

## **Part II - Revising the sellar and parasellar region: differential diagnosis of a sellar region mass**

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## Learning objectives

Provide some examples and key features in the diagnosis of a sellar region mass, using both CT and MRI.

## Background

There is a broad spectrum of pathology that can affect structures in the sellar and parasellar regions, such as adenomas, meningiomas, less common entities such as Rathke's cleft cysts and craniopharyngiomas, but also vascular anomalies.

When evaluating sellar pathology, it is important to first localize the process to the sellar, parasellar, or suprasellar compartment and have a systematic approach towards analysis.

One of the most important clinical features to consider is **patient age**, as gender and endocrine status are helpful ancillary clues.

### THE APPEARANCE OF THE NORMAL SELLA

The pituitary stalk extends inferiorly, as a continuation of the hypothalamic infundibulum, projecting into the gland through a hiatus in the diaphragma sellae. The stalk is broadest superiorly and tapers towards its insertion into the gland. Its upper limits are variable, but a consensus can be made regarding its measurements, reaching as much as 3.5mm at the median eminence, 2.9mm at the midpoint and 1.9mm at the insertion.

Usually, the pituitary stalk is best seen on postgadolinium T1 weighted images (T1WI), due to its strong enhancement, and moderately well seen on T2 weighted images (T2WI) due to the natural contrast provided by the cerebrospinal fluid (CSF).

CSF follows the same signal intensity as other fluids, with low signal intensity on T1WI and high on T2WI.

The gland is considered to be somewhat symmetric, but some variability can exist regarding lobule morphology.

Almost directly superior to the stalk lies the **optic chiasm**, which tends to have an ovoid shape with isointensity to white matter on T1WI (**Fig. 3 on page 7**)

Laterally to the sella lie the **cavernous sinuses** (**Fig. 2 on page 6**) which contain countless sinusoids and allow the return of venous blood to the petrosal sinuses. Regarding signal intensity, they are isointense on T1WI, slightly hyperintense on T2WI and enhance considerably after gadolinium.

The most conspicuous structure within the cavernous sinuses is the cavernous segment of the internal carotid artery which, due to rapid blood flow, has little magnetic signal.

Other important but poorly seen structures within the cavernous sinuses are the third and sixth cranial nerves. Of these, the abducens (VI pair) sits near the inferolateral margin of the cavernous internal carotid artery, whereas the trochlear nerve (III) lies in the lateral wall.

Remembering these normal features is important in addressing sellar and parasellar region masses.

## **TUMORAL PATHOLOGY OF THE SELLAR AND PARASELLAR REGIONS**

### **ADENOMAS**

Adenomas consist of the most frequent intrasellar tumors, only rarely presenting in an ectopic location such as the nasopharynx, sinonasal region or skull base.

By definition, they can be classified as microadenomas (less than 10mm) or macroadenomas (when they present with 10mm or more of maximum dimension), or as functional or non functional. When functional, the tumor is named accordingly to the hormone it produces and prolactinomas are the most common, presenting with amenorrhea-galactorrhea in women and gynecomastia, hypogonadism or impotence in men.

Usually, non functional adenomas present with symptoms due to compression or invasion of adjacent structures. In case of superior extension, optic chiasm impingement may present with loss of temporal vision. On the other hand, lateral invasion of the cavernous sinuses usually presents with cranial neuropathy.

### **MENINGIOMAS**

Meningiomas are the second most frequent tumors of the sellar and parasellar regions. They can originate from the tuberculum sellae, diaphragma sellae, sphenoid wing, cavernous sinuses' dura or planum sphenoidale.

Depending on size and location, meningiomas can either present as an incidental finding or cause headaches, visual deterioration, cranial neuropathy, seizures or even pituitary dysfunction.

**Differential diagnosis:** macroadenoma

## **RATHKE POUCH CYSTS**

Congenital in origin, Rathke pouch cysts are nonneoplastic and typically involve the sellar and suprasellar compartments. They commonly present as an incidental finding, with only 3-9% being symptomatic. In these cases, headaches, visual disturbances or endocrine disorders can occur due to mass effect.

Imaging features are highly variable.

**Differential diagnosis:** craniopharyngioma, adenoma, non neoplastic cyst

## **CRANIOPHARYNGIOMAS**

These tumors arise from squamous epithelial remnants of the Rathke pouch. Craniopharyngiomas are the most frequent nonglial tumors in children, only rarely occurring in adulthood. Presentation depends on location and size and can include headaches, nausea, vomiting, visual as well as pituitary abnormalities.

They primarily occur in the infundibular region, although they can arise along the path of the craniopharyngeal duct.

In terms of histology, there are essentially two subtypes, with varying clinical and imaging presentations:

- adamantinomatous type: most common, presenting in younger patients as a multiloculated, cystic or solid, calcified masses;
- papillary type: usually presents in adulthood as a solid, calcified mass.

**Differential diagnosis:** Rathke pouch cyst, non neoplastic cyst, chiasmatic glioma

## **METASTASES**

Metastases can occur at the infundibulum or pituitary gland and thus mimic an adenoma. Most frequent metastatic tumors that occur at the sellar and parasellar regions include lung and breast carcinomas. Both anterior and posterior gland can be involved, although there is a higher occurrence in the posterior gland due to a higher vascular supply.

Most metastases tend to be clinically asymptomatic, only rarely causing endocrine abnormalities and visual defects due to suprasellar extension.

The most important differential diagnosis is a macroadenoma, mainly because of an overlap of imaging features. Clinical history plays an important role in the diagnosis of metastases and an acute onset of symptoms

## **VASCULAR PATHOLOGY OF THE SELLAR AND PARASELLAR REGIONS**

The occurrence of vascular lesions in the sellar and parasellar regions, although less frequent than tumoral pathology, should be kept in mind, specially in terms of aneurysms which are an important differential for macroadenomas.

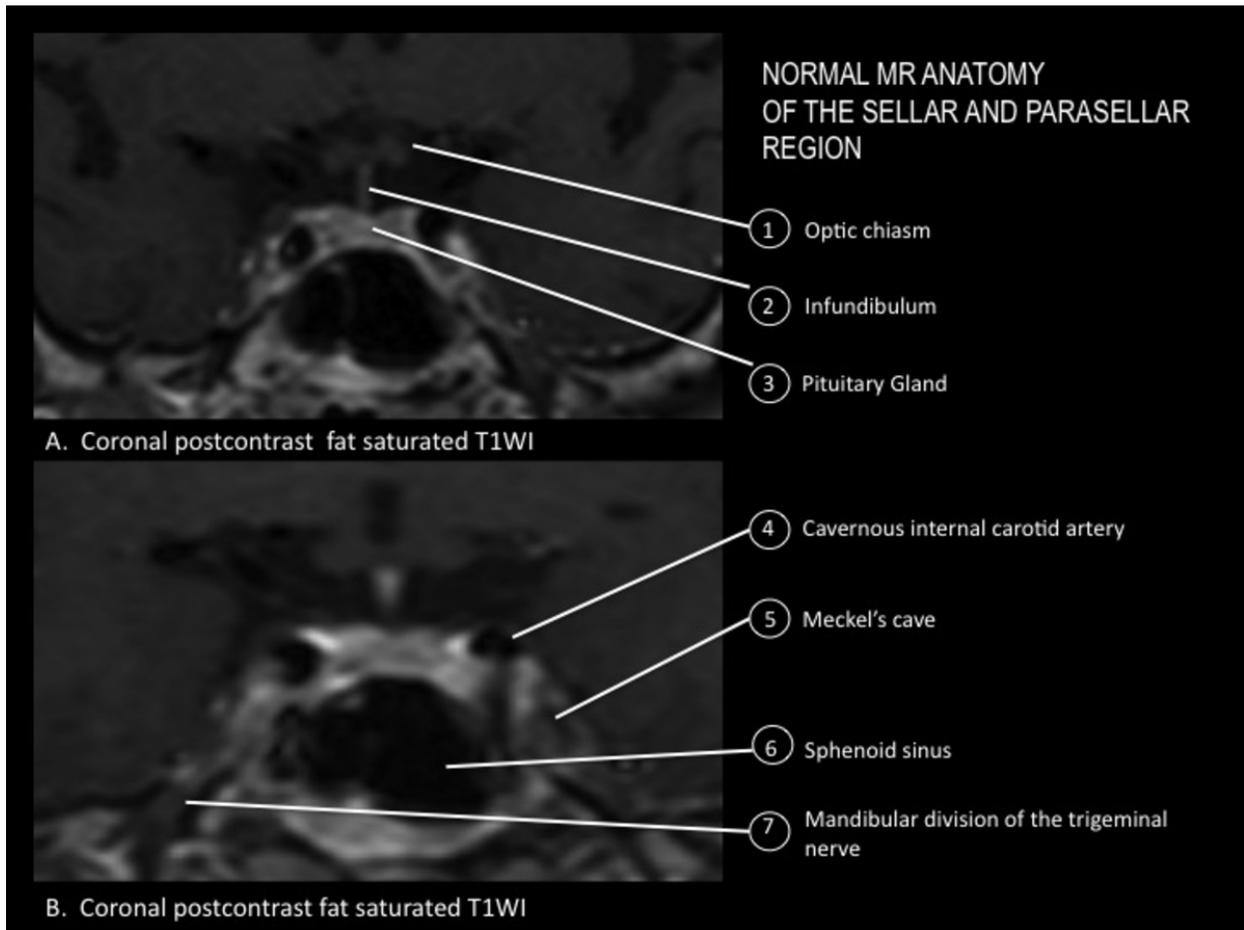
A more detailed description of tumoral and vascular pathology of the sellar and parasellar regions can be found in the following section.

