The Sella and Parasellar Region

Anatomic and Pathologic Considerations:

A Practical Approach

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The Sella and Parasellar Region

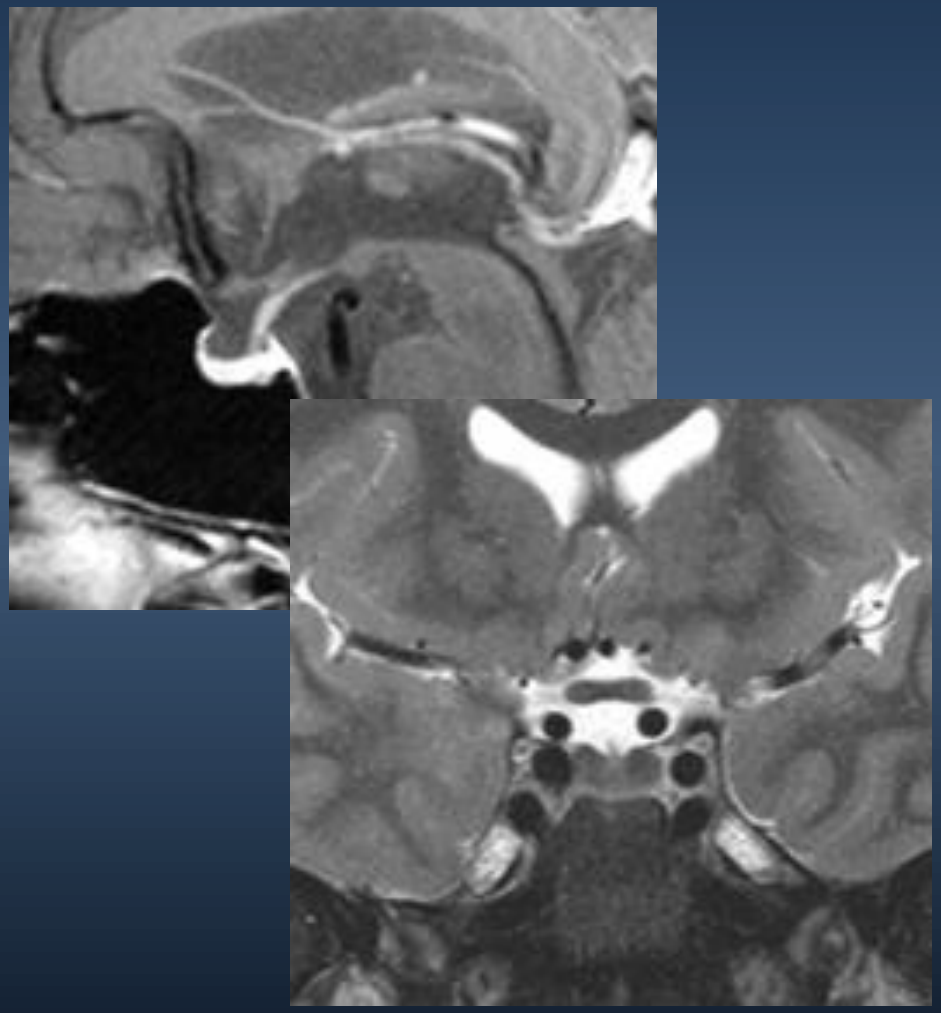
Outline

- Imaging Techniques
- Normal Anatomy
- Differential Diagnosis
  - Sella
  - Suprasellar
  - Infundibulum

Recommended Imaging Techniques

MRI Imaging

- Multiplanar:
  - Sagittal and Coronal
- Small FOV 16-18 cm
- 3mm
- T1W, T2W
- Post T1W + FS
- Dynamic enhanced for pituitary lesions



Sella: Normal Anatomy

Pituitary Gland

- Anterior Lobe (75%)
- Pars Intermedia
- Posterior Lobe (25%)
- Infundibulum

Pituitary: Normal Anatomy

Anterior Lobe

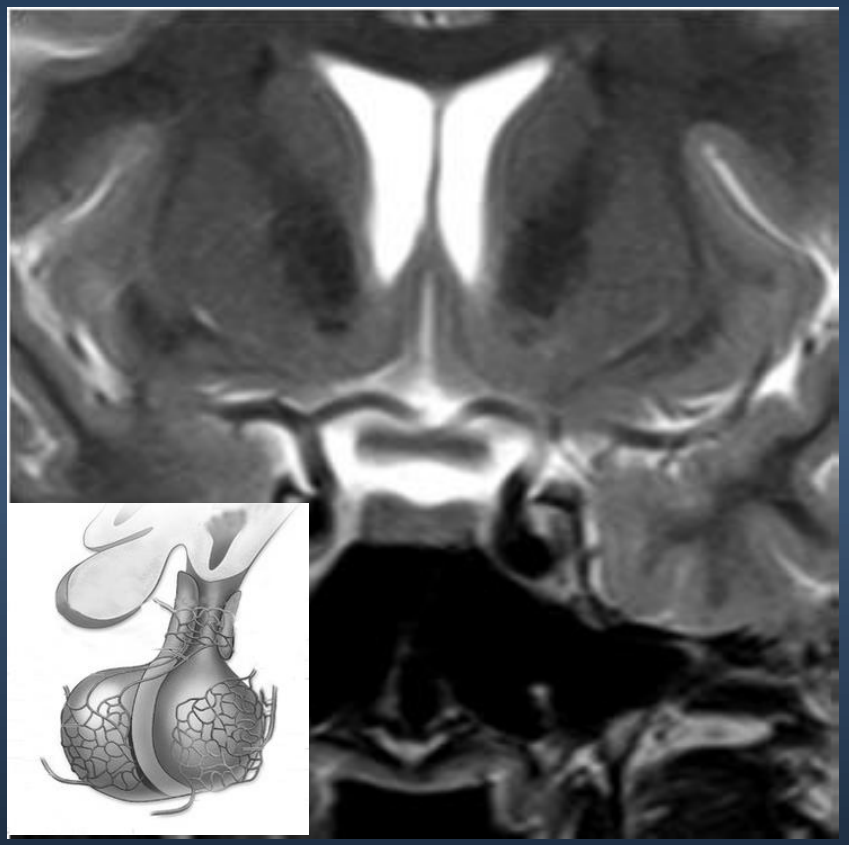
Lateral

- PRL (10-30%)
- GH (50%)

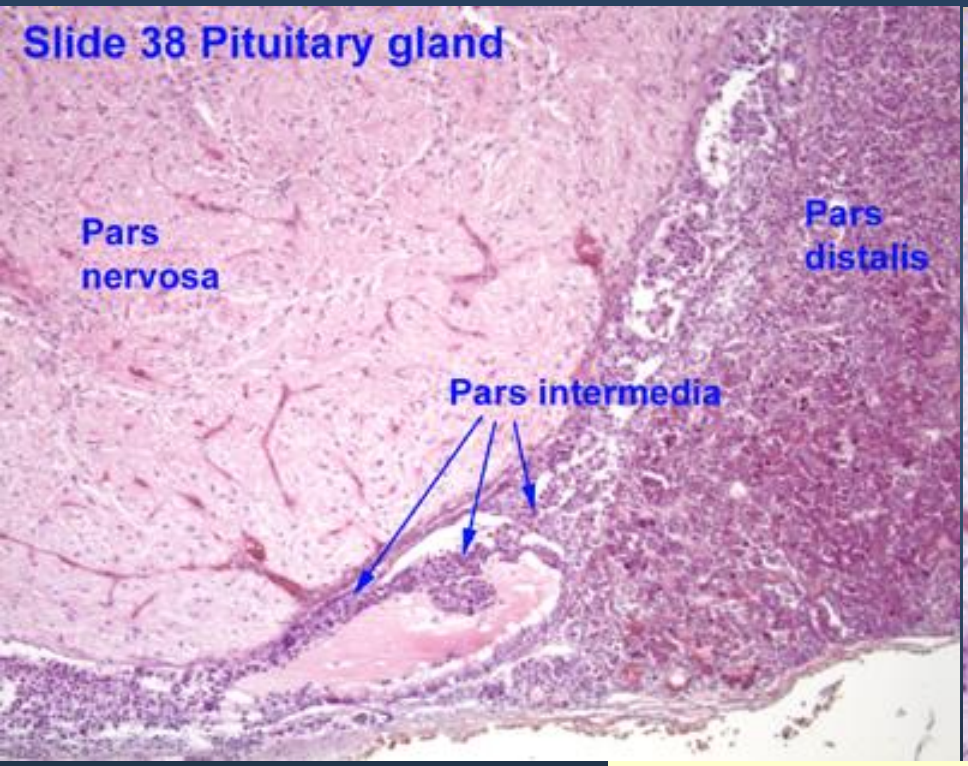
Midline

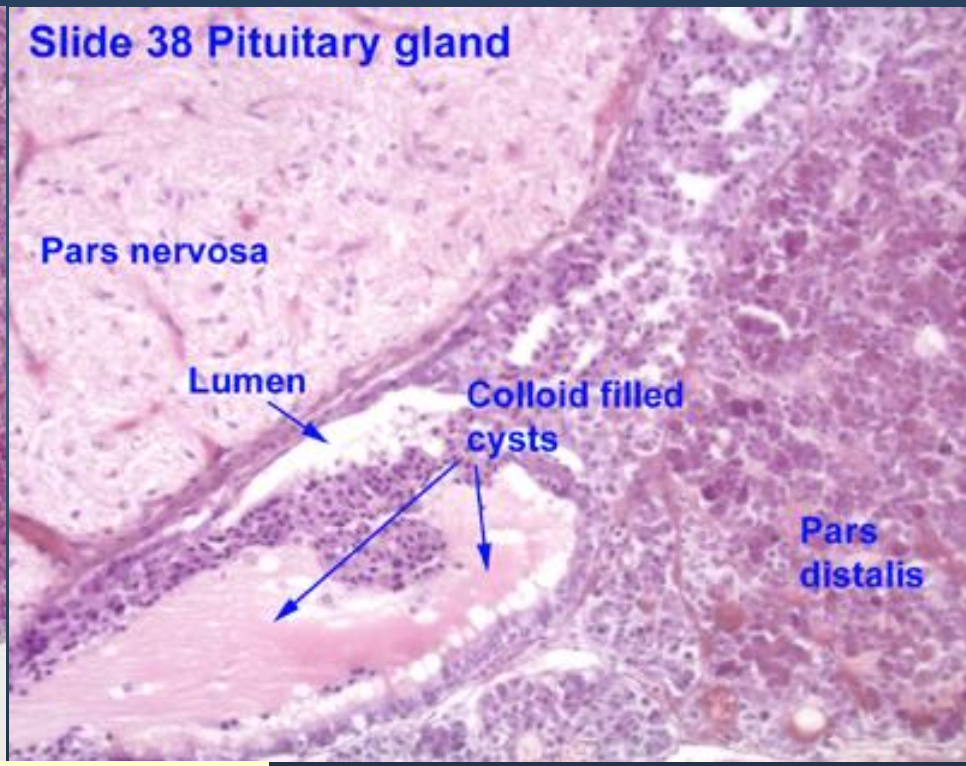
- ACTH (10-30%)
- TSH (5%)
- FSH/LH (10%)

