Imaging characteristics of non-tumorous sellar lesions

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Learning objectives

The aim of this paper is to:

• illustrate MRI anatomy of the sellar region;

• present numerous educational examples of tumor mimickers and other non-neoplastic sellar lesions on MRI

• emphasize the imaging features and potential pearls and pitfalls that can help to distinguish among non-neoplastic lesions of the sella and most common tumors.
Background

MRI has been considered as the most important imaging modality of the diagnosis of sellar region diseases. Advanced MRI technology has high reliability to depict small lesions of this area of different origin. Anatomical evaluation includes detailed evaluation of the anterior lobe of the pituitary gland, pituitary stalk, posterior lobe and cavernous sinus. Each of these spaces can be affected by wide spectrum of diseases, some of which share rather similar imaging features with micro and macroadenomas.
Findings and procedure details

Standard MRI protocol for sellar region includes 3 mm slice thickness, sagittal T1W sequence, a coronal fast spin-echo T2W sequence and a coronal T1 spin-echo sequence before gadolinium administration. Also, the protocol includes postcontrast study in coronal and sagittal planes. Advanced protocol includes diffusion weighted imaging.

This presentation focuses on several non-tumorous sellar and parasellar conditions, including Rathke Cleft cysts, pituitary abscess, primary hypophysitis, involvement of pituitary gland in systemic diseases, Sheehan syndrome, pituitary hyperplasia in associated different endocrine conditions, arachnoid, epidermoid and dermoid cysts, meningocele, ectopic posterior lobe, aneriesms and other cavernous sinus lesions.

1. Rathke Cleft Cyst (Figure 1.)

Rathke Cleft Cysts (RCC) are the most frequent pituitary lesions revealed on MRI. They are intra-/suprasellar lesions believed to derivate from remnants of the Rathke pouch. Therefore one major characteristic is their strict and quite constant midline location. Nevertheless, they may be encountered off-midline. If initially intrasellar, RCCs are located in midline, just in front and in close contact with the posterior lobe. If initially suprasellar, they are depicted on the upper surface of the pituitary gland, or embedded in the gland. RCCs are most of the time described as cystic lesions with smooth contours, without calcification and no rim enhancement (if not complicated). Cyst content is composed either of a thick mucus rich in protein and mucopolysaccharide or, much less frequently, of CSF-like fluid with low viscosity.

MRI characteristics of asymptomatic RCCs usually enough to make a diagnosis:

- no or faint sellar floor changes;
- unique midline location;
- close contact with posterior lobe, if intrasellar;
- T1 hyperintense with T2 hypointense hyperproteinic nodules,
- no cyst wall enhancement; (1,2)

2. Pituitary abscess (Figure 2.)

Pituitary abscess represents less than 1% of all pituitary lesions. Pathophysiology of the pituitary abscess consists in a contiguous spreading of a local infection arising from the sphenoid sinus, surrounding meninges or thrombophobitis of the cavernous sinus. Direct
hematogenous seeding to the gland is also possible. In most of the cases, they usually develop on a pre-existing lesion such as adenoma, RCC or craniopharyngioma especially if there is necrosis or hemorrhage. Pituitary abscess can also occur as a complication of transsphenoidal surgery.

MRI features of pituitary abscess is sellar/suprasellar cystic mass, that appears hypo/isointense on T1W and hyper/isointense on T2W images, and always shows peripheral ring enhancement after gadolinium administration with no internal enhancement. Diffusion weighted imaging (DWI) is also very useful to differentiate abscess from other cystic and necrotic pituitary lesions. (3,4)

3. Primary hypophysitis (Figure 3.)

Hypophysitis is a chronic inflammation of the pituitary gland, which can be classified as a primary or secondary.

Table 1. Hystologic forms of primary hypophysitis

<table>
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<td>lymphocytic</td>
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<td>granulomatous</td>
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<tr>
<td>xanthomatous</td>
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<tr>
<td>necrotizing</td>
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<td>IgG4</td>
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<td>plasmacytic</td>
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Eventhough lymphocytic form is the most common form of all primary hypophysitis, it represents less than 1% of all pituitary lesions. According to the anatomic involvement of the gland, adenohypophysitis, infundibuloneurohypophysitis or panhypophysitis may be distinguished with an MRI examination.