**Images for this section:**

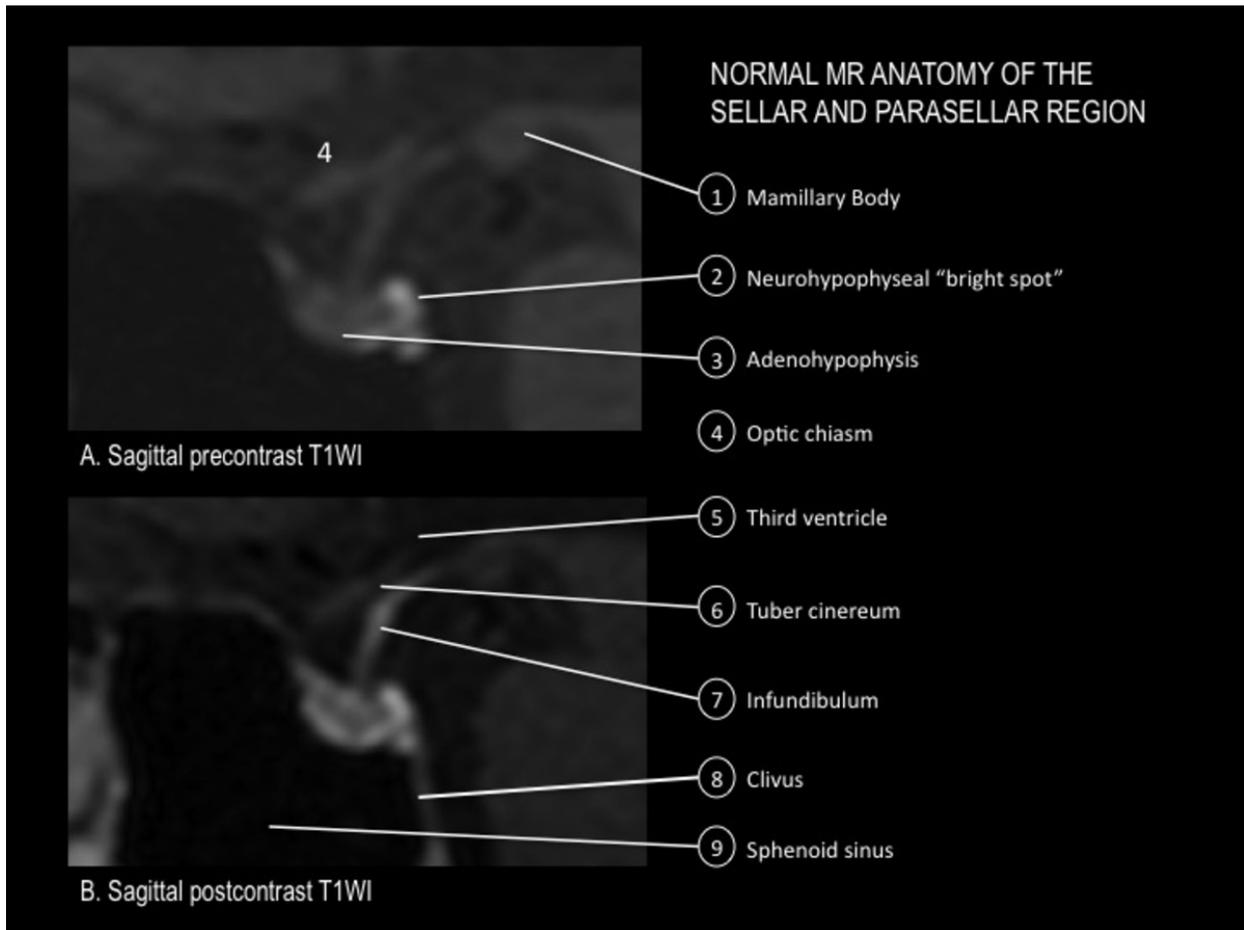
## Key features in the approach of sellar and parasellar pathology

- Patient's age, medical history, signs and symptoms?
- Is the center of the mass sellar, parasellar or suprasellar in origin?
- If it involves the sella turcica, is the pituitary gland normal, enlarged or displaced?
- Is the mass solid, cystic or mixed in signal characteristics or attenuation?
- Is there calcification or hemorrhage present?
- Does the mass enhance, and to what degree?
- What is the enhancement pattern?
- Is there involvement of the surrounding structures?
- Is there vascular encasement, narrowing or occlusion?

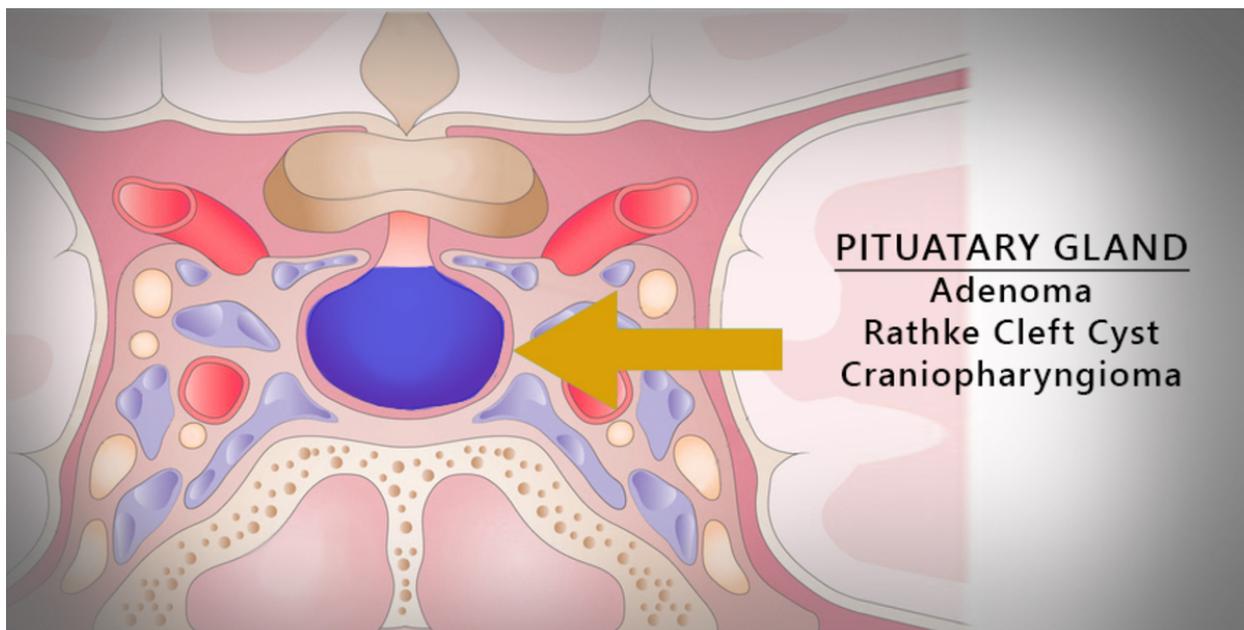
**Fig. 1:** Table 1 - Some key features in the diagnostic approach to sellar, parasellar and suprasellar masses.