- Location of adenomas parallels the distribution



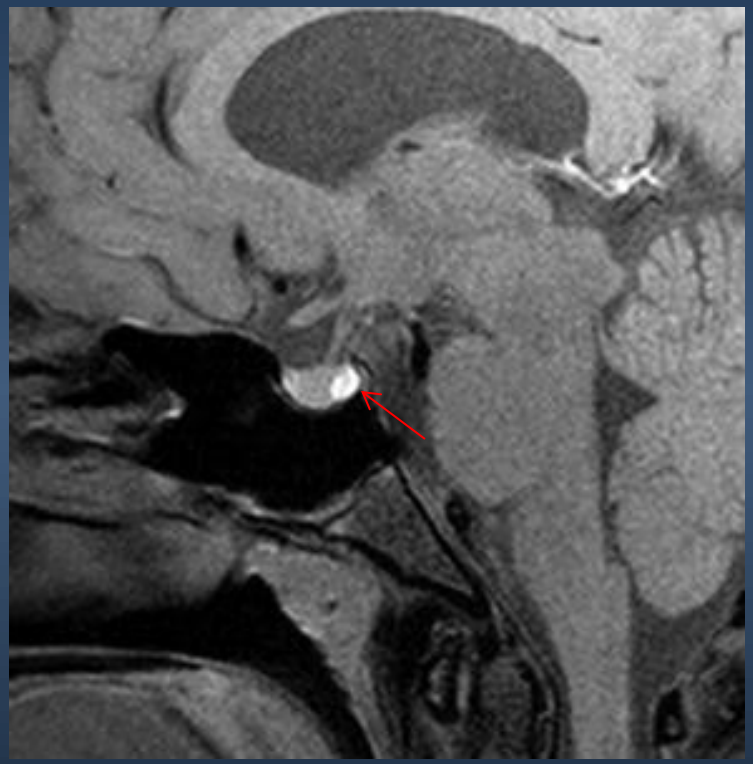
Pars intermedia

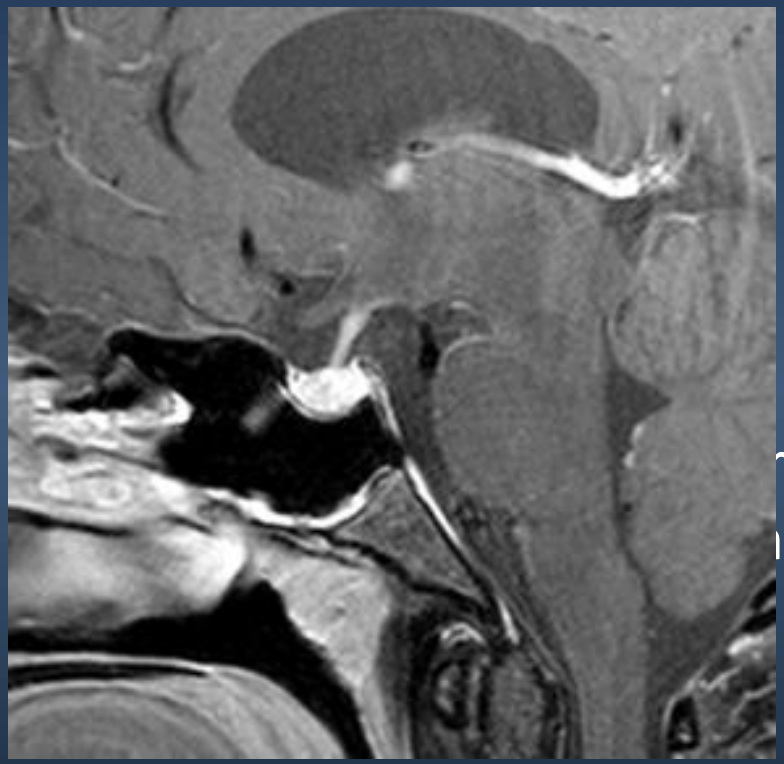




University of Oklahoma Health Sciences Center Interactive Histology Atlas

Sella: Normal Anatomy

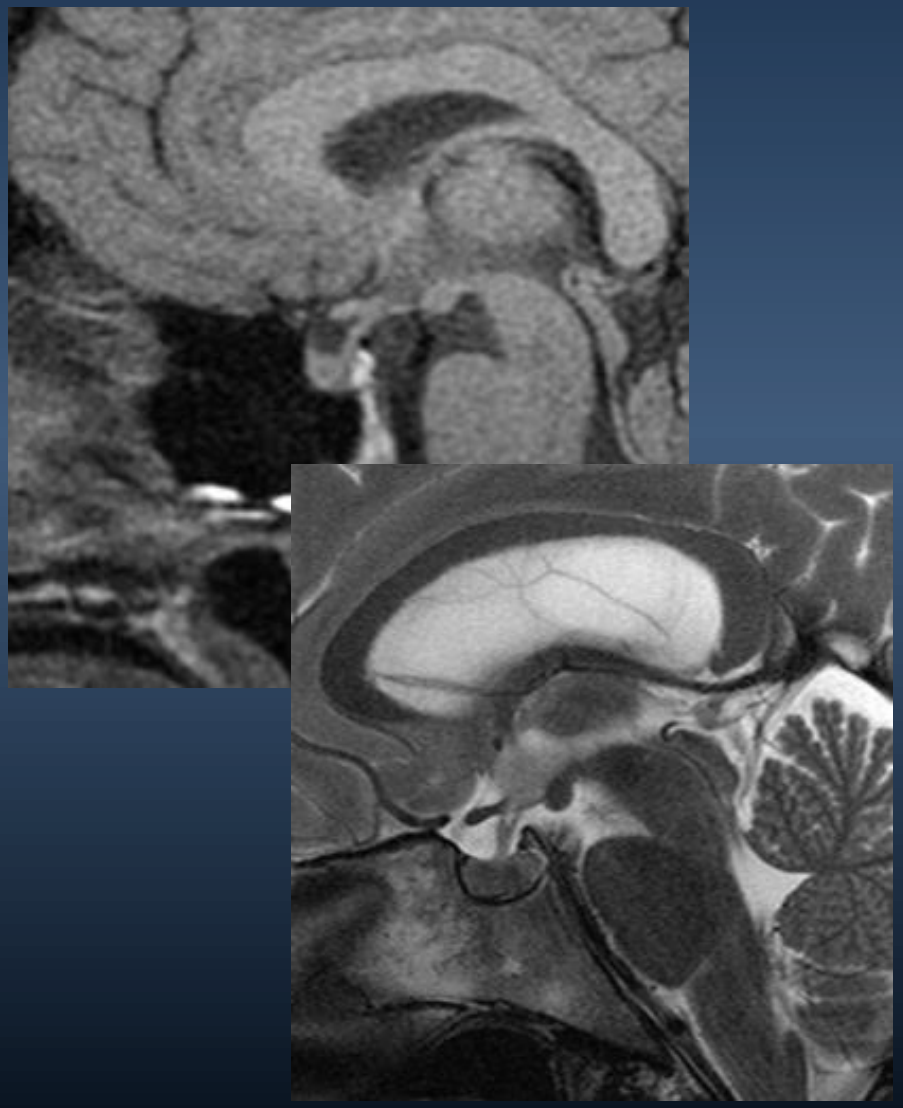




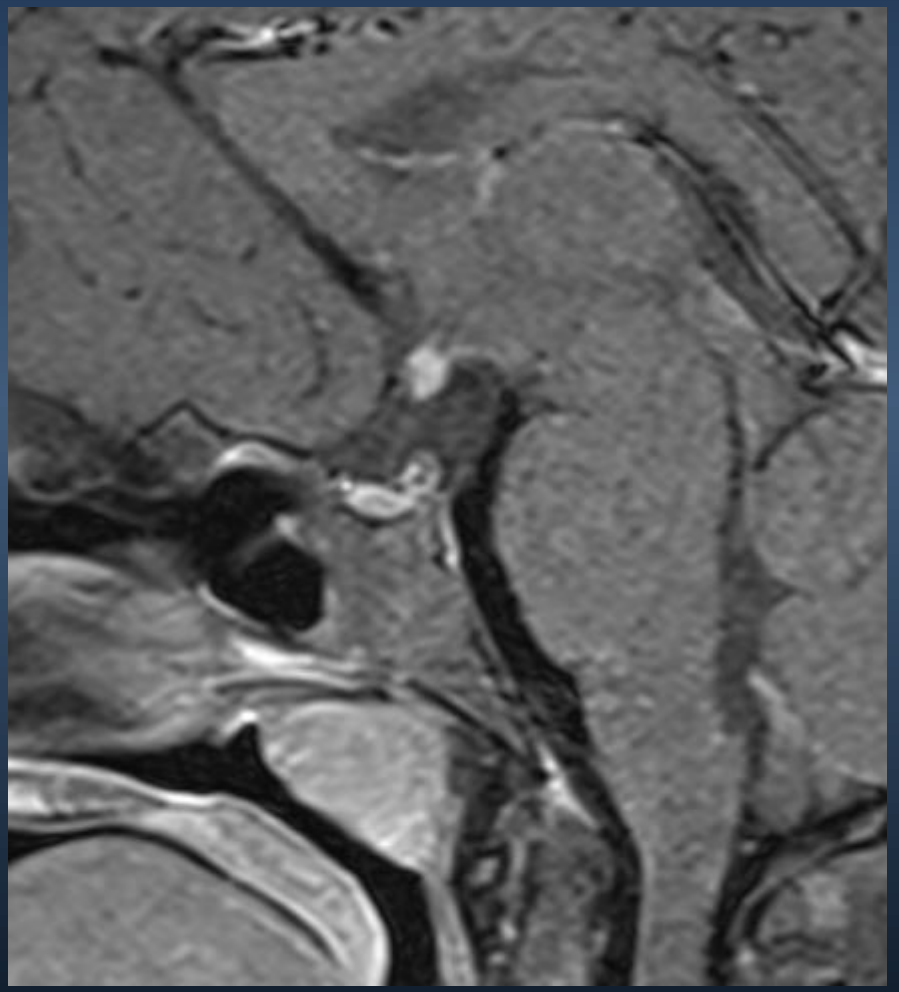
Pituitary: Normal Anatomy

Posterior Lobe

- Infundibulum
- Pituicytes (glial)
- Axons
- Vasopressin (ADH)
- Oxytocin



Ectopic Posterior Pituitary

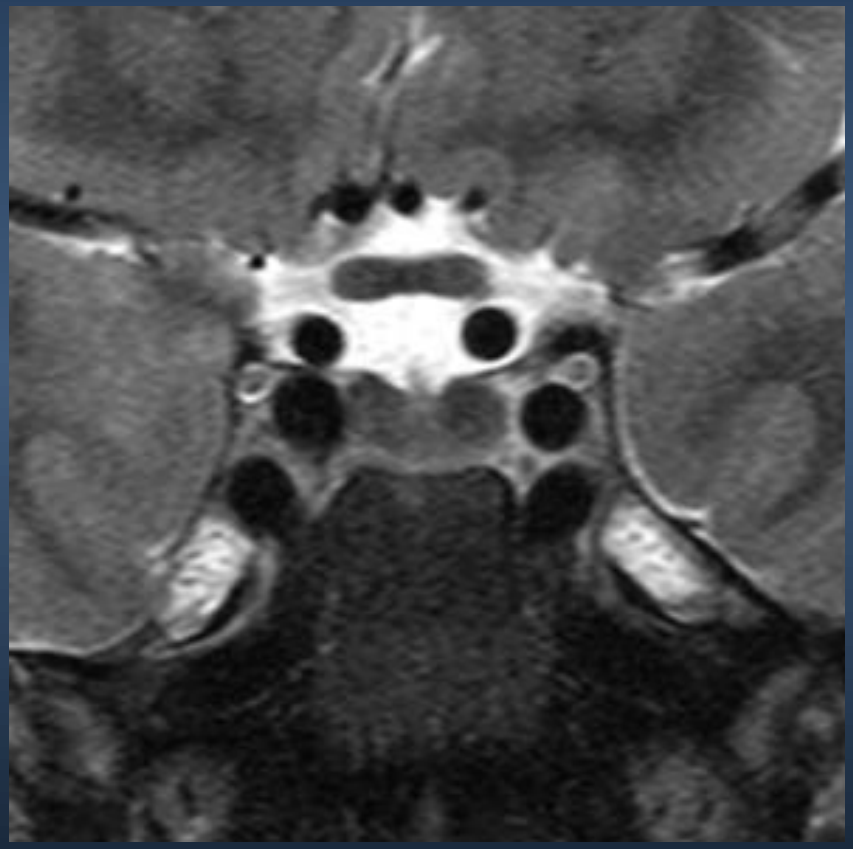


Parasellar Region: Normal Anatomy

Parasellar Structures

- Cavernous Sinus
- Cranial Nerves
- III, IV, V1, V2, VI
- Cavernous ICA
- Optic Chiasm
- Hypothalamus
- Sphenoid Sinus

Parasellar Region: Normal Anatomy



Parasellar Region: Normal Anatomy

Bony Structures

- Planum sphenoidale
- Tuberculum sellae
- Sella turcica
- Dorsum sellae

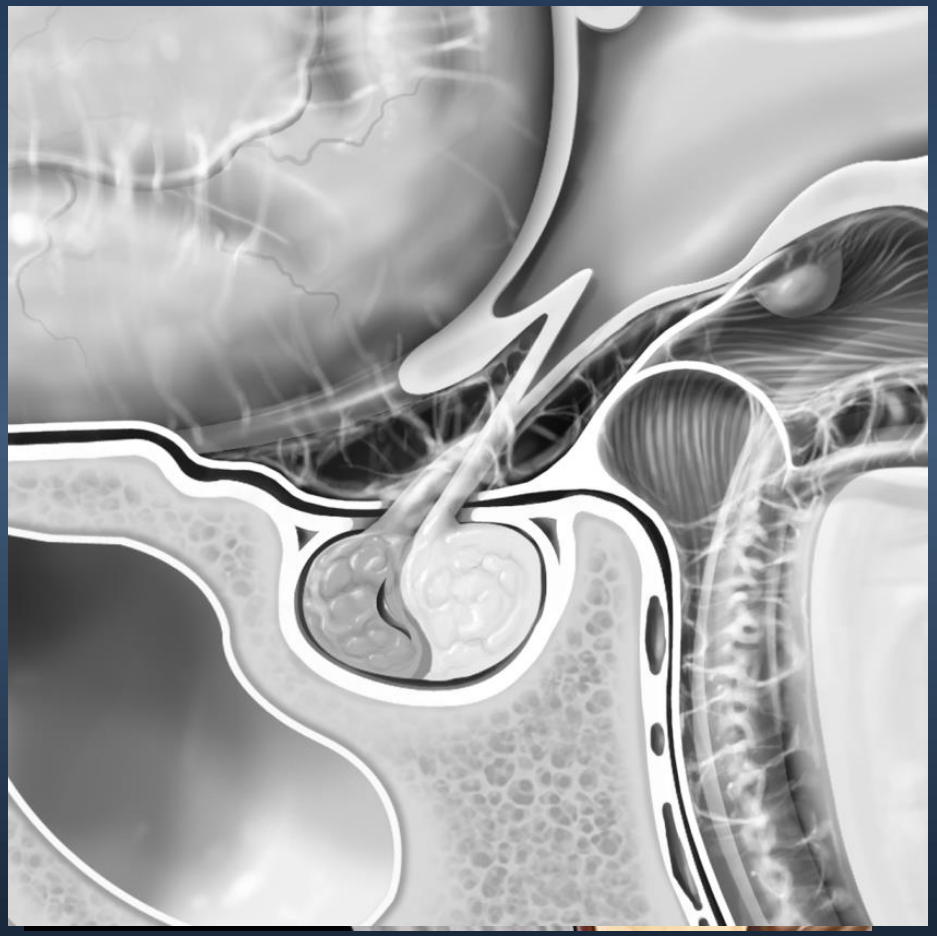
***CT is complementary for evaluating central skull base lesions:

- Effects on skull base
- Calcifications

Sella and Parasellar Pathology

Differential Diagnoses

- Sellar
- Suprasellar
- Infundibular



Sellar Pathology

Non-neoplastic Lesions

- Hyperplasia/Hypertrophy (physiologic, end organ failure)
- Cysts (RCC, pars intermedia cyst)
- Empty Sella

Primary Neoplasms

- Pituitary adenoma (Most common)
- Craniopharyngioma (Only 5% purely intrasellar)
- Meningioma (Purely intrasellar rare)
- Abscess (Rare)
- Pituitary carcinoma (Extremely rare)

Metastasis (1%)

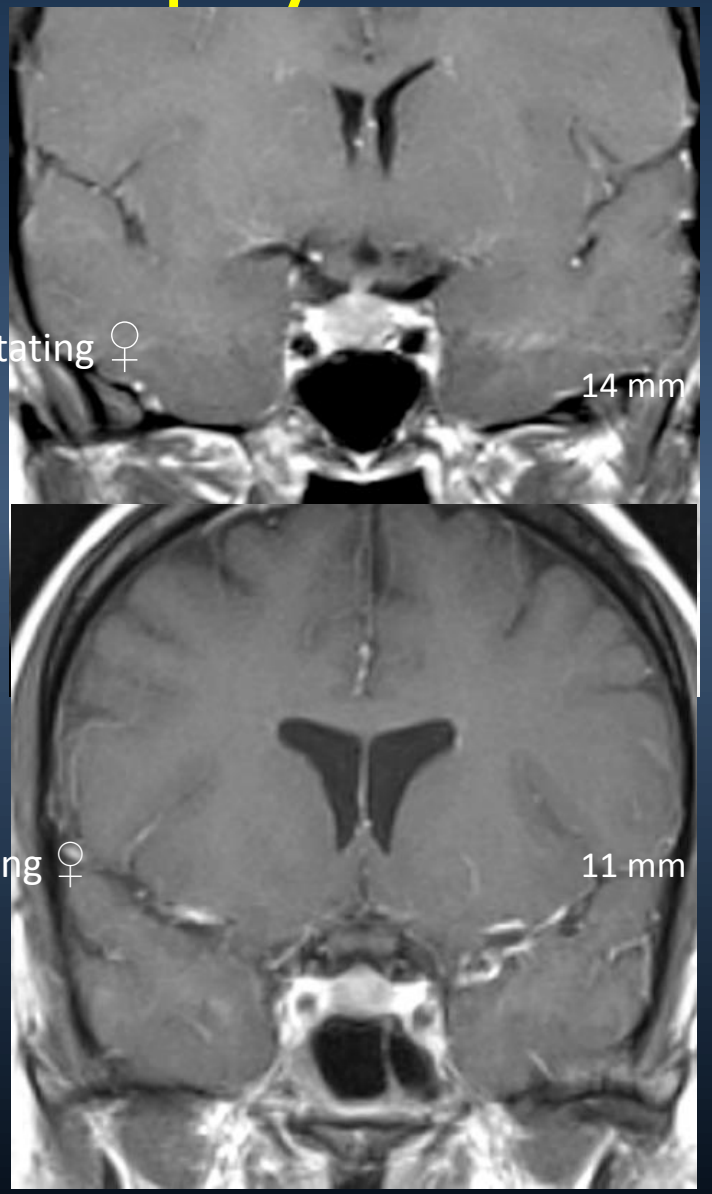
Pituitary Gland Size

Maximum normal height

- 6 mm infants and children
- 8 mm males, postmenopausal females
- 10 mm young women of childbearing age
- 12 mm late pregnancy, postpartum females
- “Elster’s Rule”

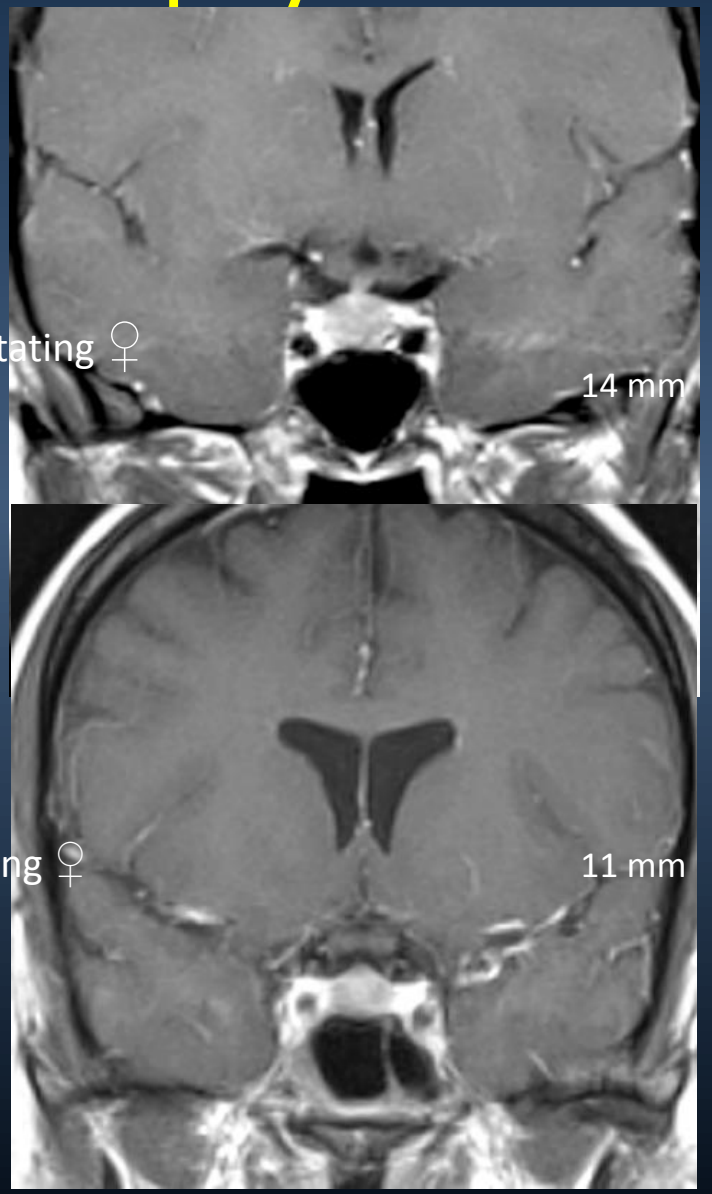
Pituitary Hyperplasia/Hypertrophy

- Must know age, gender!!
- Physiologic ↑
  - 10-15 mm
  - Convex upwards
  - Strong, uniform enhancement
- Can be indistinguishable from:
  - Macroadenoma
  - Lymphocytic hypophitis
  - Metastasis, lymphoma



Pituitary Hyperplasia/Hypertrophy

*** Dynamic imaging may help distinguish physiologic hyperplasia from macroadenoma



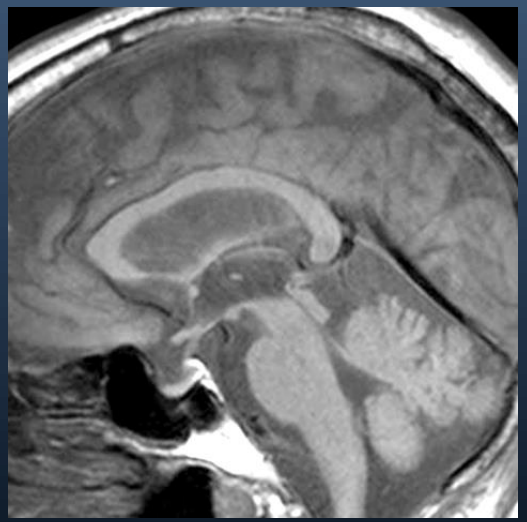
Pituitary Gland Hyperplasia/Hypertrophy

Pathologic hypertrophy

- End-organ failure
  - Hypothyroidism
  - Ovarian failure
- Neuroendocrine tumors

Pituitary hypertrophy secondary to untreated hypothyroidism

“EMPTY” SELLA



Considered normal variant. *Loose* association with Pseudotumor Cerebri

Pituitary Neoplasms

Adenoma

- Adenomas comprise the majority (80%) of pituitary lesions.

