndrome)

Finally, some associations:

DISEASE	CNS NEOPLASIA
NF-I (Von Recklinghausen disease)	Optic nerve glioma
NF-II	Bilateral neuroma VIII
Sclerosis tuberosa (Pringle Bourneville syndrome)	Subependymal giant cell astrocytomas
Sturge-Weber syndrome (encephalotrigeminal angiomatosis)	Cerebral angiomas
Von Hippel-Lindau syndrome	Cerebellar hemangioblastoma
Klippel-Trenaunay syndrome	Spinal cord cavernous angioma
MEN-I	Pituitary hyperplasia or adenoma
Turcot syndrome	Astrocytomas, medulloblastoma
HIV infection	Primary brain lymphoma

SUMMARY KEY CONCEPTS TOPIC 6

- Oligodendroglioma
  - ♂, *not very aggressive, hardly distinguishable, the most epileptogenic*
  - 1p19q deletion = good response to chemotherapy
- Primary brain lymphoma
  - ♂ immunosuppressed
  - Treatment by the haematology department. Surgery and corticosteroids NOT recommended
- Ependymoma
  - Child-young ventricles and invades brainstem, filum terminale in adults
  - Possible spread by CSF. Bad prognosis
- Meningioma
  - 2nd most frequent intracranial tumour, benign
  - ♀ middle age, calcifications. Surgery (+ radiotherapy and / chemotherapy if remnants)

SUMMARY KEY CONCEPTS TOPIC 6

- Schwannoma
  - VIII bilateral → NF-II diagnosis. Treatment according to size
- Pituitary tumours → hormonal disturbance + vision loss
- Pineal region tumours → histological variety (biopsy needed)
  - Germinomas respond to radiotherapy
- Choroid plexus papilloma
  - Children lateral ventricles, fourth ventricle in adults
- Craniopharyngioma
  - Children and adolescents ♂, dysembryoplastic tumour, benign
  - Calcifications, cystic, suprasellar. Surgery + radiotherapy
- Medulloblastoma
  - Most common paediatric tumour, poor prognosis

SUMMARY KEY CONCEPTS TOPIC 6

- Some typical features
  - Epileptogenic → oligodendroglioma
  - Calcifications → craniopharyngioma, oligodendroglioma, meningioma (psammoma bodies)
  - Bleeding
    - *Primary → glioblastoma multiforme, medulloblastoma, oligodendroglioma, pituitary adenoma*
    - *Metastases → choriocarcinoma, melanoma, lung, kidney, thyroid*
  - Distribution by gender
    - *Meningioma, ~~neurinoma~~ schwannoma - Female ♀*
    - *Glioma, medulloblastoma - Male ♂*

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