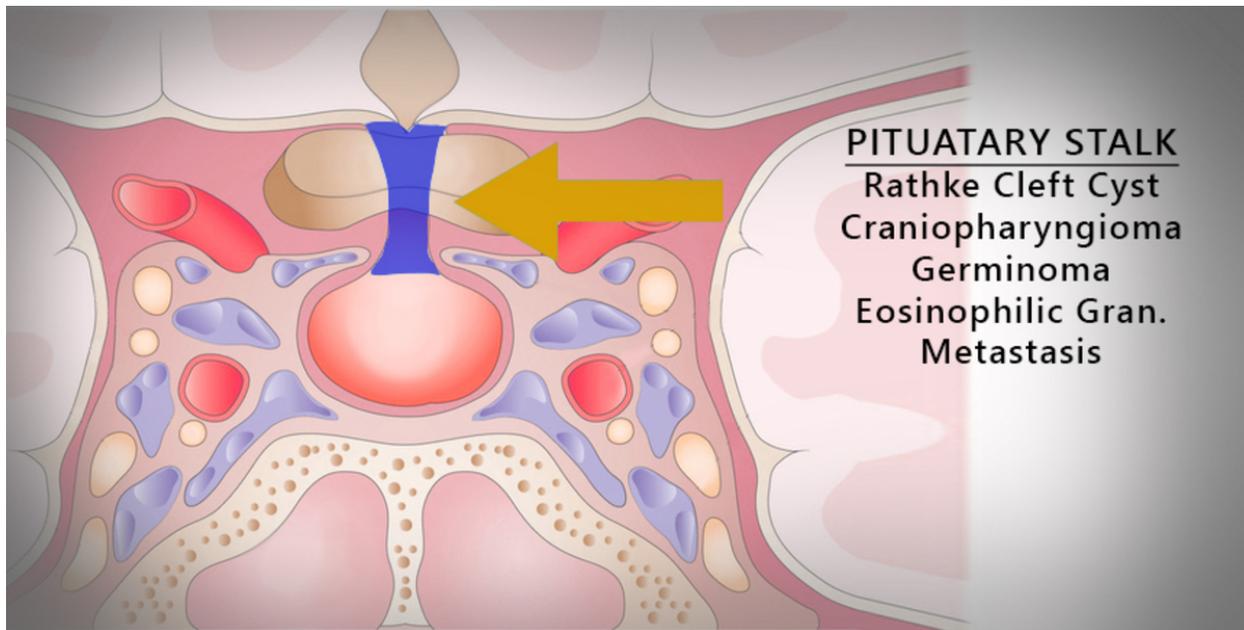
**Fig. 2:** Pre and postgadolinium T1WI - normal anatomy of the sellar and parasellar region on coronal view.



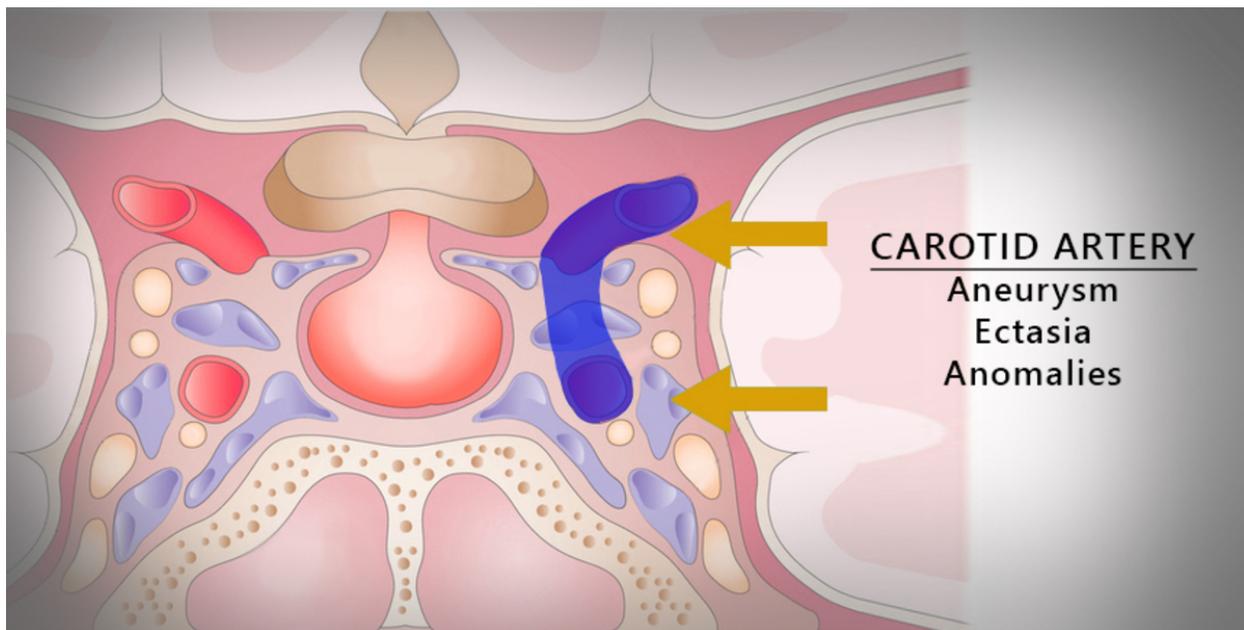
**Fig. 3:** Pre and postgadolinium T1WI . Same as above, the normal anatomy of the sellar and parasellar region is depicted, in sagittal view,



**Fig. 4:** Schematic representation of the sellar and parasellar region - Most important differential diagnosis of pituitary gland lesions



**Fig. 5:** Schematic presentation of the sellar and parasellar region - Most important differential diagnosis for pituitary stalk lesions.



**Fig. 6:** Schematic representation of the sellar and parasellar region - Most important differential diagnosis of lesions arising in the internal carotid artery.

## Findings and procedure details

Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are complementary modalities for the evaluation of the sellar and parasellar regions.

MRI is the most important initial imaging technique in localization and characterization of a sellar mass, acting as an important tool to allow an accurate diagnosis and successful treatment.

The imaging protocol must be tailored to the clinical suspicion, but usually includes precontrast T1WI in the coronal and sagittal planes, T2WI in the sagittal plane and dynamic postcontrast imaging.

CT is obtained either when there is a contraindication to MRI or as a complementary tool to evaluate anatomic variants, calcification or osseous involvement.

Due to a vast number of entities that can occur in these regions, we'll focus our discussion in some frequent pathology, such as **tumors** (adenomas, meningiomas, craniopharyngiomas and metastases) and **vascular pathology** (aneurysms and fistulas).

### IMAGING FINDINGS

#### A) TUMORAL PATHOLOGY

##### ADENOMAS

MR is the preferred imaging tool and CT should only be regarded when there is contraindication to the former or to evaluate anatomical variants, calcifications or intraosseous involvement.

**MRI features:** Macroadenomas usually present as isointense masses on T1WI and T2WI (**Fig. 7 on page 13 and Fig. 9 on page 14**) when compared to white matter. Their signal intensity is heterogeneous due to internal hemorrhage, cystic changes or necrosis. Enhancement is usually mild to moderate and, occasionally, dural enhancement can also be seen.

On coronal plane, macroadenomas present with a typical "figure of eight" or "snowman" morphology.

Microadenomas have a wide range of appearances, usually presenting as isointense masses on coronal T1WI.

**CT features:** Macroadenomas usually appear as solid, non calcified, isodense masses to gray matter. When they outgrow their blood supply, macroadenomas become heterogeneous due to hemorrhage or necrosis.

## MENINGIOMAS

**MRI features:** most meningiomas are isointense to gray matter on T1 and T2WI. They can also demonstrate heterogeneous signal intensity on T2WI due to calcium, cystic changes or hemorrhage. (Fig. 10 on page 15 and Fig. 12 on page 17) Due to its vascularity, meningiomas usually demonstrate avid enhancement. Supportive features for its diagnosis include hyperostosis, thickened dural tail and occlusion of the cavernous segment of the internal carotid artery.

**CT features:** usually, meningiomas present as a solid extra-axial hyperdense mass, with or without areas of cystic degeneration/necrosis. Enhancement can either be homogeneous or heterogeneous, depending on the cystic or necrotic components.

As stated before, supportive features include calcification, hyperostosis and sphenoid or ethmoidal sinus enlargement.

## RATHKE POUCH CYSTS

**MRI features:** Rathke pouch cysts can have variable signal intensity depending on its contents (protein, cholesterol or hemorrhage). On T1WI, 40% can be hyperintense, 40% hypointense and as much as 36% isointense. On T2WI, as much as 75% are hyperintense. In 70% of cases, there is also a solid intracystic nodule (Fig. 14 on page 19), which presents with heterogeneous signal on T1 and T2WI and does not enhance after gadolinium (Fig. 13 on page 18)

After gadolinium, as much as 50% demonstrate rim enhancement, which can occur due to pituitary displacement or pericystic inflammation.

**CT features:** Rathke pouch cysts present as solid masses, oval/dumbbell or multilobulated shape, and can either be hypodense or hyperdense. There is no internal enhancement but as much as 50% can have rim enhancement.

Rim calcification is also seen in about 5% of patients.

## CRANIOPHARYNGIOMAS

Regarding imaging features, they are usually heterogeneous masses both on CT and MRI.

**MRI features:** extremely variable due to the presence of either cholesterol, protein and hemorrhage. Fluid-fluid levels can be present. The solid component tends to be isointense/hypointense on T1WI and heterogeneously hyperintense on T2WI. Enhancement is also heterogeneous (**Fig. 15 on page 20 and Fig. 16 on page 21**).