- A large percentage of these (approximately 75%) are functioning and result in endocrine abnormalities.

Adenoma type

- Prolactinoma 30%-40%
- Null cell 25%
- GH 20%
- ACTH 10%
- FSH/LH 10%
- PRL-GH 5%
- Mixed, TSH 1-5%
- Incidental pituitary lesions are common

Sella: Pathology

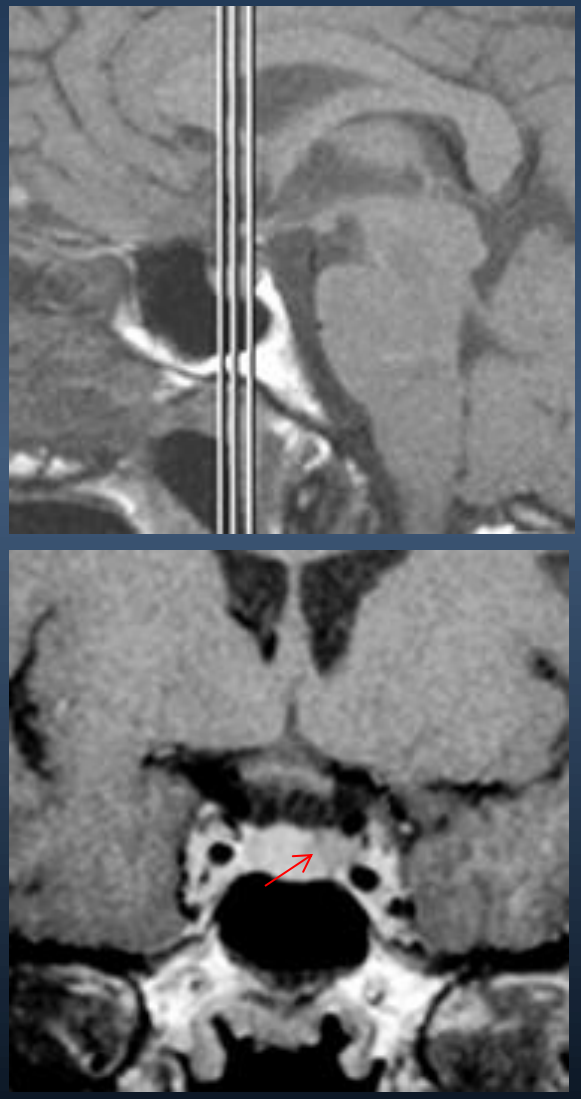
Pituitary Microadenoma

- 10 mm or less
- 10-20% of autopsies
- Micro >>> Macro
- Convex margin
- Stalk deviation
- Sella floor thin

Recommended Imaging Techniques

Dynamic Imaging

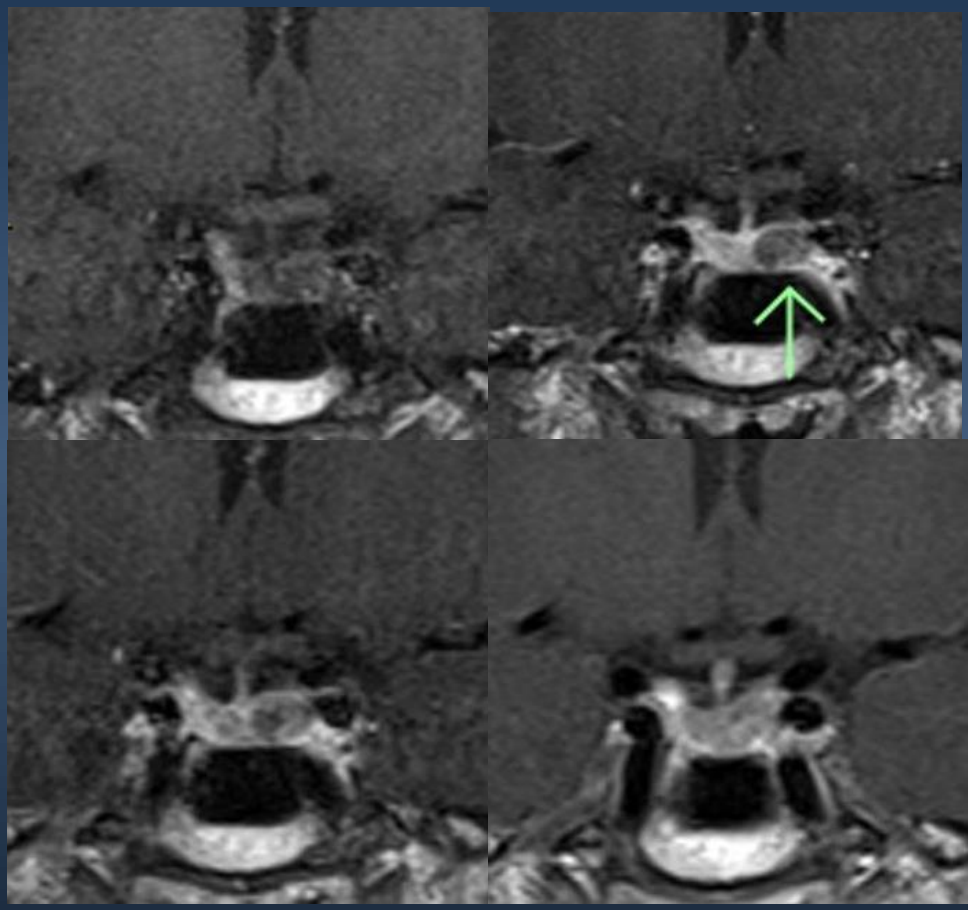
- Microadenomas
- 4-5 slices
- T1 FSE, Turbo SE
- Image continuously after contrast for app 2 minutes
- Increases sensitivity for small adenomas



Sella: Pathology

Dynamic Imaging

- In essence, the normal pituitary gland enhances at a faster rate than the microadenoma, so that early during contrast injection (90 seconds), the adenoma appears as hypointense against the backdrop of enhancing pituitary tissue.
- This difference is lost as microadenoma gradually accumulates contrast (after app 2 minutes)



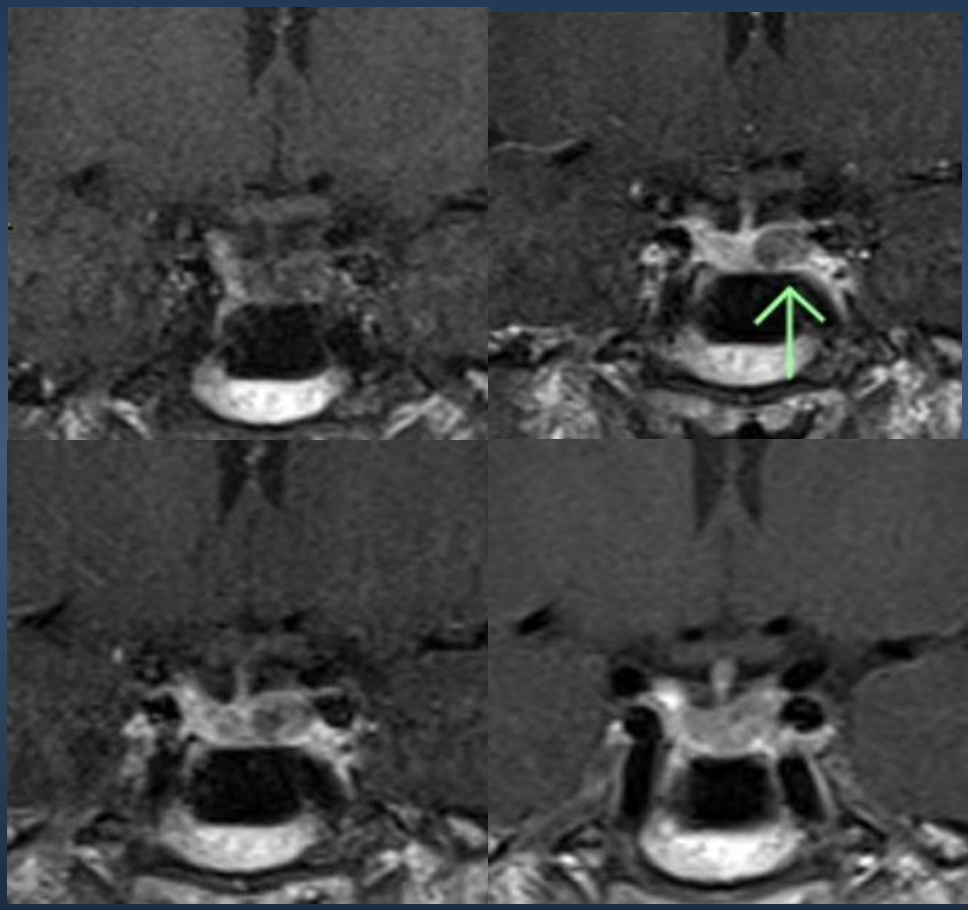
There is up to a 20% false-negative rate in the detection of microadenomas.

Sella: Pathology

Microadenoma

Dynamic Imaging

- Increases sensitivity
- (10-30% seen only on dynamic MR)



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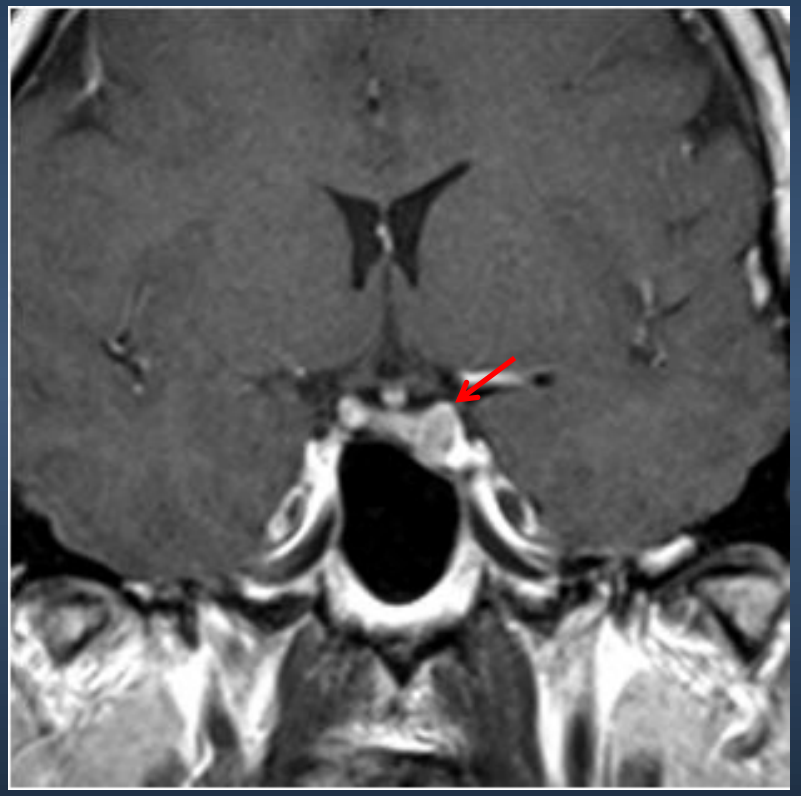
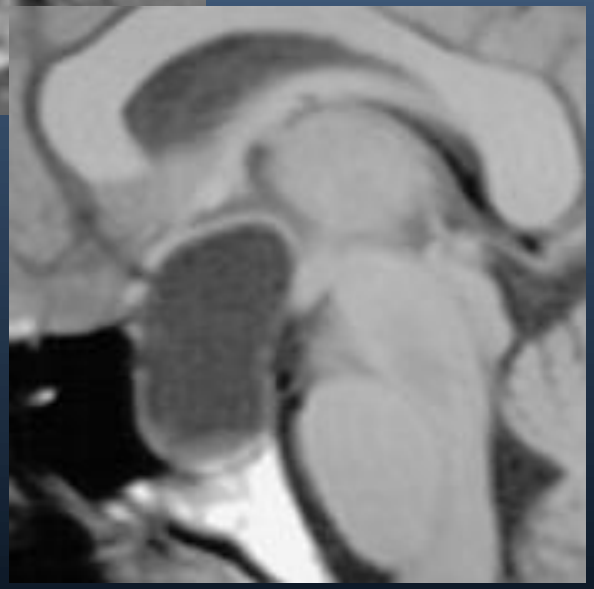
Pituitary Microadenoma



Sella: Rathke Cleft Cyst

Clinical

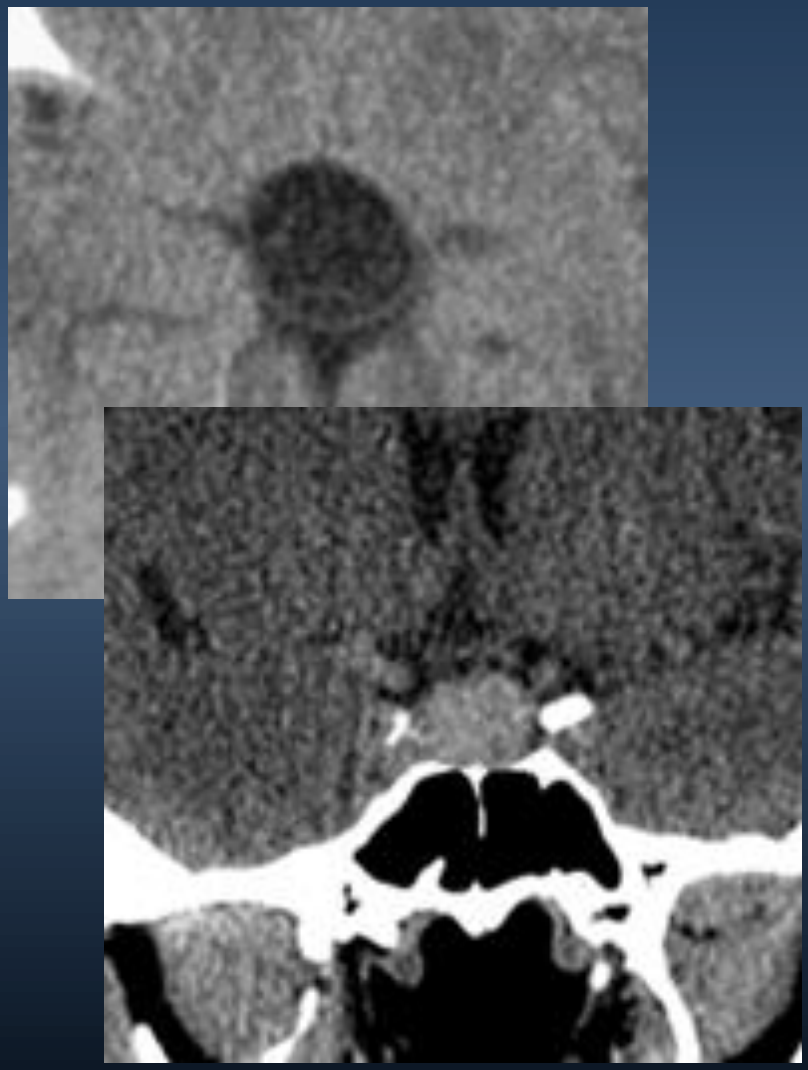
- Intrasellar 40%
- Suprasellar extent 60%
- 3mm – 3cm
- Most incidental
- Symptomatic
  - Pituitary dysfunction
  - Visual change, HA