In adenohypophysitis MRI shows diffuse and symmetric enlargement of the anterior lobe, with variable optic chiasm compression. The signal of the gland is usually T1 hypointense and more or less T2 hyperintense with homogeneous postcontrast enhancement.

In infudibuloneurohypophysitis, pituitary stalk is thickened and there is a loss of T1 bright spot on T1W non contrast images.

In panhypophysitis signs of both entities will be seen. (5)

4. Sheehan syndrome (Figure 4.)

Sheehan syndrome represents pituitary necrosis following severe postpartum hemorrhage and hypovolemia. First MRI sign, few days after the ischemic infarction, is an enlarged pituitary gland. Enlarged gland is usually T1 hypointense, while the
signal intensity on T2W images is heterogeneous with hyperintense foci. After gadolinium administration only peripheral enhancement is observed along with dural enhancement and sphenoidal musoca thickening. Later, pituitary gland becomes atrophic and empty sella is formed. (6)

5. Aneurysms (Figure 5.)

Aneurysms are focal outpouchings of arteries. Intracranial aneurysms mainly develop on the vessels that form circle of Willis, which is very close to the sella. Thus, intracranial aneurysms can present as intra-, para- or suprasellar masses. In this area, aneurysm may exert mass efect on the pituitary gland, stalk or cranial nerves or be incidental finding of MRI examination. They could also be associated with other sellar lesions.

On conventional MRI, aneurysms have different presentation depending on several factors. If there is no thrombosis, they typically present with low signal intensity or flow void on all spin echo sequences, especially on T2W and they may enhance on GE sequences. On the other hand, thrombosed aneurysms have heterogeneous signal on both T1W and T2W images. After contrast administration, noncirculating clotted parts do not enhance while the walls of aneurysms do enhance on GE T1W images.

Best imaging modalities for aneurysm evaluation are MRA, CTA and angiography. (7)

6. Pituitary hyperplasia and primary hypothyroidism (Figure 6.)

Pituitary hyperplasia in primary hypothyroidism is a rare condition. It must be distinguished from TSH secreting pituitary adenoma.

MRI characteristics include enlargement of the gland with no changes in T1 signal intensitiy, with slightly hyperintenstiy on T2W images and also with homogeneus postcontrast enhancement. (8)

7. Arachnoid cyst (Figure 7.)

Arachnoid cyst is a benign CSF-like collection encased within an arachnoid membrane. Their localization is sellar region is less than 10% of all intracranial cysts. There are two types of arachnoid cysts: intrasellar and suprasellar.

On MRI they appear as well defined, intra-/suprasellar cystic lesions, with no soft tissue components, wall enhancement and calcifications, with signal intensitiy like CSF - low T1 and high T2 signal intensity. For better diferention from other similar changes (i.e. empty
8. **Epidermoid cyst (Figure 8.)**

Epidermoid cyst is a benign congenital lesion formed of accidental inclusion of ectodermal tissue during the closure of neural tube. Growth of the cyst is a consequence of accumulation of desquamated products of epithelial cells. Most common intracranial location is pontocerebellar angle, but they can also occur in sellar region.

On MRI they have similar characteristics as fluid, but slightly brighter on both T1W and T2W images without contrast enhancement. Using FLAIR sequence it could easily be differentiated from arachnoid cyst. In evaluation of epidermoid cysts, DWI is crucial because it shows restriction of water molecules diffusion. Also, MR spectroscopy could be useful because of elevated lactate peak. (10)

9. **Dermoid cyst (Figure 9.)**

Dermoid cyst is a rare congenital lesion that results form inclusion of ectodermal tissue during the closure of neural tube. Its wall is made of connective tissue and it can be filled with various tissue products. Most of the time, they tend to occur in midline, especially in sellar/parasellar region.