**CT features:** the adamantinomatous subtype tends to appear as a hypodense, multiloculated sellar/suprasellar mass, with predominantly cystic or cystic and solid components. There is usually a thin rim of calcification of the cystic component. The papillary subtype tends to be more solid, hypodense and with homogeneous enhancement.

## METASTASES

As stated before, metastases can occur at the infundibulum or pituitary gland and thus mimic an adenoma, so there is basically an overlap of imaging features as shown in **Fig. 17 on page 22**

Clinical history plays an important role in the diagnosis of metastases and an acute onset of symptoms.

## B) VASCULAR PATHOLOGY

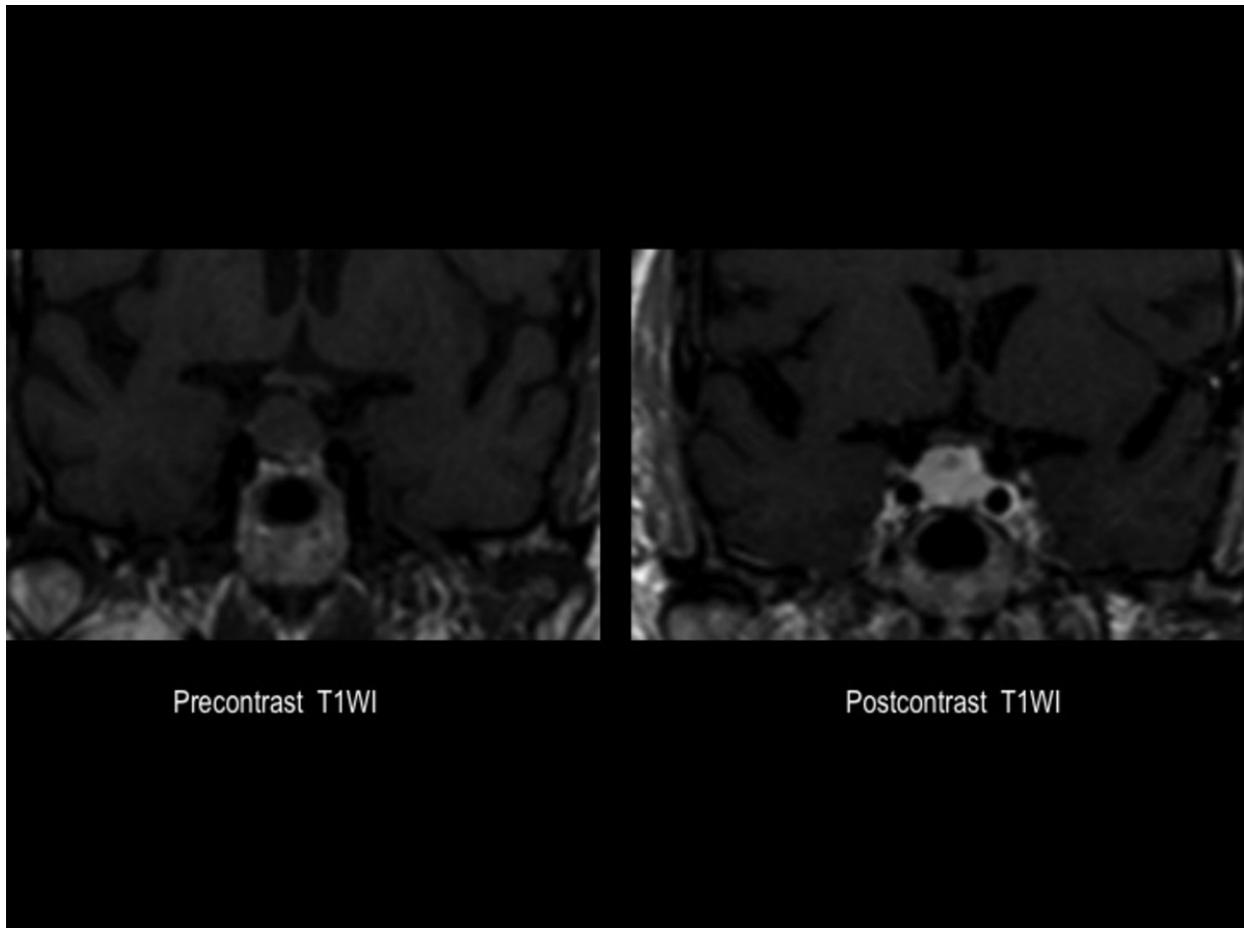
### ANEURYSMS

Aneurysms of the cavernous, clinoid, ophtalmic or anterior communicating artery complex can protrude into the sella and possibly mimic an adenoma, specially if the pituitary gland is not visualized.

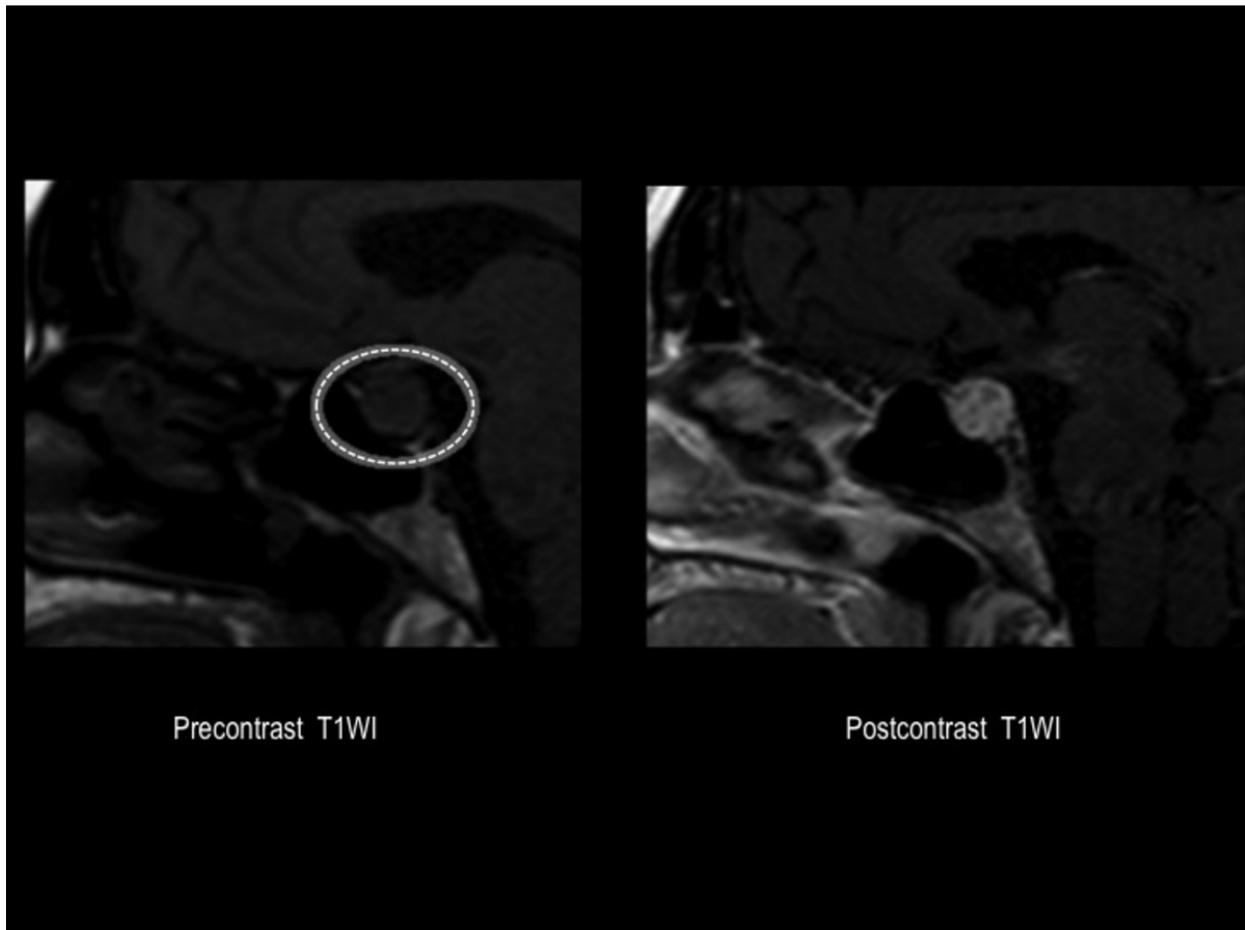
Usually, aneurysms present off-midline and can exhibit rim calcification on CT and demonstrate flow-void or mural thrombus on MRI.

If there is high suspicion of an aneurysm, CT or MRI angiograms should be performed (**Fig. 18 on page 23 and Fig. 19 on page 24**).