Rathke Cleft Cyst: CT

CT

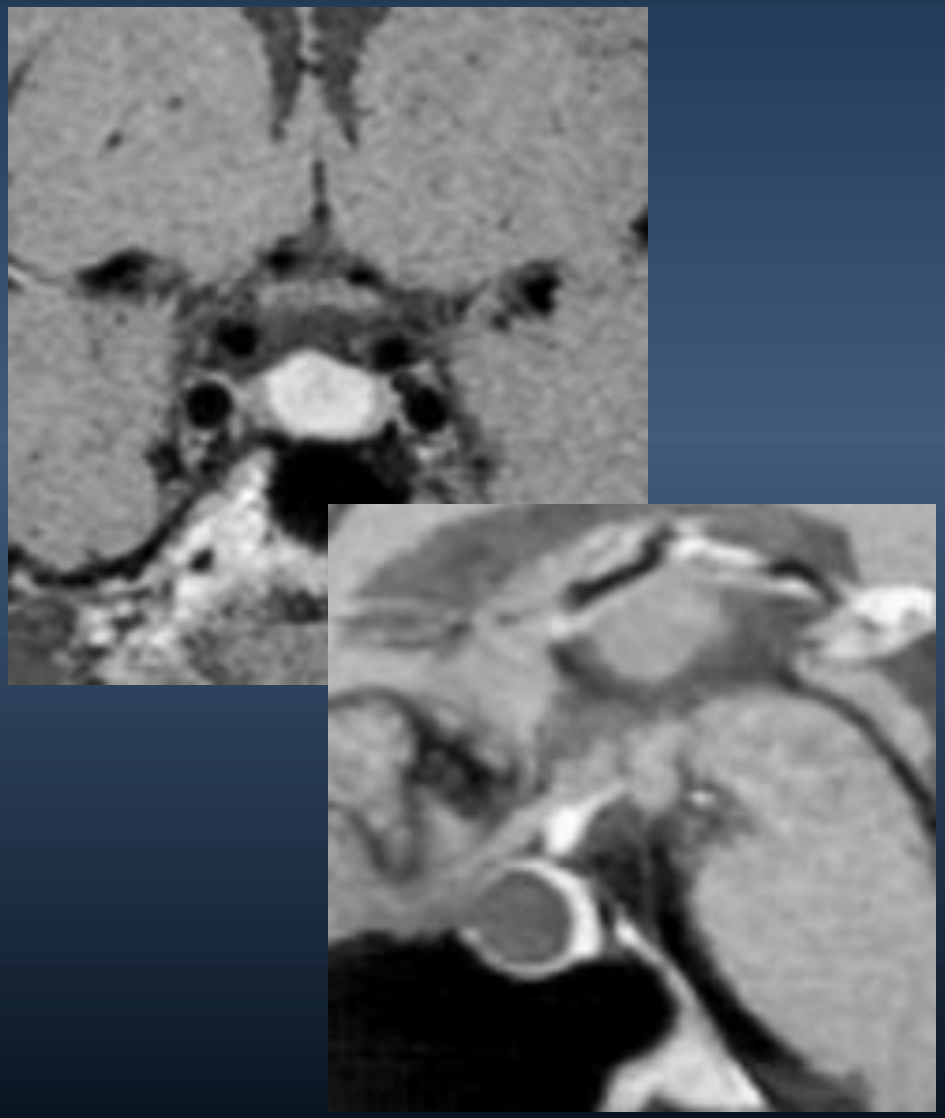
- 75% hypodense
- 25% iso/hyperdense
- Ca++ rare
- May be difficult to differentiate from other benign cysts or craniopharyngiomas



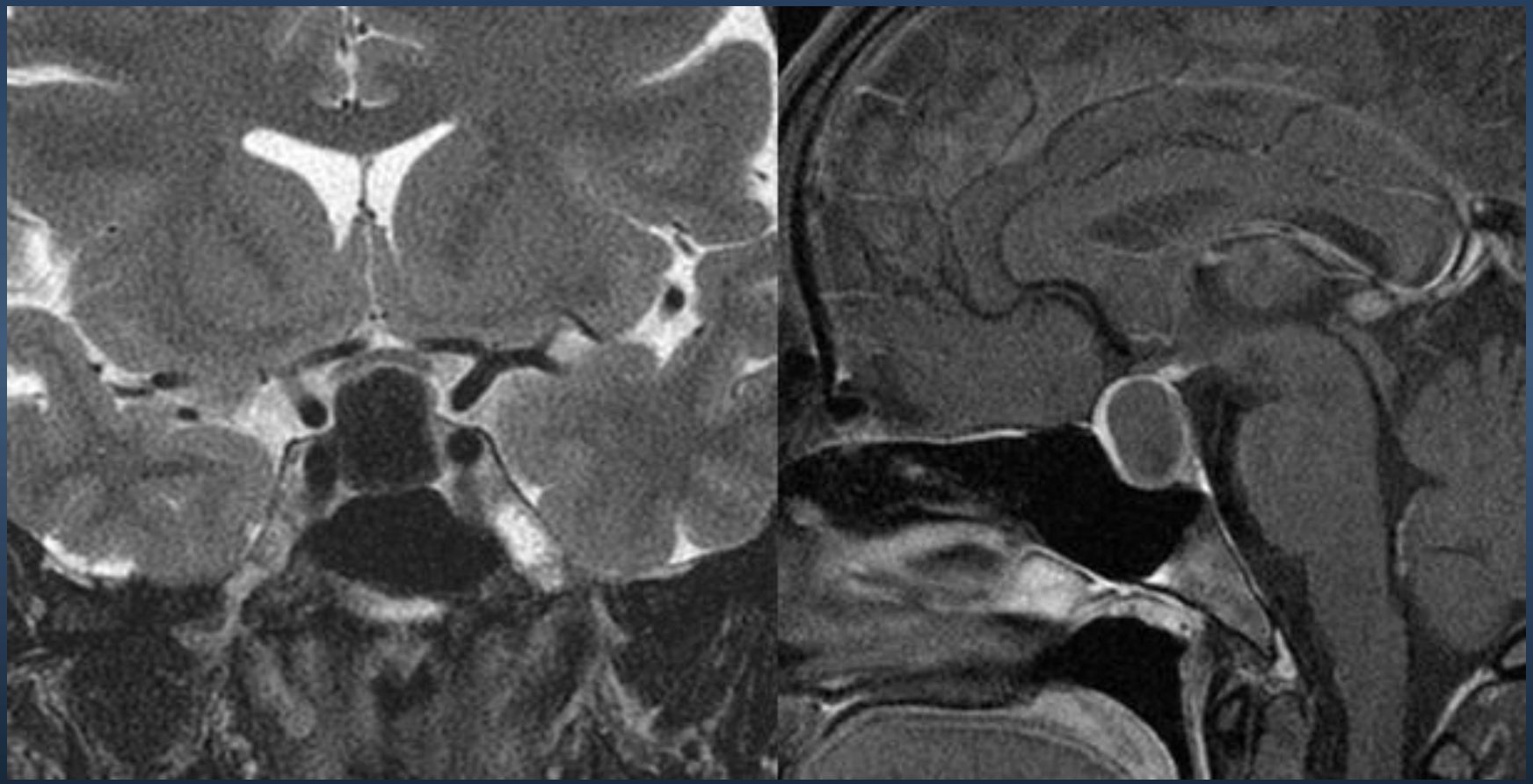
Rathke Cleft Cyst: MR

Imaging Features

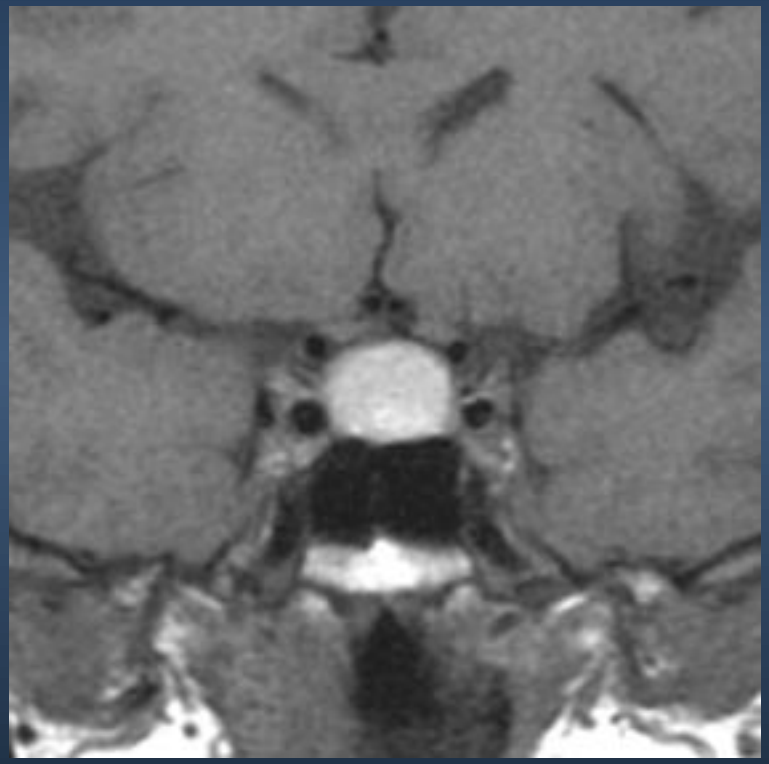
- Signal varies - cyst content
- 50-60% T1 hyperintense
- 30-40% follow CSF
- 75% intracystic nodule
- +/- rim enhancement

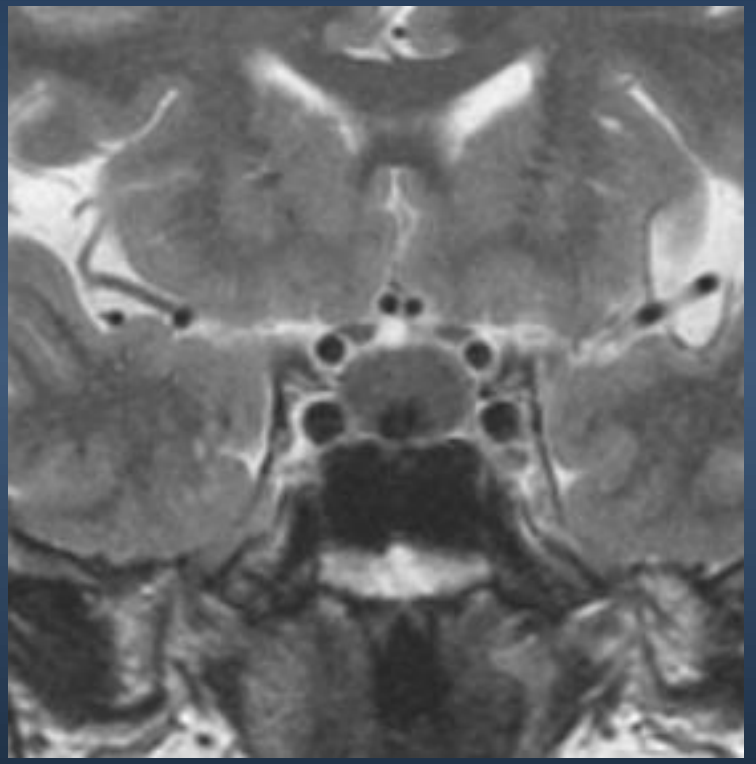


Rathke Cleft Cyst



Rathke Cleft Cyst





Suprasellar Masses: The “Big Five”

- 75% of all sellar/parasellar masses
  1. Pituitary macroadenoma (35%-50%)
  2. Meningioma
  3. Aneurysm
  4. Craniopharyngioma
  5. Astrocytoma (hypothalamic-chiasmatic)

10% each

Suprasellar Differential Diagnosis

Adult Lesions

- Pituitary Macroadenoma
- Meningioma
- Aneurysm

Pediatric Lesions

- Craniopharyngioma
- Chiasmatic / Hypothalamic Glioma
- Hypothalamic Hamartoma

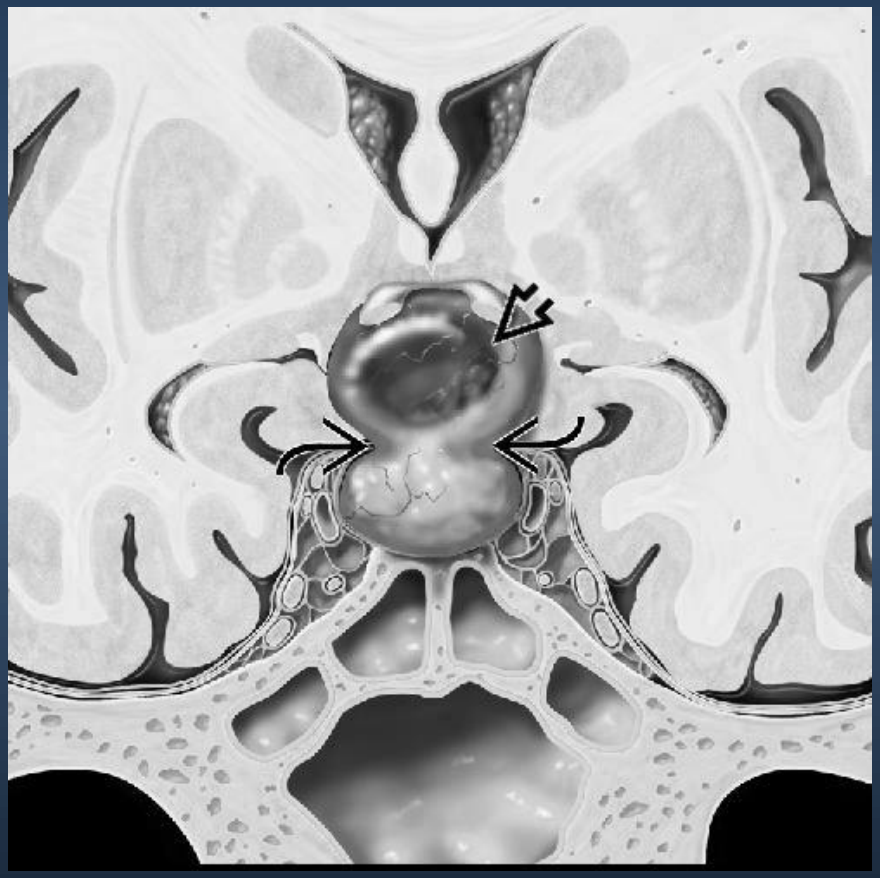
Suprasellar Masses

- Is the patient adult or child?
- Is the mass intra- or extra-axial?
- If extra-axial, does it arise from pituitary?
  - Can you identify pituitary gland separate from mass?
  - Or is the gland the mass?
  - Does it mostly involve the infundibular stalk?
- Intra-axial masses arise from
  - Optic chiasm, hypothalamus
  - 3rd ventricle
- Is the mass cystic or solid?
  - If cystic, is it exactly like CSF?