On MRI they appear as well-circumscribed lesions, with fatty content and wall that may enhance and/or be calcified. They have high signal intensity both on T1W and T2W images, and low signal intensity on GE sequences. If they rupture, there are T1 hyperintense droplets in the cerebral sulci. (11)

10. **Ectopic posterior lobe (Figure 10.)**

Posterior lobe on a MRI appears as T1 bright spot that represent storage of vasopresine. Ectopic posterior lobe results when normal transportation of vasopresin is impossible due to stalk blockage. It can be found in some congenital disorders such as Kallmann syndrome, but can also be acquired in the cases of head trauma, after pituitary surgery and in cases of large sellar tumors. Typical location of an ectopic posterior lobe is along the eminentia mediana. (12)

11. **Meningoencephalocele (Figure 11.)**
Meningoencephalocele is a rare congenital anomaly that represents a herniated brain tissue with meninges in intra/supra/parasellar region and sphenoid sinus also. They are usually associated with various congenital anomalies.

MRI examination is crucial in cases of meningoencephalocele regardless if they are small asymptomatic, medium sized or large because it can reveal their content, extension and relation with other structures in this location. (13)
Fig. 1: Rhatke Cleft Cyst. Coronal T2W (A), coronal T1W (B) and sagittal T1W postcontrast (C) images showing intrasellar oval cyst-like mass (arrows) midline located close to the posterior pituitary lobe, without postcontrast enhancement.

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Fig. 2: Pituitary abscess. Coronal (A) and sagittal (B) T1W images after administration of paramagnetic contrast agent reveal expansile pituitary mass with rim enhancement (arrows in A and B). Pituitary mass shows restricted diffusion evident on axial DWI (arrow in C) and corresponding ADC map (arrow in D)
**Fig. 3:** Primary hypophysitis. Coronal T1W (A) and coronal T1W postcontrast (B) images showing enlargement and homogeneous enhancement of the pituitary gland (arrows) after gadolinium administration. Pathohistological confirmation of granulomatous primary hypophysitis.

**Fig. 4:** Sheehan syndrome. Sagittal T1W (A), coronal T2W (B) and sagittal T1W postcontrast (C) images showing enlargement of the pituitary gland with lower T1 signal intensity (arrow in A), heterogeneous signal (arrow in B) and peripheral enhancement after gadolinium administration (arrow in C).
**Fig. 5:** Internal carotid aneurysm. Axial T2W (A), FLAIR (B) and 3D TOF MRA (C). Arrows suggesting giant aneurysm, of cavernous/supraclinoid segment of left ICA, partially thrombose, with compression of the pituitary gland, cranial nerves in left cavernous sinus and left ICA.

**Fig. 6:** Pituitary hyperplasia in primary hypothyroidism. Coronal T2W (A), coronal T1W (B) and T1W postcontrast (C) images. Arrows in A, B and C showing enlargement of pituitary gland with no changes in T1 signal intensity, slightly hyperintensities on T2 and homogeneous enhancement after gadolinium administration.
**Fig. 7:** Arachnoid cyst. Coronal T1W (A) and coronal T2W (B) images. Arrows presenting and well delineated suprasellar prepontine cystic lesion with CSF-like collection, with no soft tissue component or calcifications.  

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**Fig. 8:** Epidermoid cyst. Sagittal T1W (A), coronal T2W (B), axial T1W postcontrast (C), DWI (D) and ADC map (E). Arrows suggesting sellar/suprasellar cystic lesion with signal intensity on T1W and T2W images slightly brighter than CSF, with discrete wall enhancement on C, D and E showing restriction of water molecule diffusion.  

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**Fig. 9:** Dermoid cyst. Sagittal T1W (A), coronal T1W (B), coronal T2W (C), coronal T1 postcontrast with fat-saturation (D) and axial GE (E). A, B and C showing suprasellar cystic lesion well circumscribed with fatty content. On D fatty content is saturated and with wall enhancement after contrast administration. E showing typical presentation of dermoid cysts on GE sequences.

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Fig. 10: Ectopic posterior lobe. Sagittal T1W image, arrow showing "T1 bright spot" representing neurohypophysis located at the eminentia mediana.

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**Fig. 11:** Meningoencephalocele. Sagittal T1W postcontrast (A) and coronal T2W (B). Arrows presenting intrasellar and intra sphenoid herniation of the left sided gyrus rectus compressing and displacing pituitary gland posteriorly.

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Conclusion

Solid knowledge of sellar anatomy and imaging characteristics can help in differentiation among non-neoplastic and neoplastic lesions, having an essential role in the treatment planning.
References