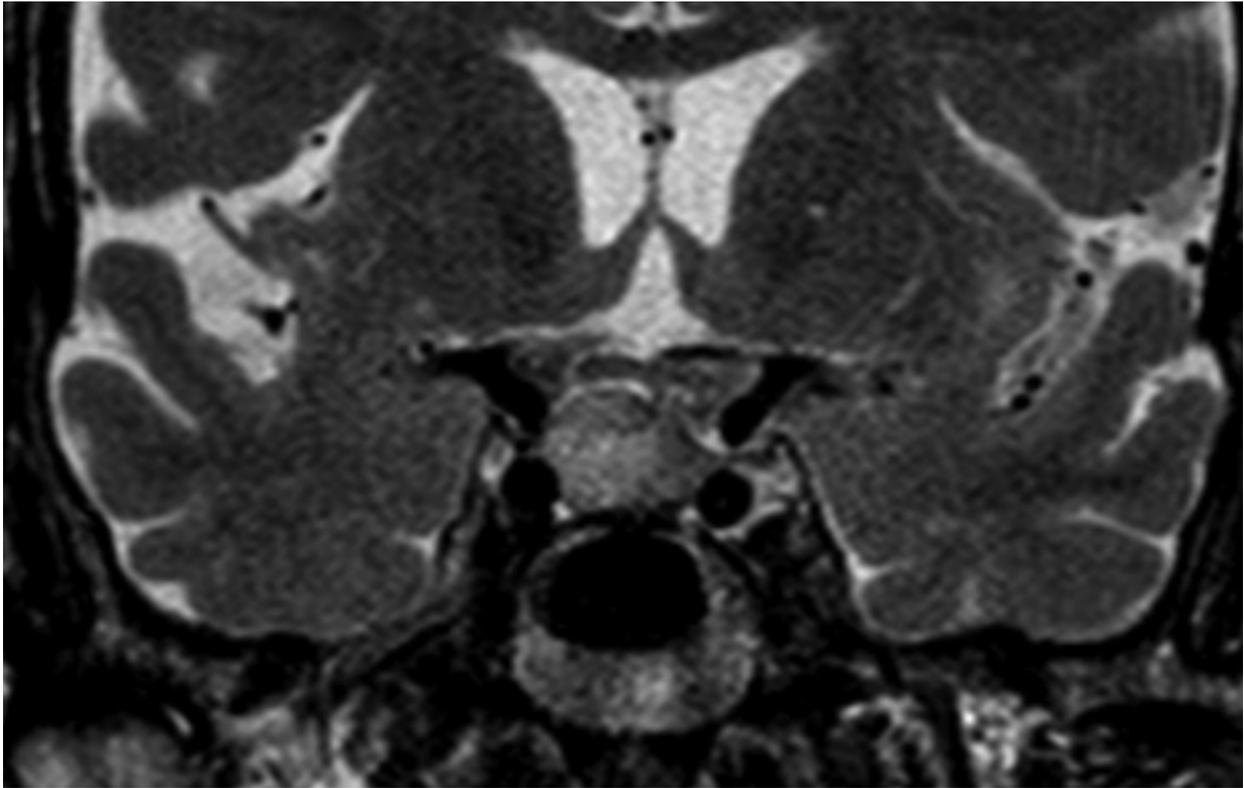
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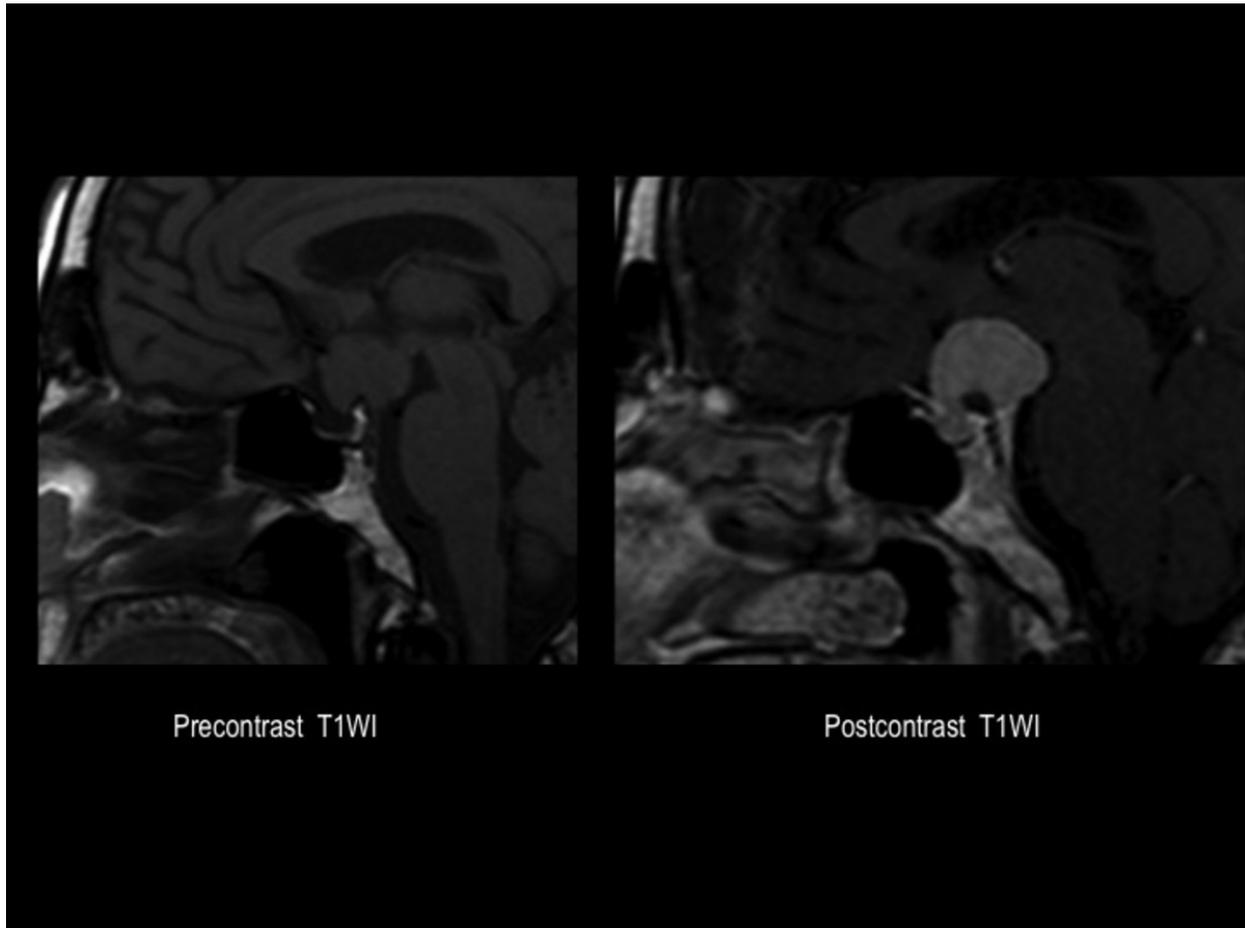
**Fig. 7:** Coronal plane. Pre and postcontrast T1WI. There is a isodense homogeneous mass occupying the sellar region, which proved to be a non functional adenoma.