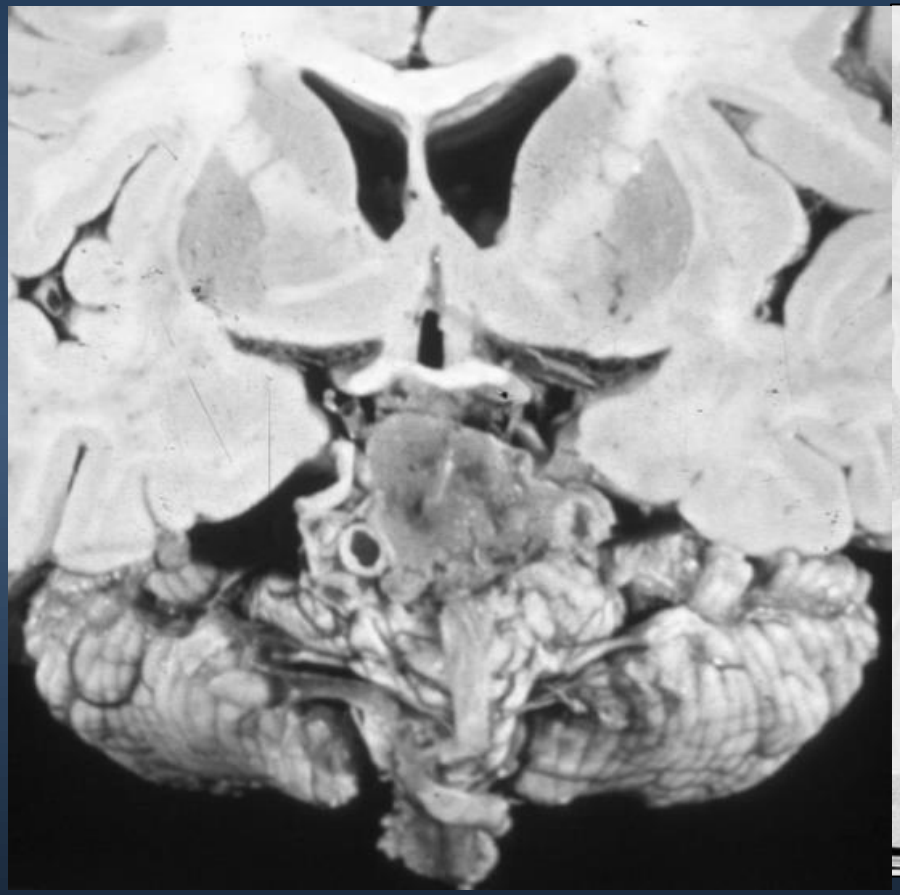
Pituitary Macroadenoma

Clinical / Pathologic

- Most common suprasellar mass (50%)
- Compressive symptoms
- 10% of intracranial tumors
- > 10mm
- Enlarged sella turcica



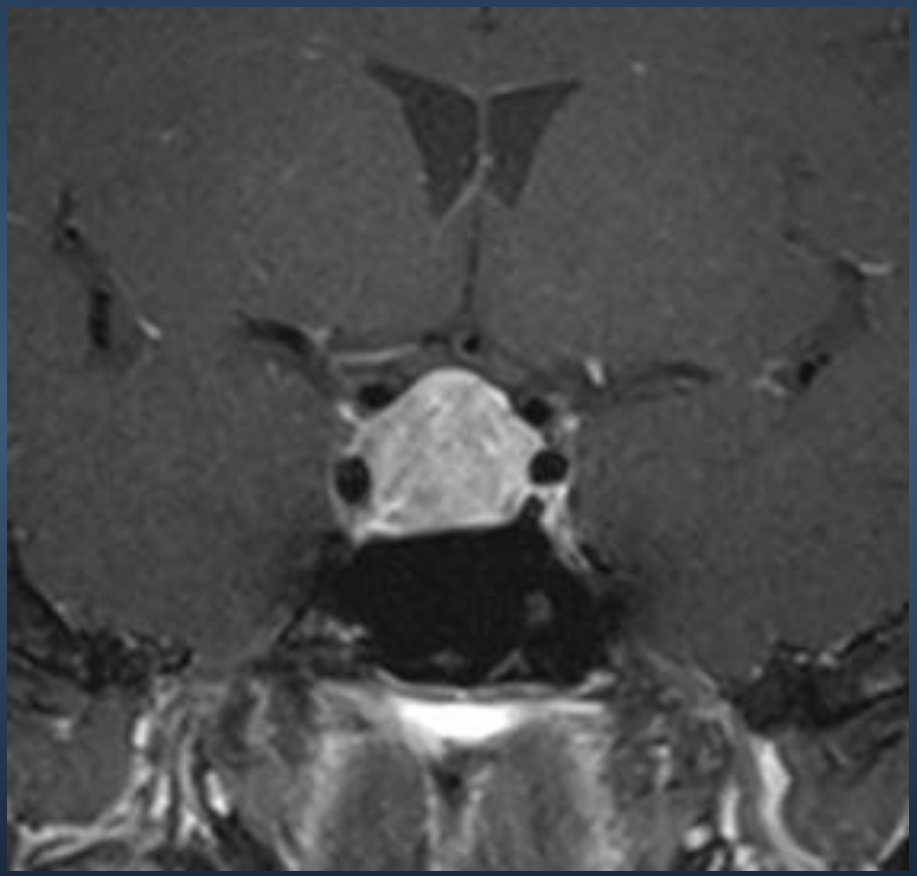
Suprasellar: Pathology



Pituitary Adenoma

Prolactinoma

- 30%-40% of adenomas
- Female >> Males
- Galactorrhea
- Amenorrhea
- Serum PRL > 150ng/mL
- If > 1000ng/mL invasion

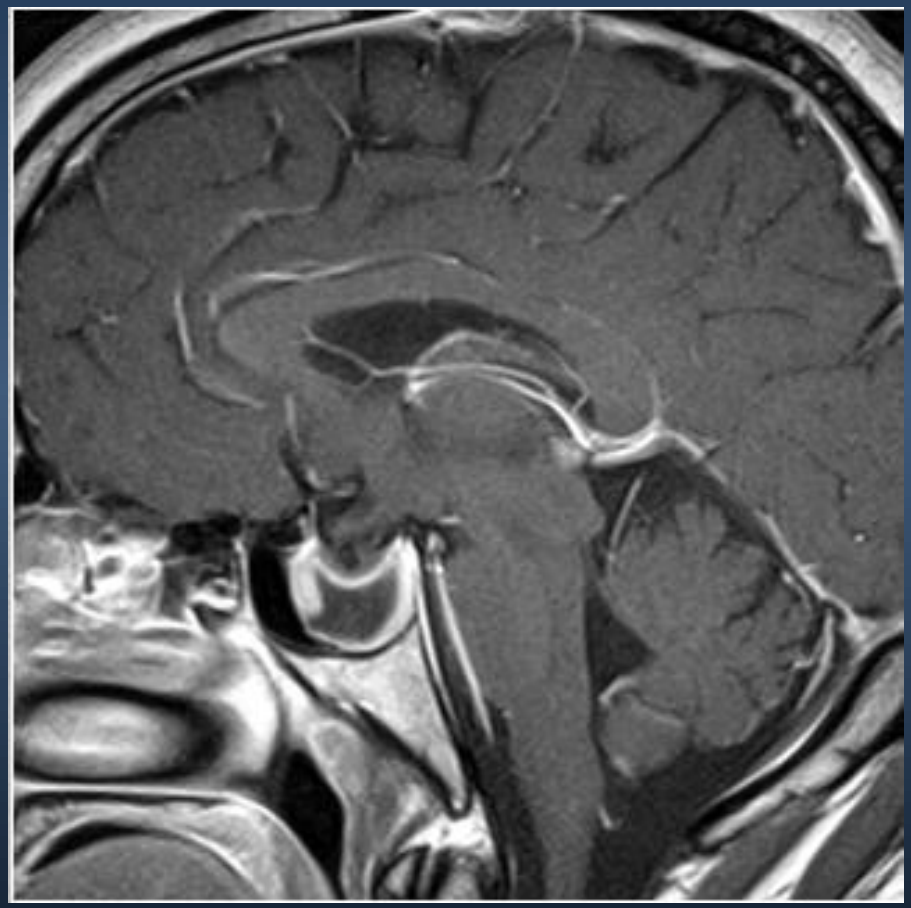


Pituitary Macroadenoma: MR

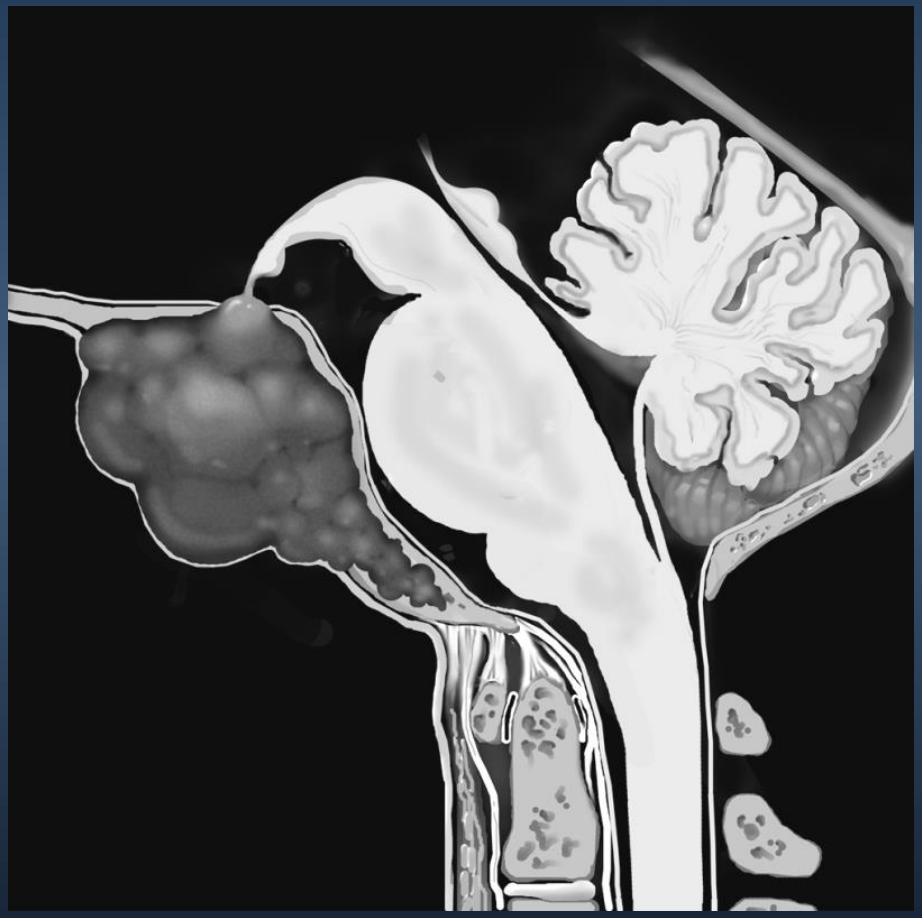
Imaging Features

- Isointense GM: T1, T2WI
- “Mass is the pituitary”
- May have hemorrhage, cystic components
- Figure-eight, snowman
- Strong but heterogeneous enhancement