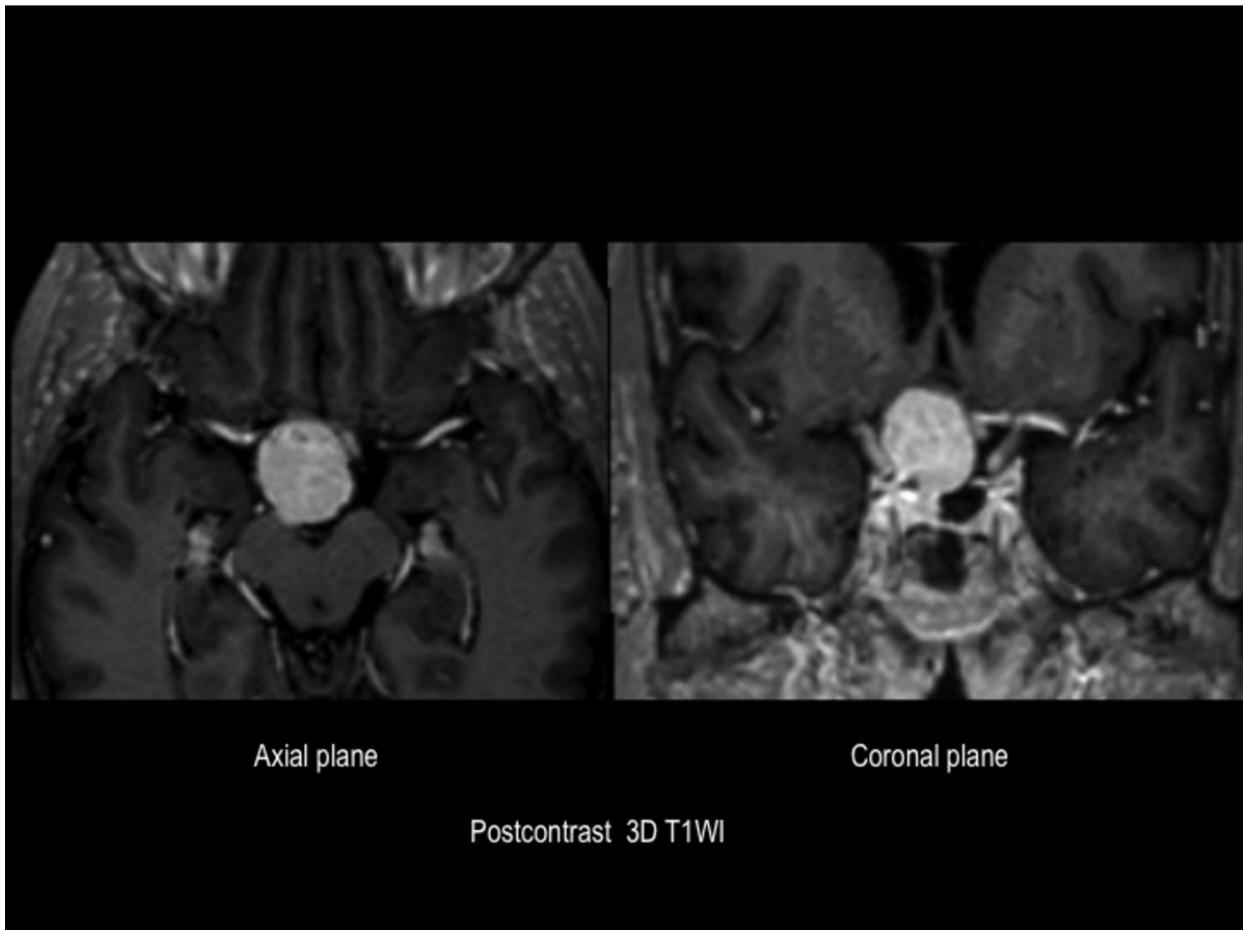
**Fig. 8:** Sagittal plane. Pre and postcontrast T1WI. Same patient as above. After gadolinium, the sellar mass demonstrates moderate and homogeneous enhancement. Its relationship with the optic chiasma becomes much more apparent.



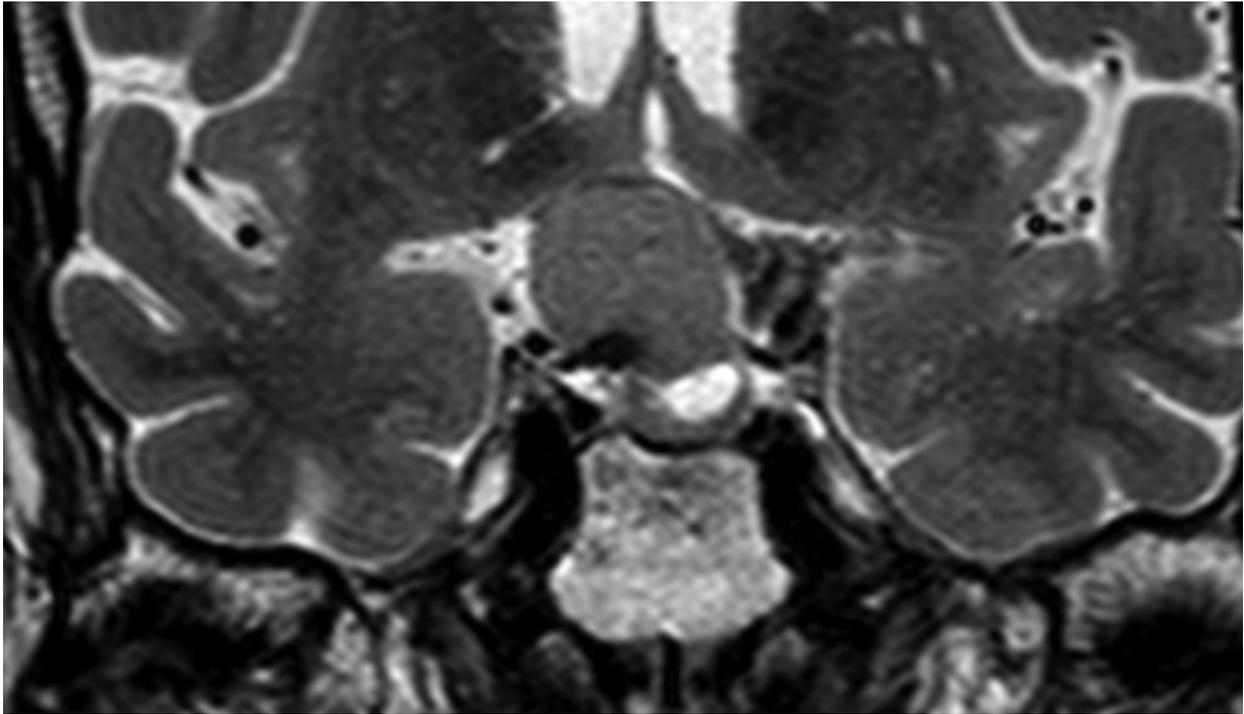
**Fig. 9:** Coronal plane, T2WI. Same patient as before. Heterogeneous signal intensity due to hemorrhage or necrosis becomes much more apparent on T2 weighted images.



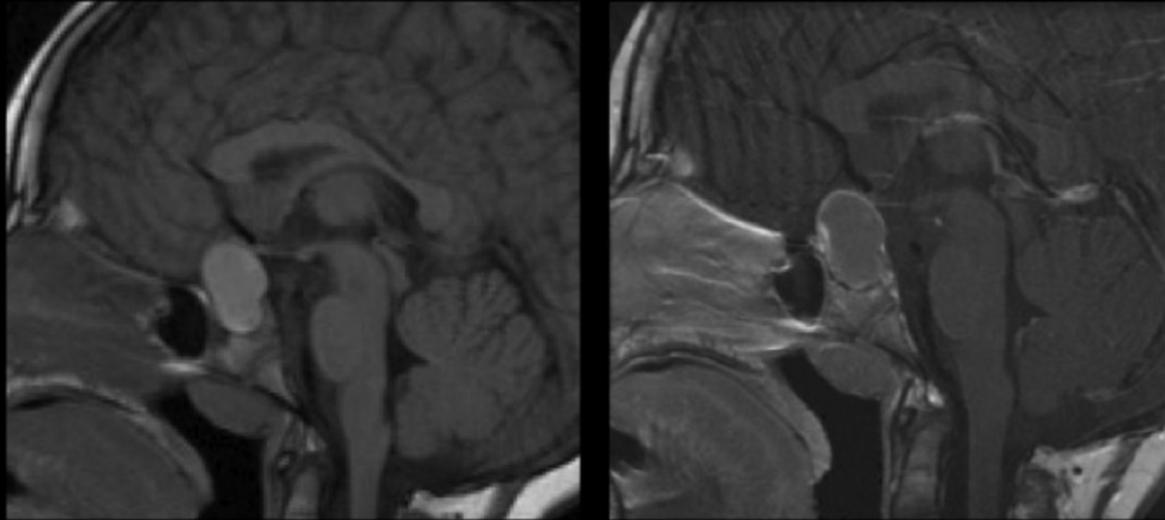
**Fig. 10:** Sagittal plane, pre and postcontrast T1WI. 54 year-old patient with complaints of visual impairment and headaches. There is a lobulated mass on the dorsum of the sella turcica, which demonstrates avid enhancement. There is no apparent calcification or hyperostosis.



**Fig. 11:** Axial and coronal plane. 3D postcontrast T1WI. Same patient as above. It is much more apparent that this lesion is extra-axial in origin, findings that are suggestive of a meningioma.

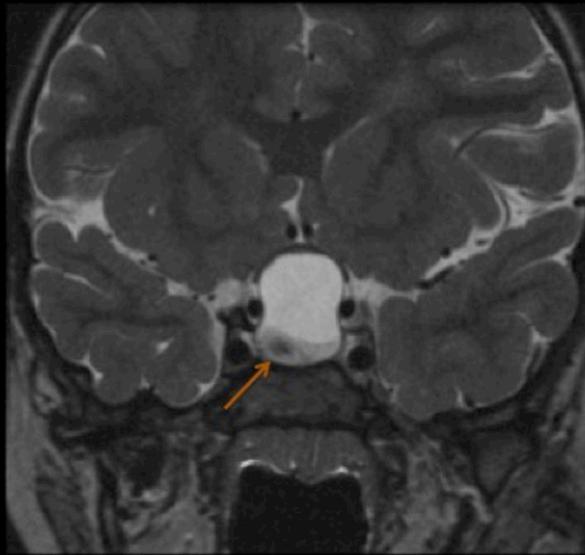


**Fig. 12:** Coronal plane. T2WI. Same patient as above. There is some signal heterogeneity within the mass, most likely due to the presence of a cystic component.