Pituitary Macroadenoma: MR

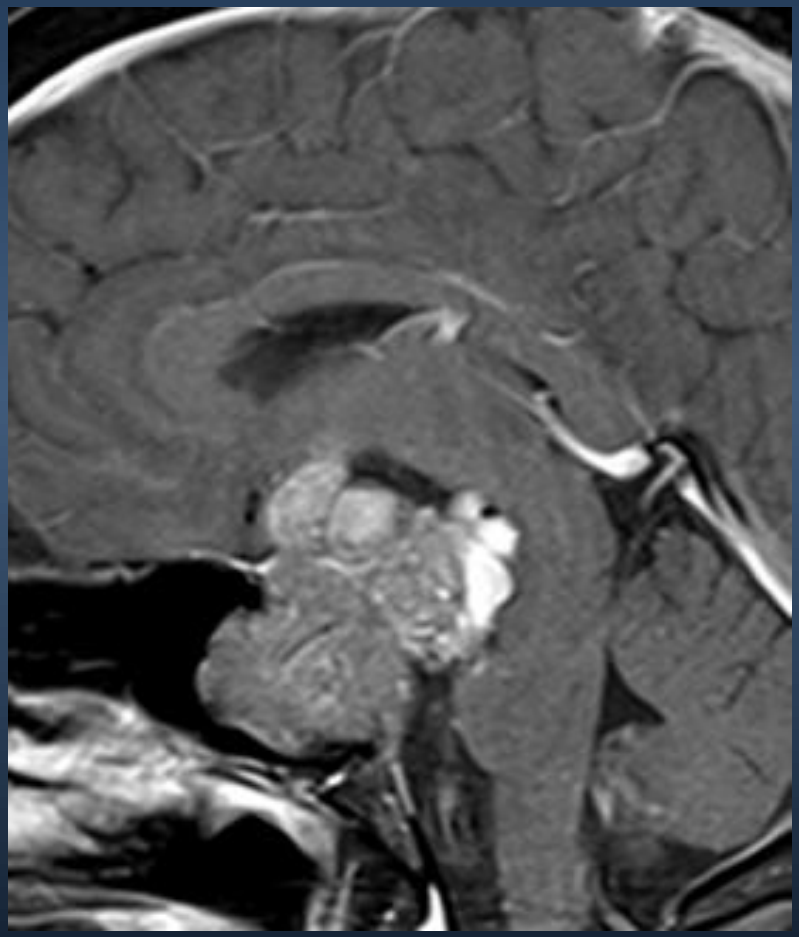


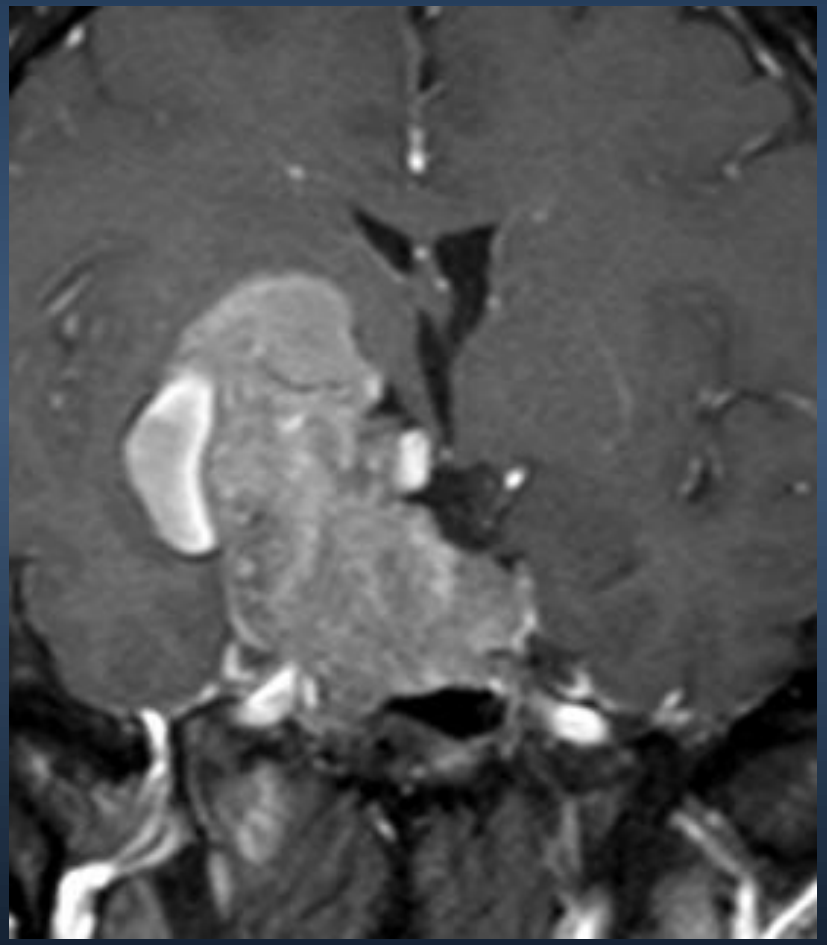
Giant Pituitary Macroadenoma



Prolactinoma

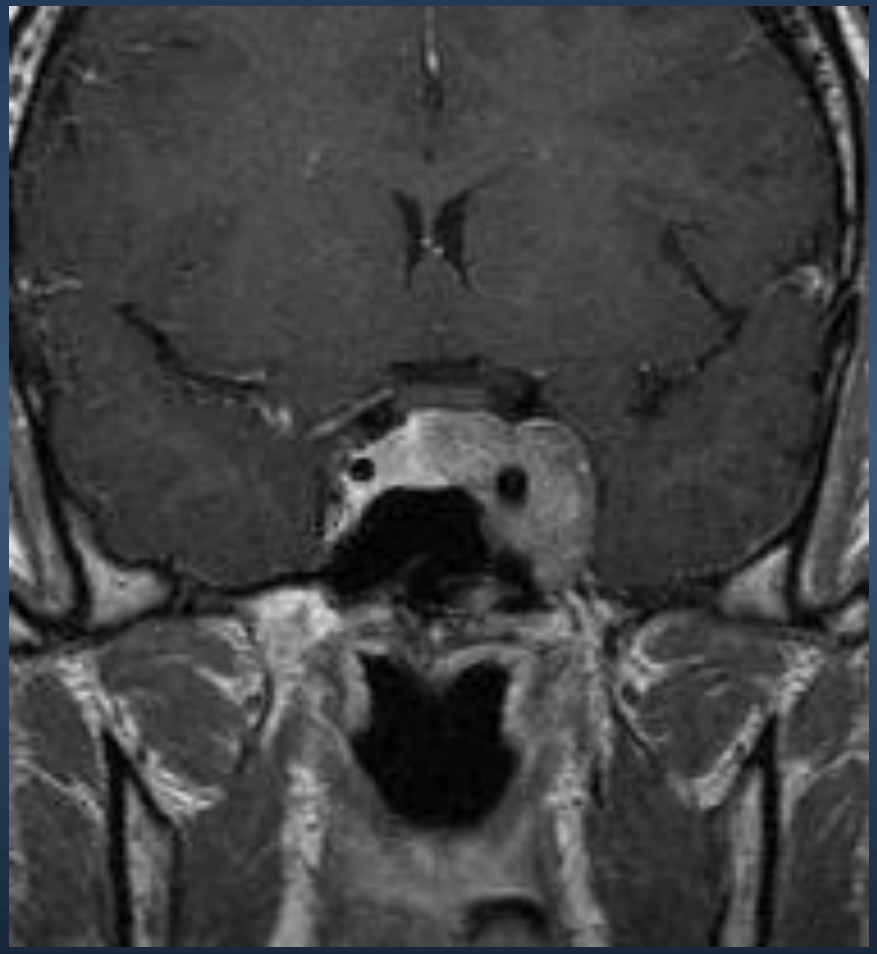
Giant Pituitary Macroadenoma





Cavernous Sinus Invasion

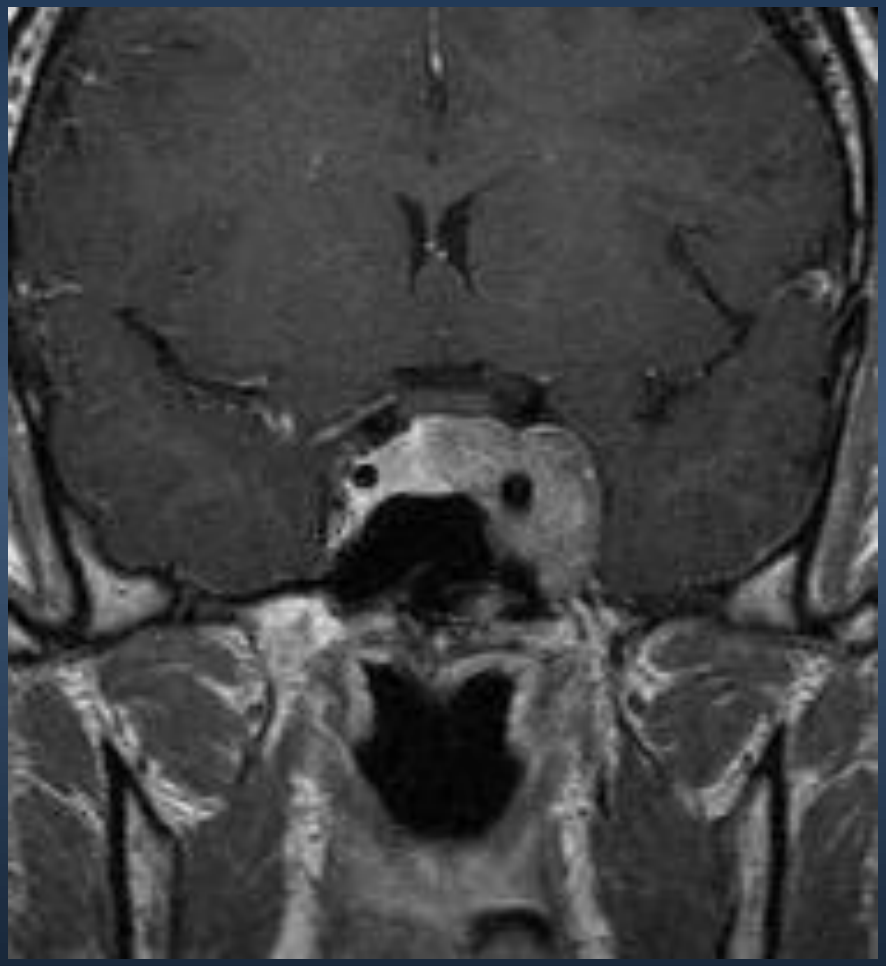
- Adenomas that involve the lateral margins of the adenohypophysis may grow laterally beyond the sellar margin and invade the adjacent cavernous sinus.
- 5- 10% of all pituitary adenomas involve the cavernous sinus and are considered to be invasive



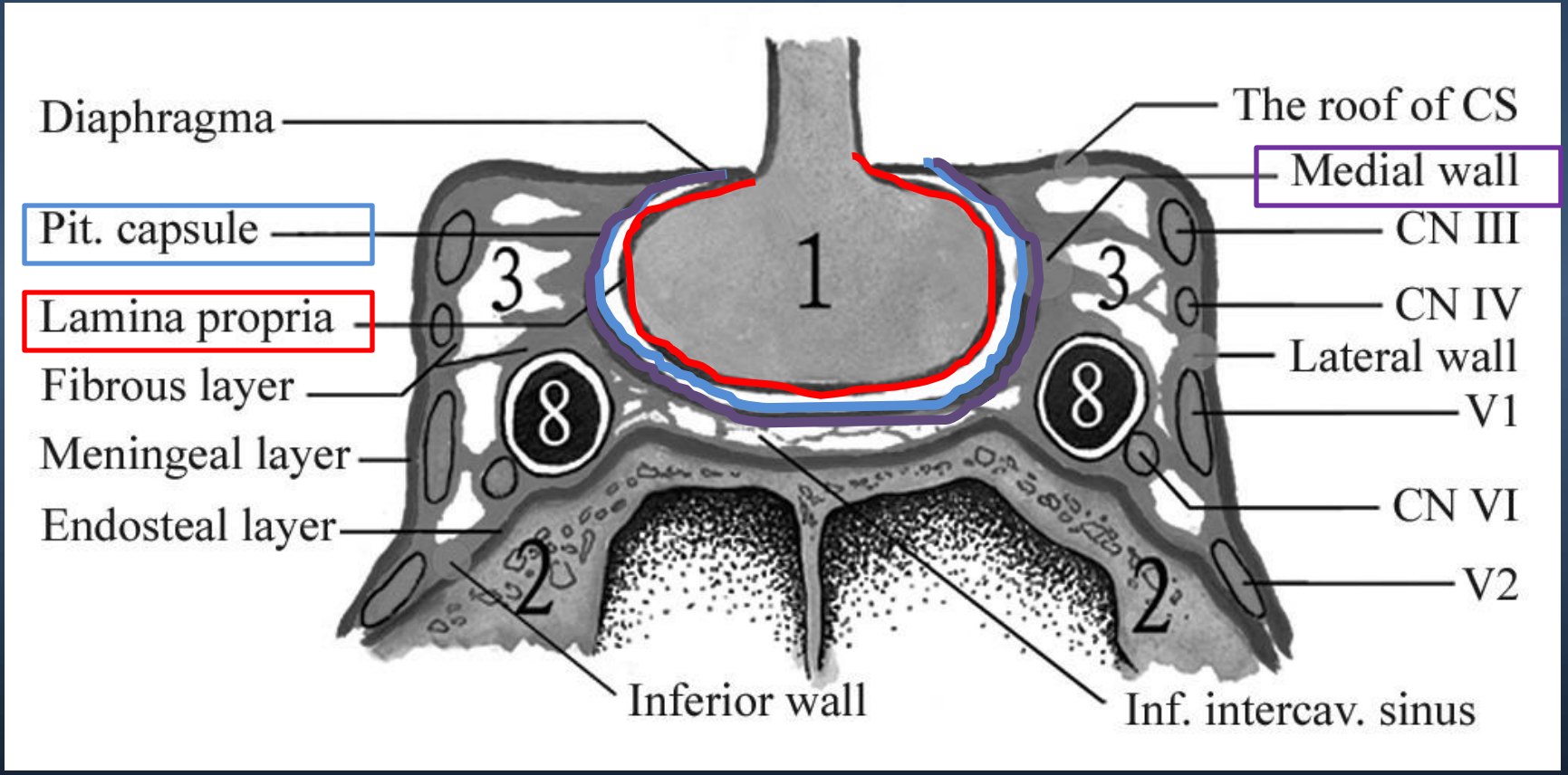
Cavernous Sinus Invasion

Involvement of the cavernous sinus:

- increases the morbidity and mortality associated with surgical procedures
- results in higher rates of residual /recurrent tumor
- may necessitate adjuvant radiotherapy or suppressive medications

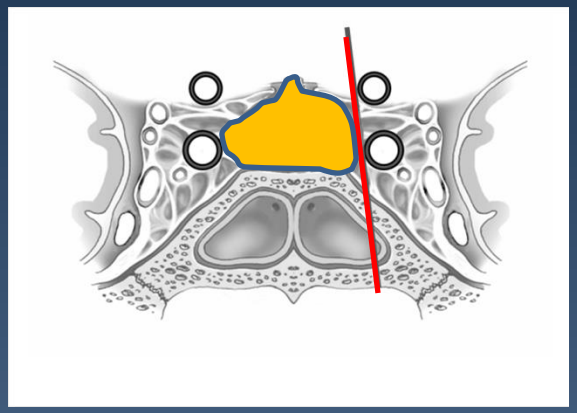


Pituitary-Cavernous Interface



Songtao, Qi, et al. Membranous Layers of the Pituitary Gland, Operative Neurosurgery, March 2009

Cavernous Sinus Invasion



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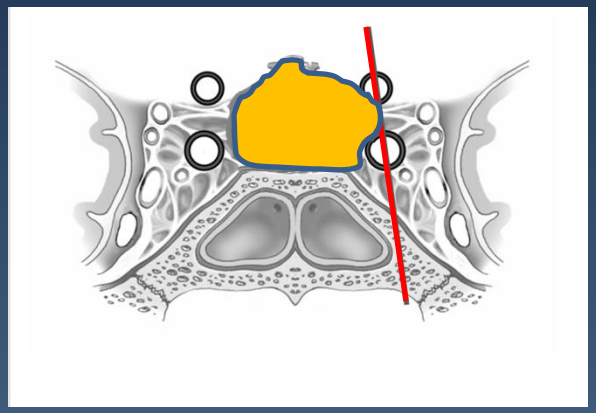

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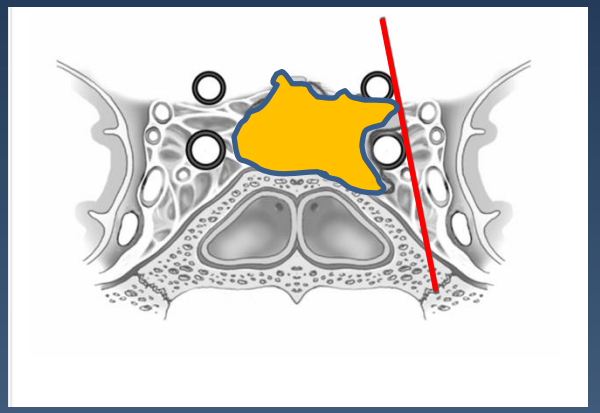

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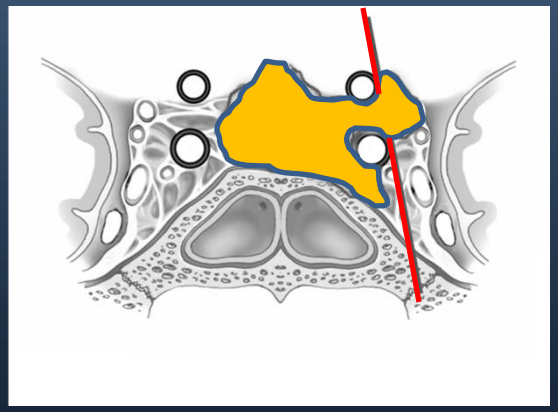

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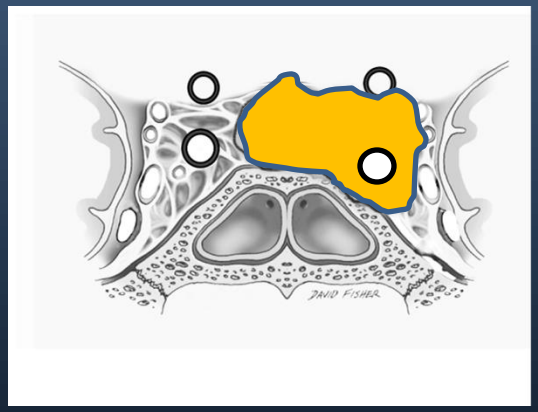

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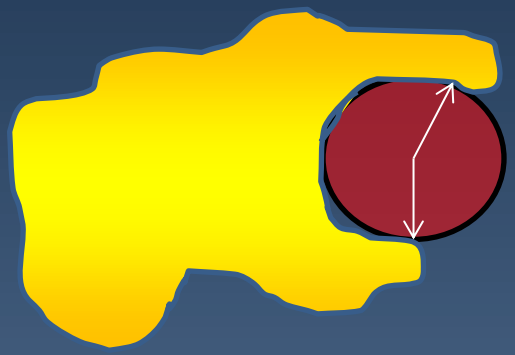
Knosp-Steiner Grading

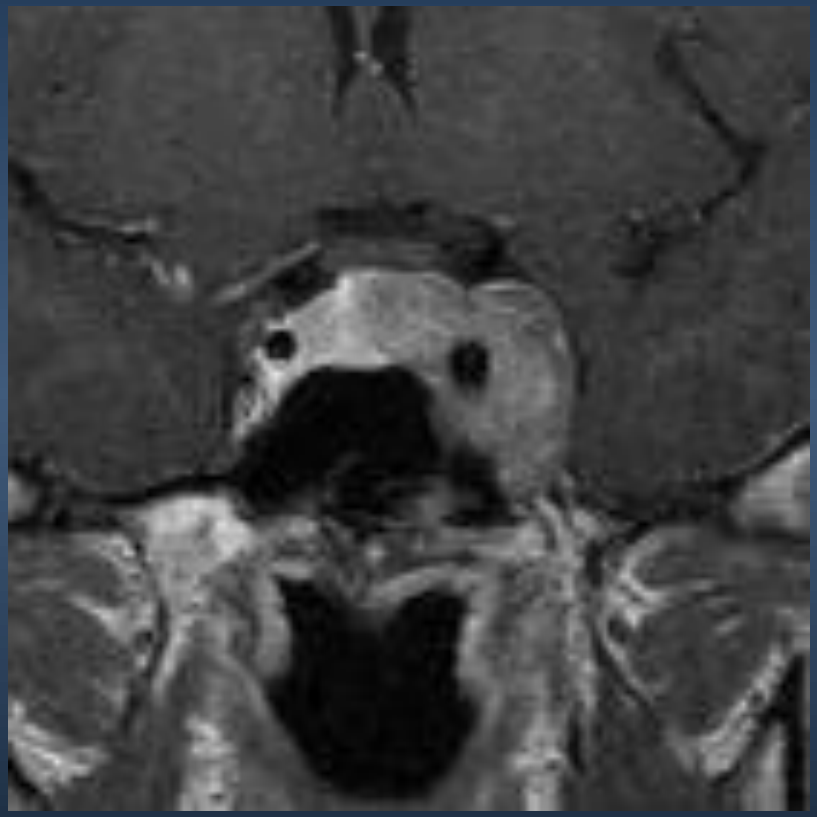
Cavernous Sinus Invasion

Cottier et al Cavernous sinus invasion by pituitary adenoma: MR imaging. Radiology. 215(2):463-469, 2000

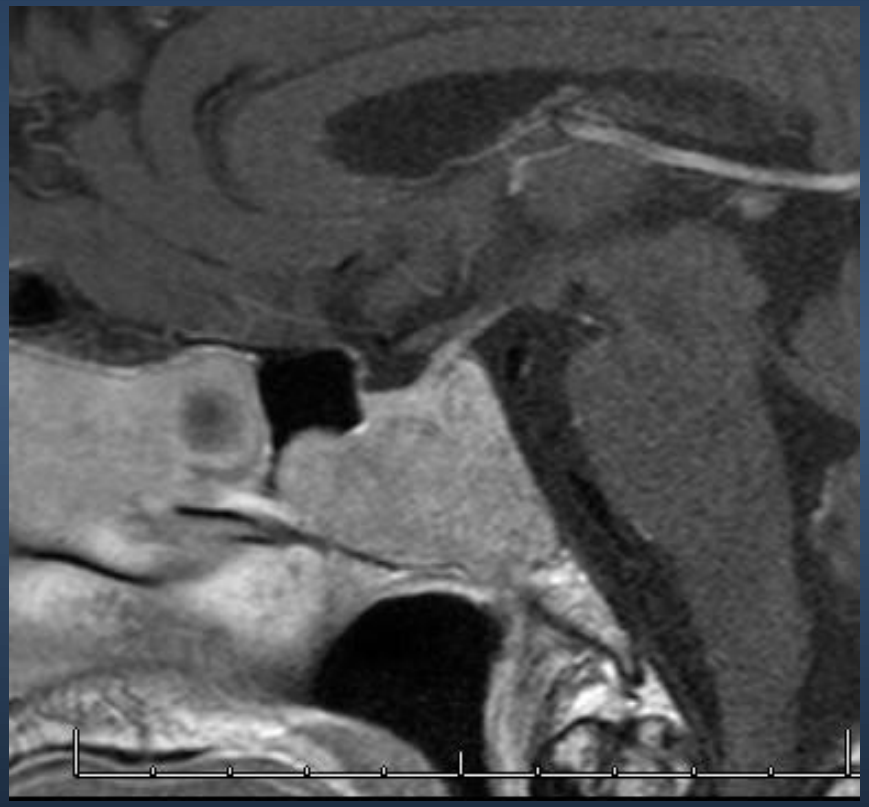
- Found the most specific sign of CSI to be partial tumor encasement of the intracavernous ICA by 67% of its circumference (positive predictive value of 100%)
- Cavernous sinus invasion could be ruled out with a negative predictive value of 100% if the percentage of encasement of the perimeter of intracavernous ICA was lower than 25%

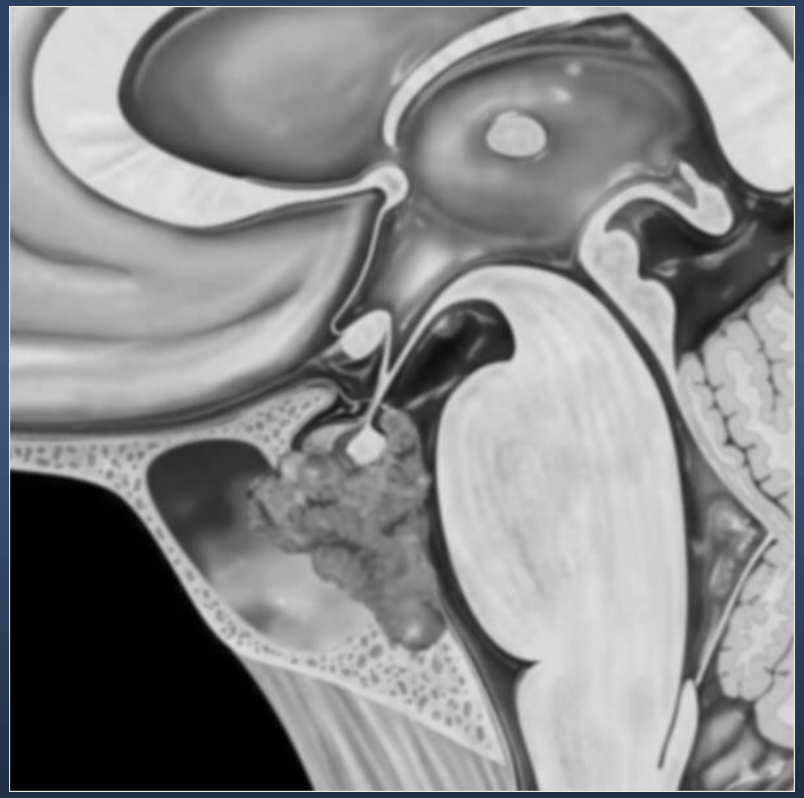


Extrinsic narrowing of the carotid artery is rarely associated with pituitary adenomas and is more suggestive of meningiomas