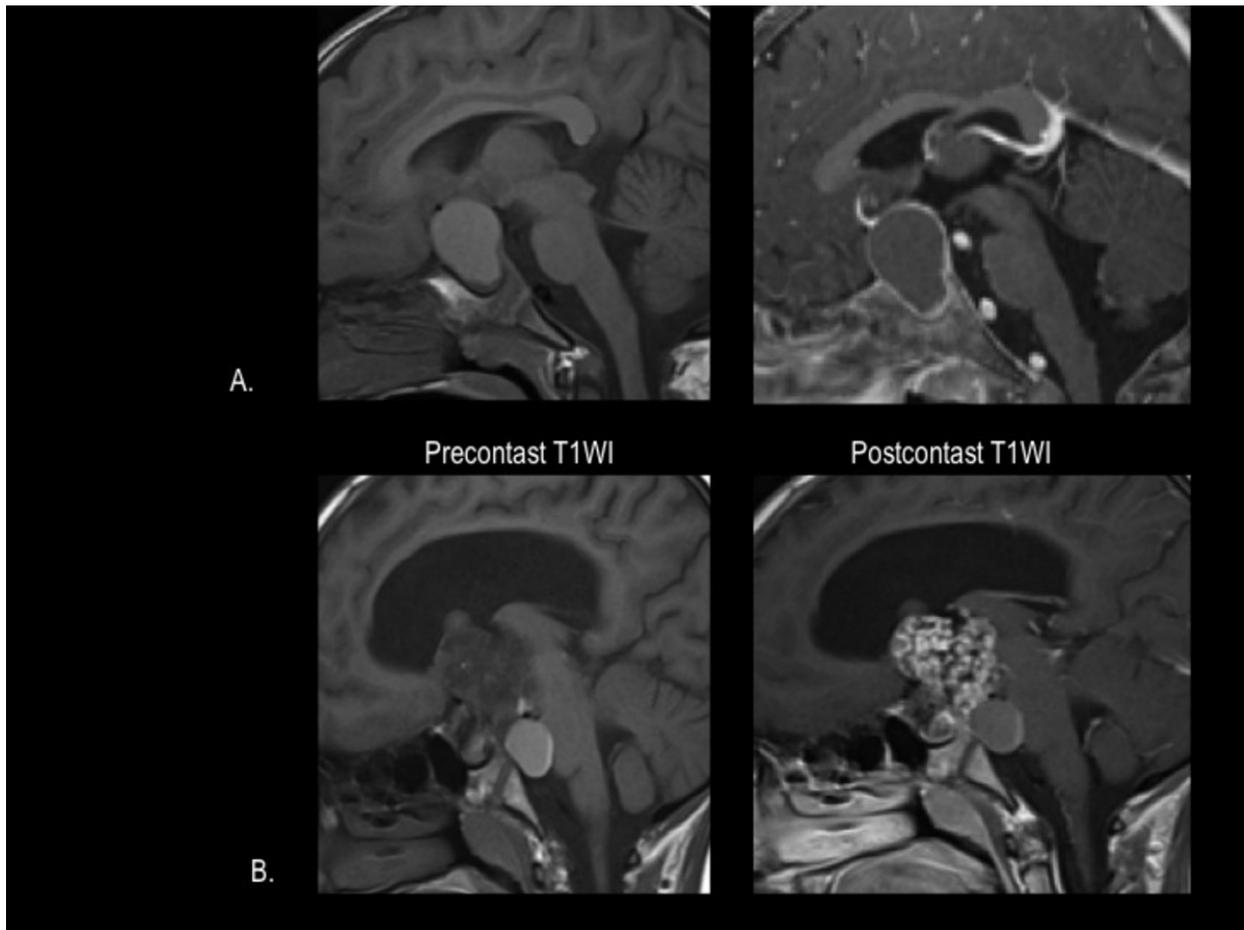
Pre and postcontrast T1WI

**Fig. 13:** Sagittal view. Pre and postcontrast T1WI. Pediatric patient with a large sellar/parasellar hyperintense cystic lesion, with slightly lobulated contours. There is typical rim or "claw" enhancement after gadolinium.

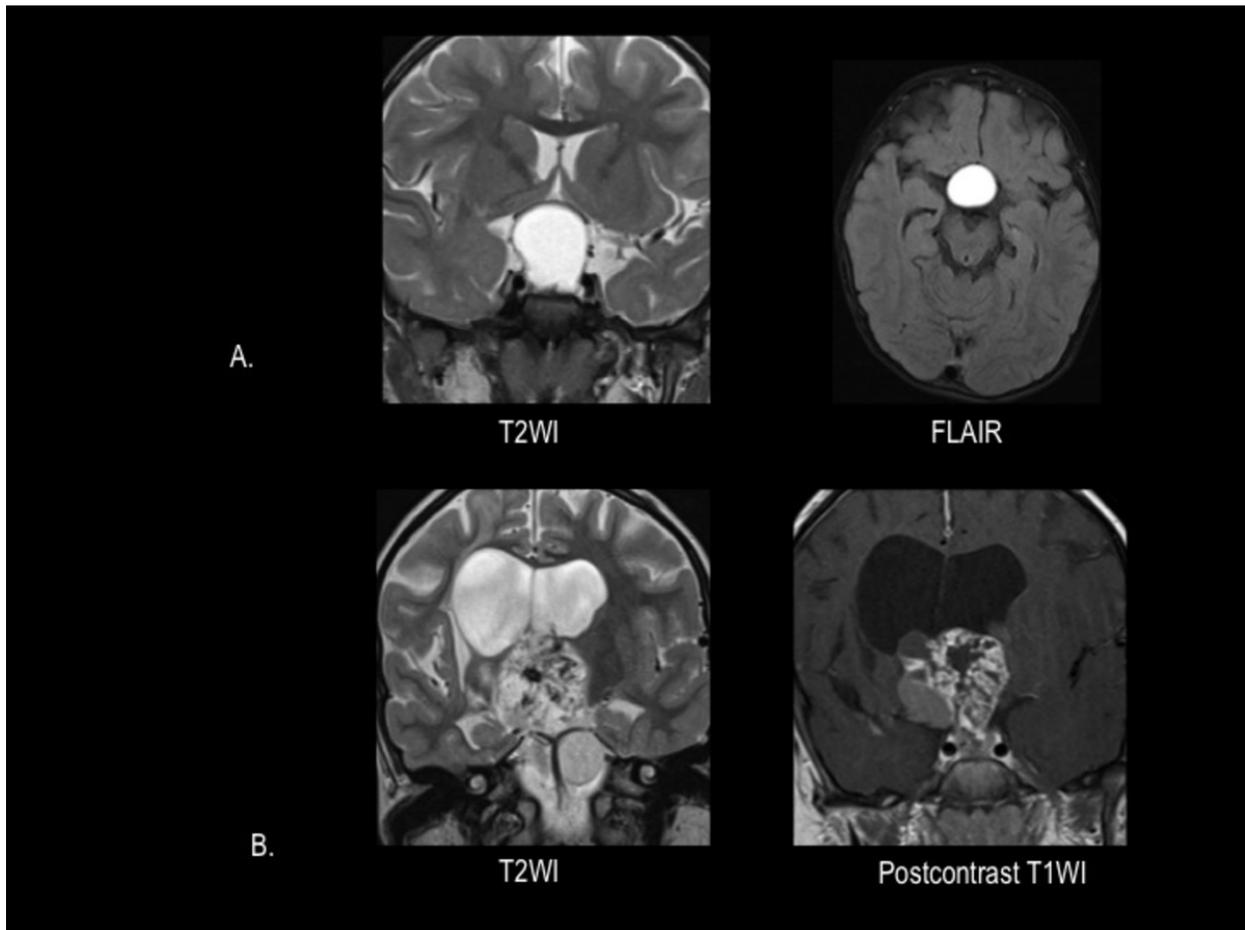


Coronal plane T2WI

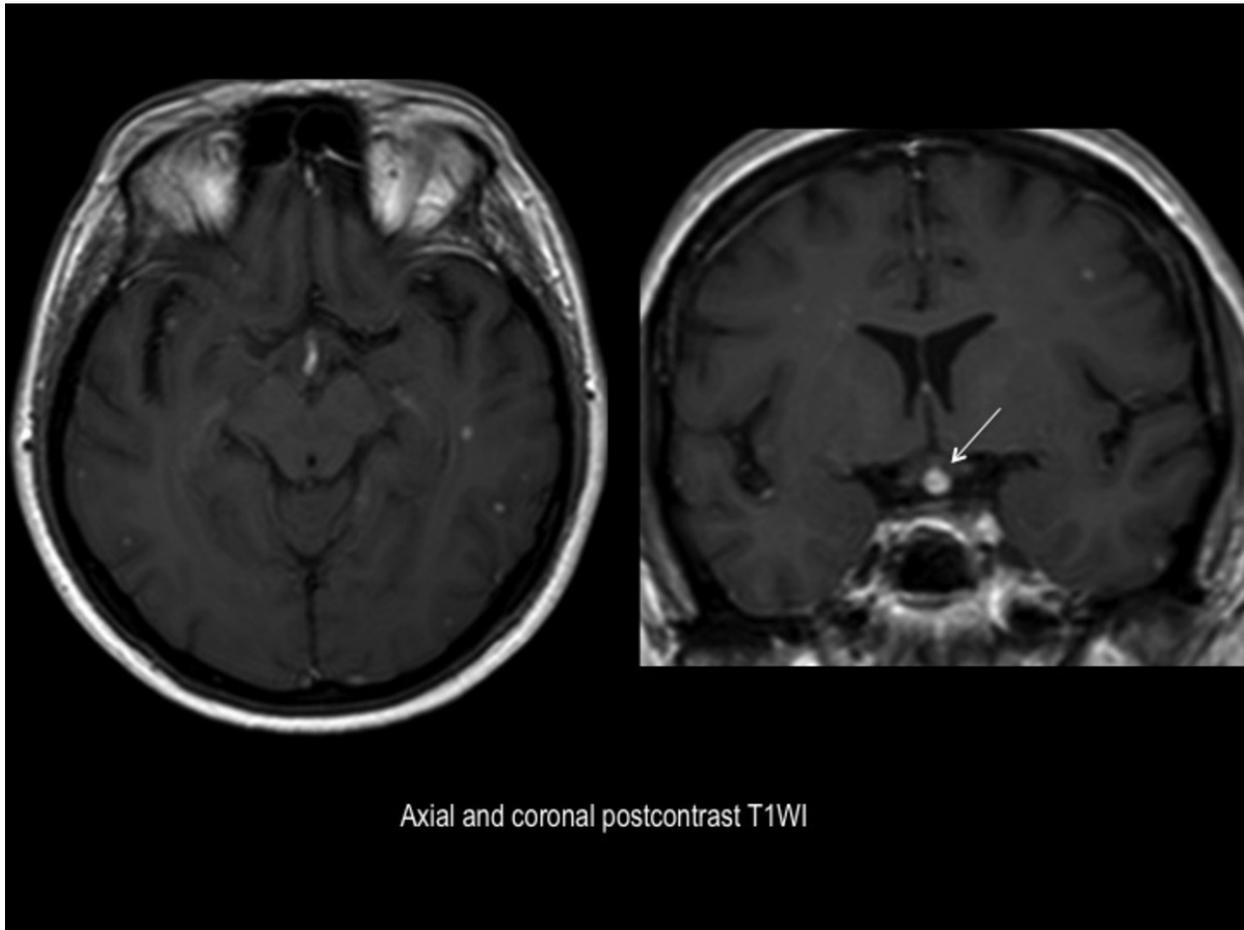
**Fig. 14:** Coronal view. T2WI. Same patient as before. There is an apparent intracystic nodule in its right lateral and inferior border.



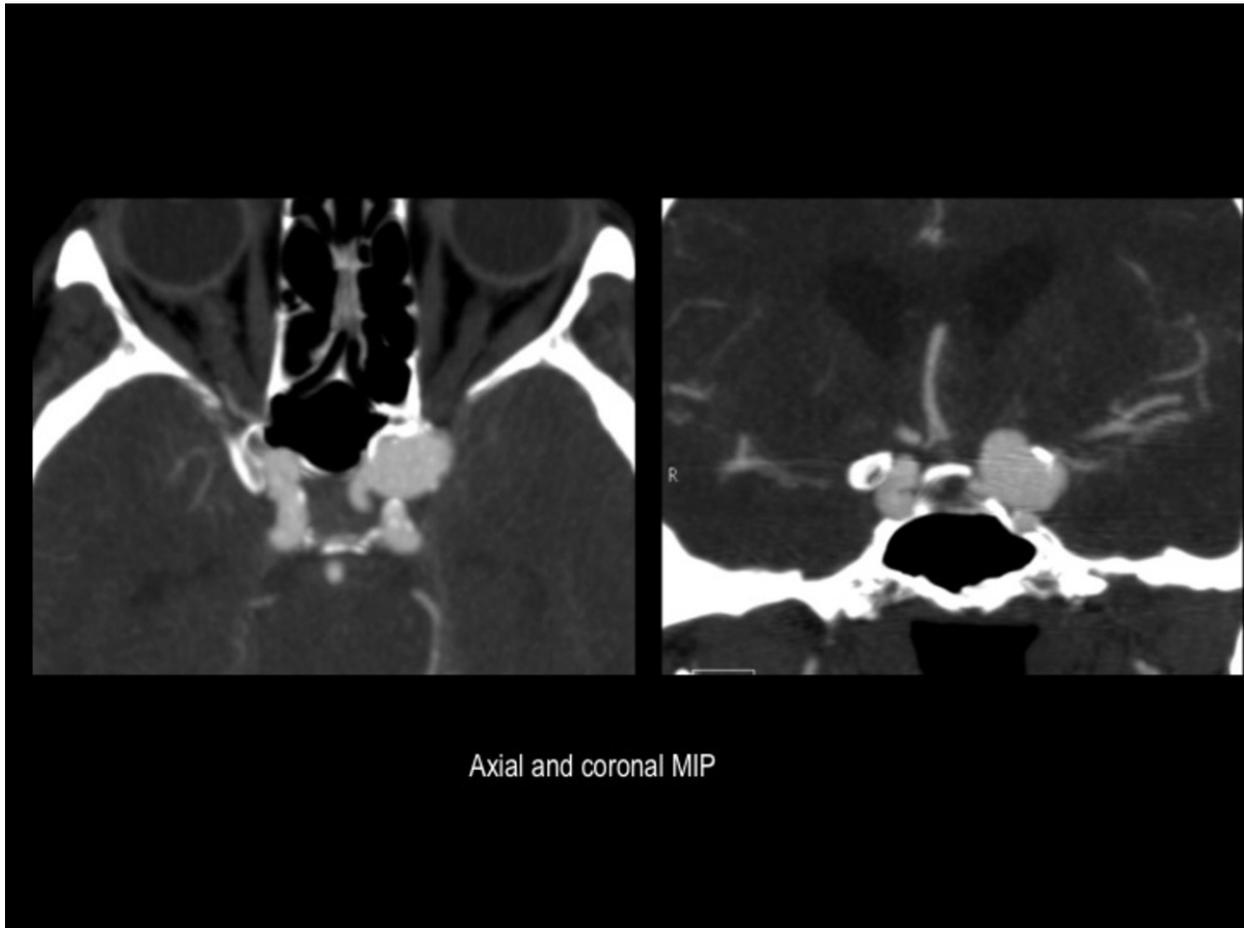
**Fig. 15:** Coronal pre and postcontrast T1WI. Two different patients: A) there is a sellar/suprasellar mass with slightly hyperintense and homogenous signal and apparent rim enhancement; B) There is a large suprasellar mass with heterogenous signal, demonstrating both solid and cystic components, the latter causing some mass effect on the optic chiasma. Both images demonstrate imaging features of craniopharyngioma.



**Fig. 16:** Coronal and axial view. T2WI. Same patient as above. The heterogeneous signal intensity of the craniopharyngioma seen in B) becomes much more apparent on T2WI.



**Fig. 17:** Axial and coronal view. Pre and postcontrast T1WI. This patient had a history of lung carcinoma. There are multiple, disperse, nodular lesions, with marked enhancement after gadolinium. There is also enhancement of the pituitary stalk and infundibulum. These findings are highly suggestive of metastases.



**Fig. 18:** CT angiogram. Axial and coronal view. There is a large aneurysm of the ophthalmic segment of the internal left carotid artery. It exerts some mass effect on the left cavernous sinus.



**Fig. 19:** VR 3D image. Same patient as above. Besides the large aneurysm, there is a smaller one at the level of the left internal carotid artery bifurcation.

## Conclusion

The spectrum of pathology involving the sellar and parasellar region is broad and often difficult to approach on imaging due to its small size and complex anatomy.

Nevertheless, understanding the normal anatomy and involvement of the surrounding structures and their signal intensity/ pattern of enhancement, can further aid in the differential diagnosis of a sellar mass.

## Personal information

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