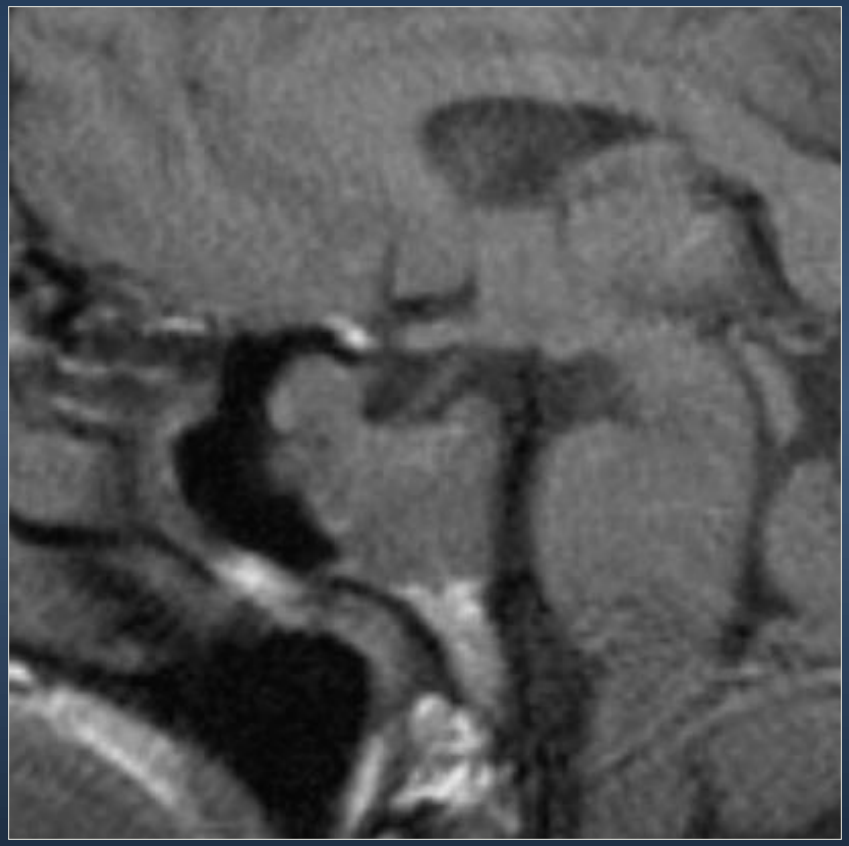


Invasive Pituitary Macroadenoma

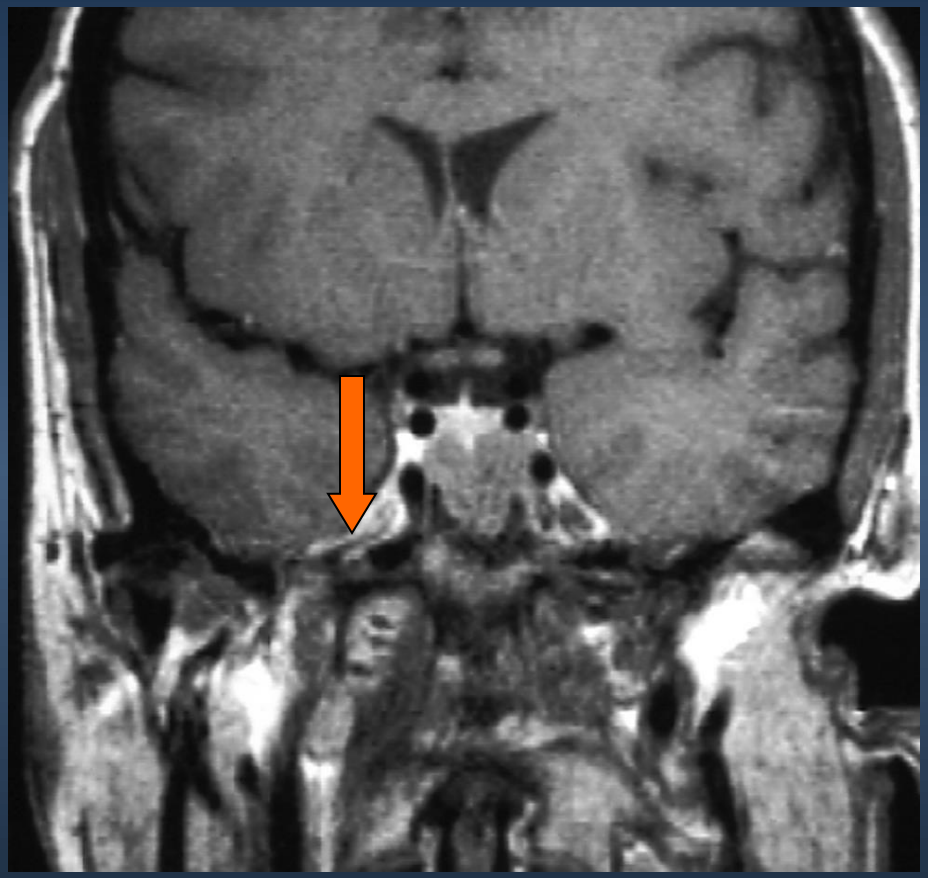




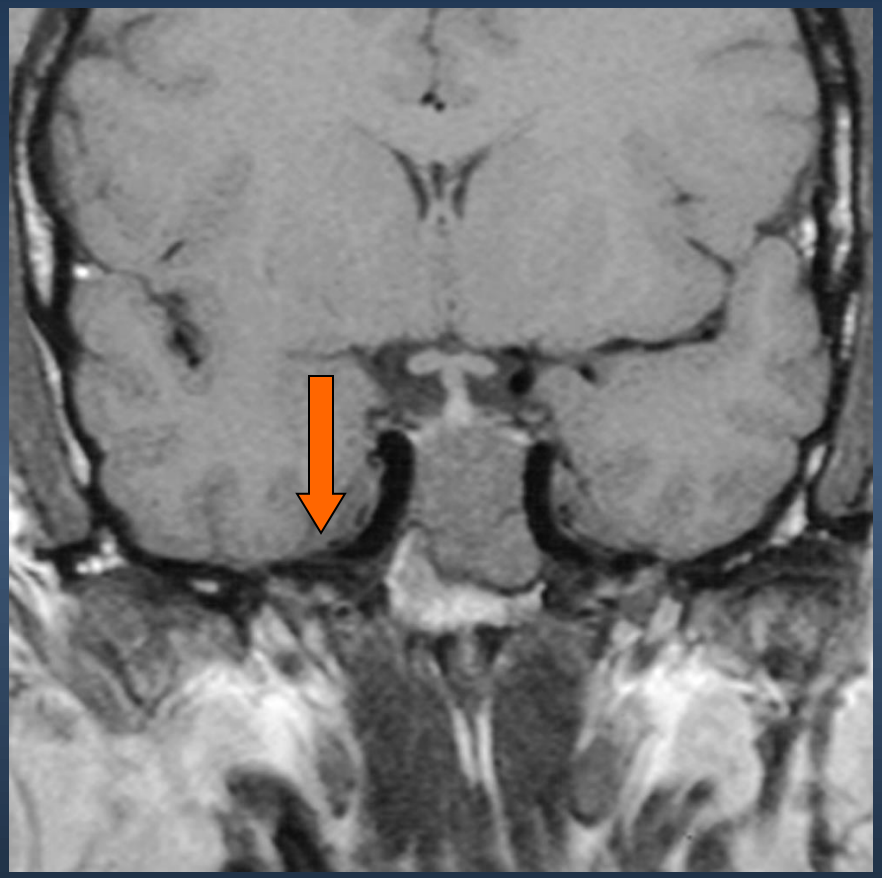
37 yo male with Prolactinoma



Infrasellar Extension

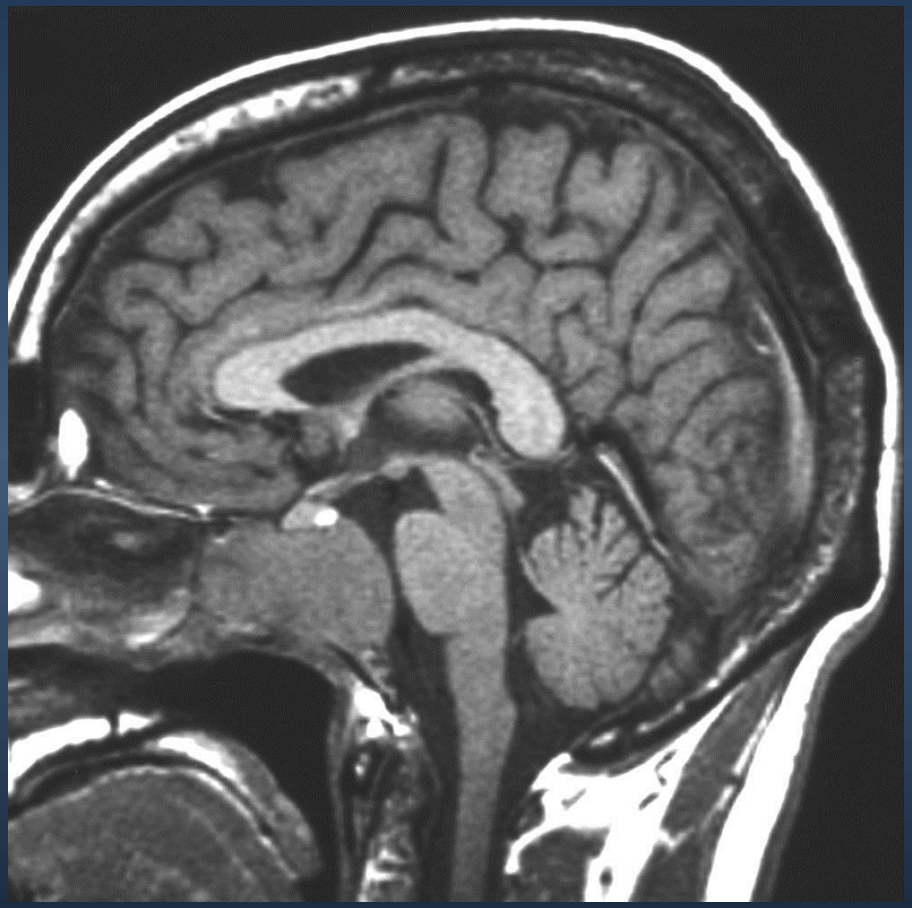


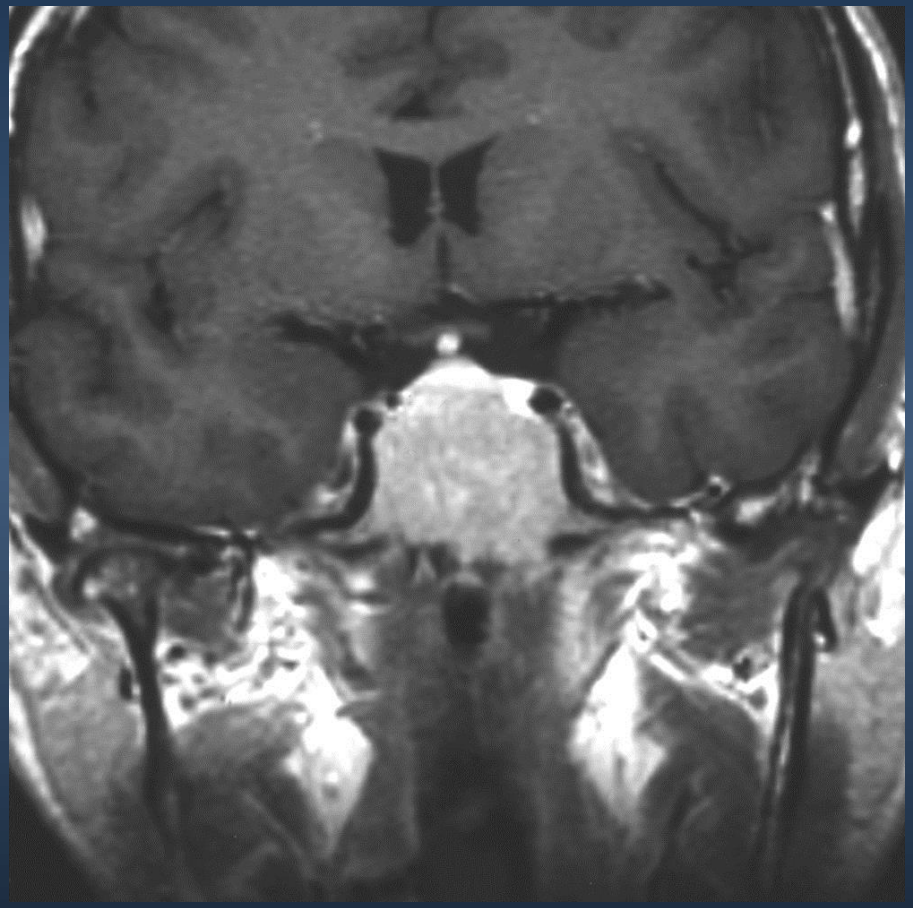
Growth hormone secreting



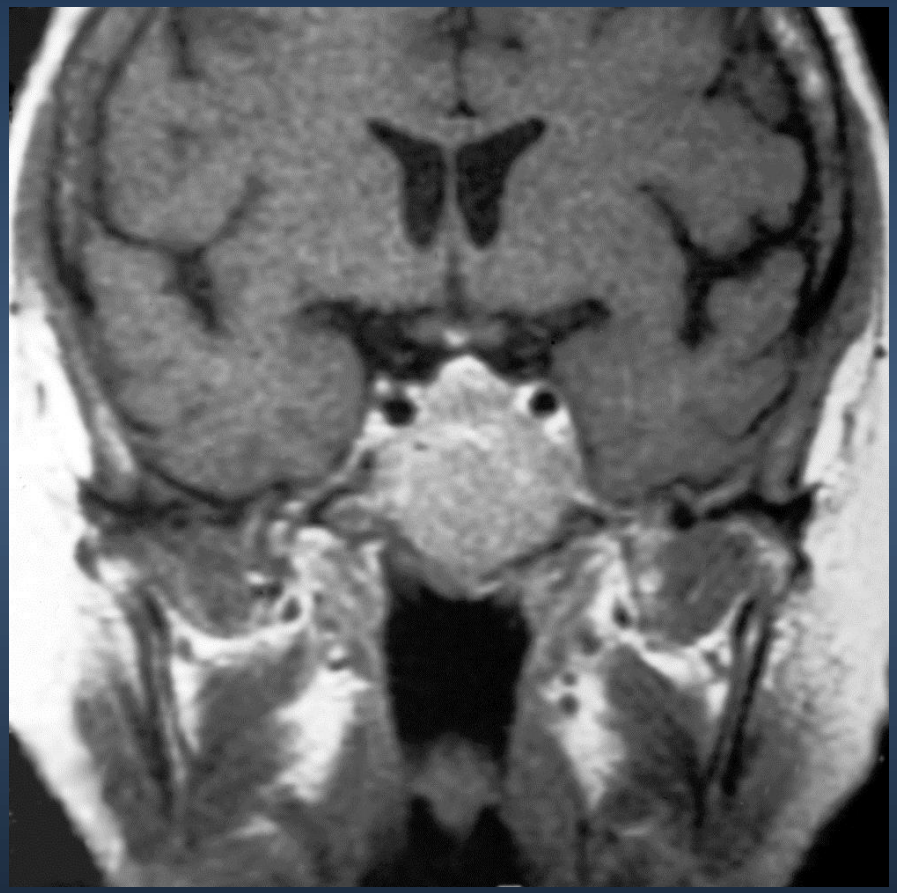
Prolactin secreting

Plasmacytoma/Myeloma

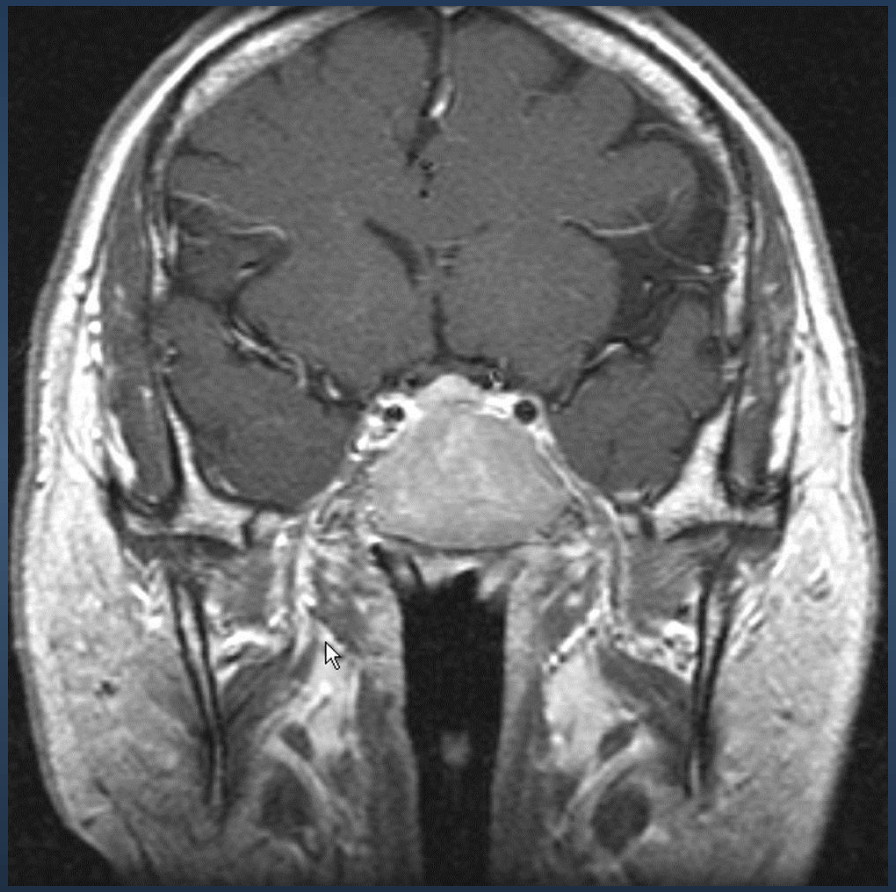




Multiple Myeloma Of Clivus

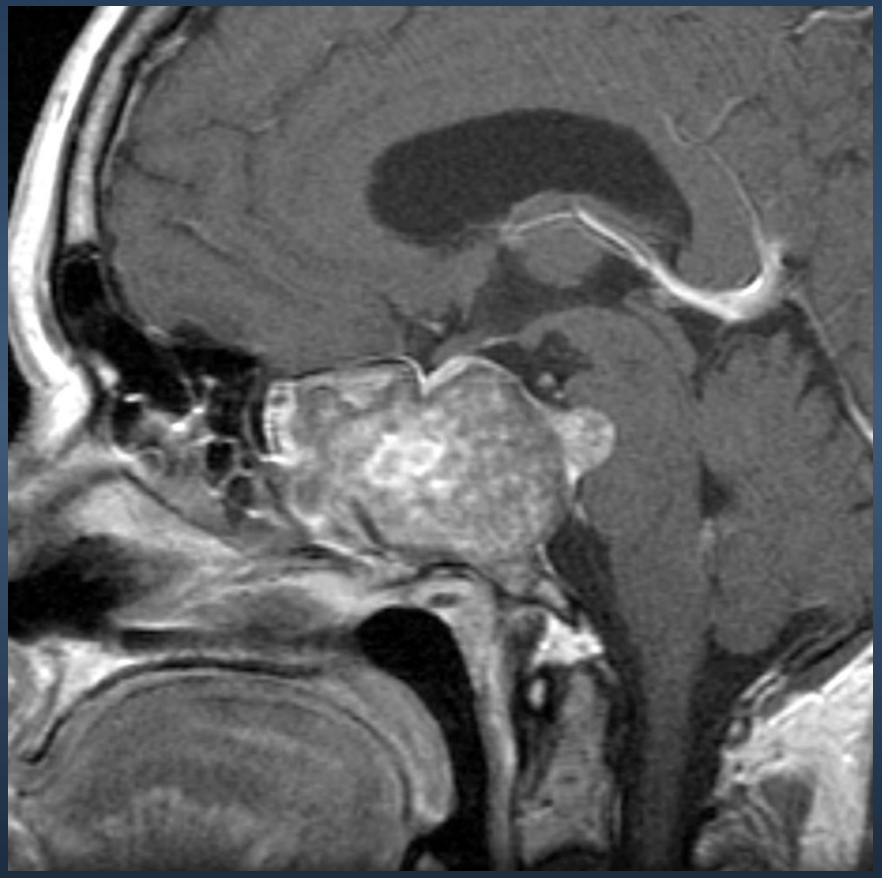


69 yo with h/o mm



65 yo male with mm

Prolactinoma



Chordoma

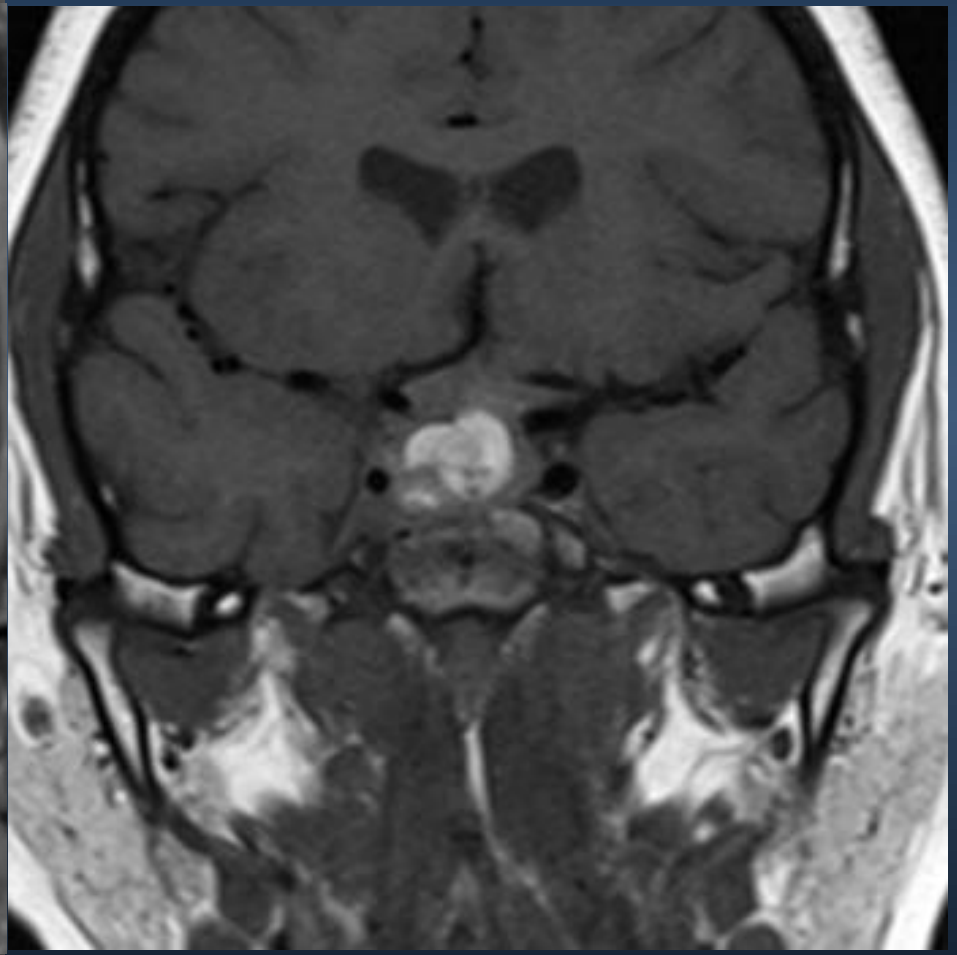
Pituitary Apoplexy

Clinical Syndrome

- Acute onset
- Visual changes
- Headache
- Vomiting
- Meningismus
- Rapid enlargement of Macroadenoma secondary to hemorrhagic infarction
- Rare, life threatening

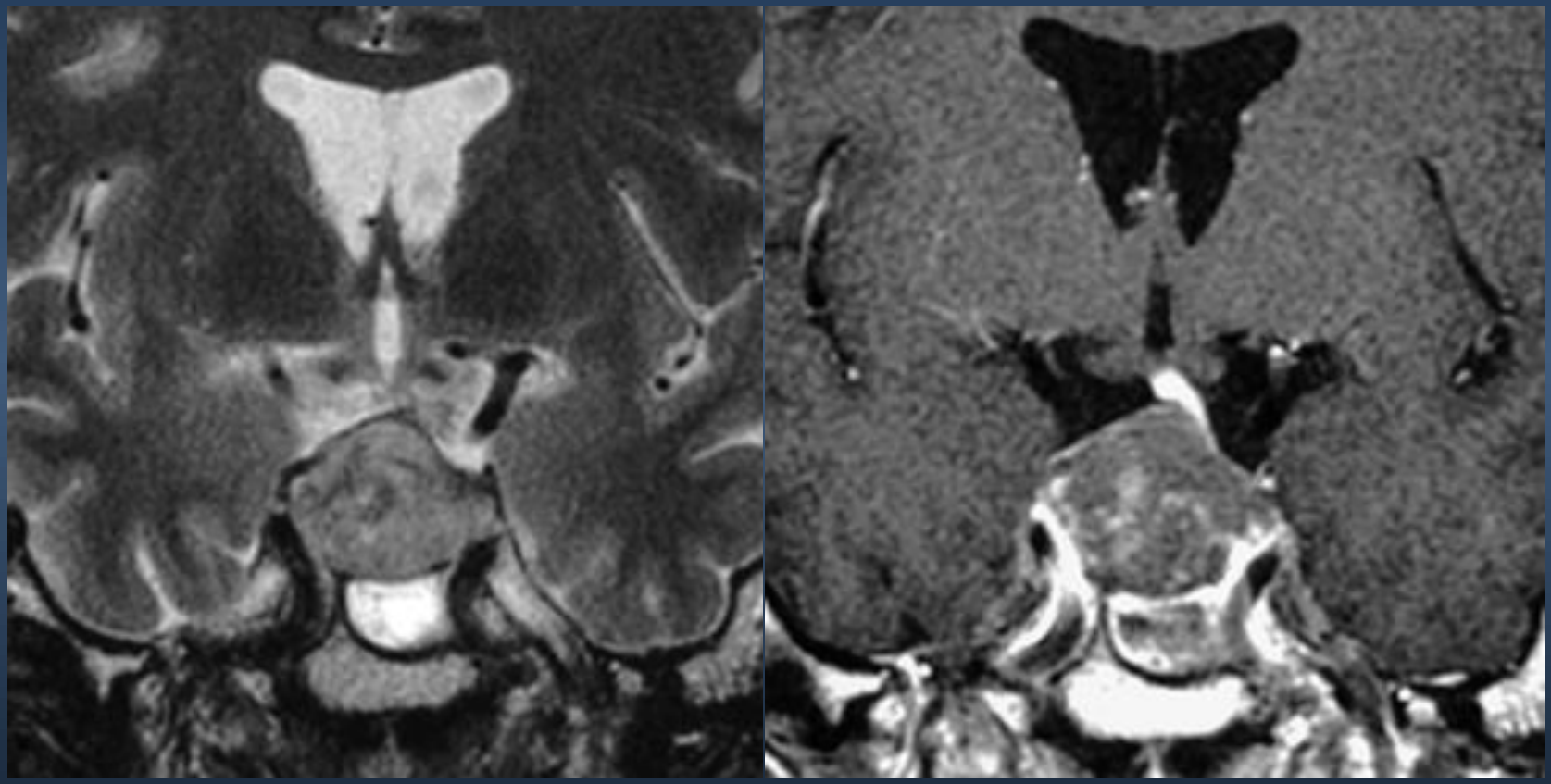
T1 Shortening in subacute hemorrhage

Pituitary apoplexy



21 yr old female with abrupt headache and visual loss

Pituitary (Tumor) Apoplexy



Peripheral enhancement may indicate acute hemorrhage or infarction

Macroadenoma with hemorrhage?