Imaging pituitary gland tumors

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Two categories of presenting signs of a pituitary mass

- **Functional** tumors present with symptoms due to excess hormone release.
  - Excess prolactin is called a prolactinoma.
  - Excess ACTH due to a pituitary adenoma is called Cushing’s disease.
  - Excess TSH.
  - Excess GH produces acromegaly.

- Functional tumors tend to present as microadenomas (a mass <10mm in size).
- Acromegaly is an exception, as it can present as a relatively large mass if the symptoms of bony growth, like increased hand and foot size, are not noticed until late in the disease.

- **Non-functional** Tumors present with symptoms due to mass effect.
  - Because they do not produce symptoms due to excess hormone release, they are often macroadenomas (a mass >10mm in size) by time of detection.
  - Gonadotropin (FSH, LH) releasing tumors usually present as non-functional masses.
Patient 1

A 69 year old male presents with a headache and visual field deficits.
Working up a suspected pituitary mass

- Work-up should include a hormonal evaluation. High levels of a hormone indicate the type of tumor (see table).
  - Low values are also significant. Hyposecretion of a hormone suggests compressive effect and the need for possible replacement.
  - Hormone levels also establish a baseline to monitor success of therapeutic intervention.

- Workup should also include a radiologic evaluation.

<table>
<thead>
<tr>
<th>High levels of…</th>
<th>Suggest…</th>
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<tbody>
<tr>
<td>Prolactin</td>
<td>Prolactinoma</td>
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<tr>
<td>ACTH + 24hr urine cortisol</td>
<td>Cushing’s disease</td>
</tr>
<tr>
<td>TSH + T4</td>
<td>TSH-secreting tumor</td>
</tr>
<tr>
<td>IGF-1*</td>
<td>Acromegaly</td>
</tr>
<tr>
<td>FSH, LH, sex steroids</td>
<td>Gonadotropin-secreting tumor</td>
</tr>
</tbody>
</table>

*GH is released in a pulsatile manner and a single elevated value is not an accurate marker of disease.
MRI is the modality of choice for imaging the pituitary gland. The standard protocol is:

- Precontrast T1 weighted thin slices through the sella (sagittal, coronal planes)
- Gadolinium contrast
- Repeat coronal and sagittal T1 sequences
- T2 sequence not considered part of standard protocol but is useful for detecting cystic changes and hemorrhage

Use CT in patients with contraindications to MRI.
Reviewing the anatomy of the sellar region

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Companion patient 1:
MRI of the sellar region

C: Optic Chiasm
A: Pituitary Gland
I: Cavernous portion of Internal Carotid Artery
*: Sphenoid Sinus
Arrowhead: Pituitary Stalk
Precontrast sagittal T1 image shows a large sellar mass.

T1 with gado in the sagittal plane shows heterogeneous enhancement of the sellar mass.
MRI of the pituitary gland

Precontrast coronal T1 image again shows a large sellar mass.

T1 with gado in the coronal plane shows heterogeneous enhancement of the sellar mass. The mass is invading the left cavernous sinus but the left ICA remains patent.
DDX of a Sellar Mass

- Benign tumor
  - Micro/macroadenomas (this is the most common cause of a sellar mass)
  - Craniopharyngioma
  - Meningioma
- Malignant primary tumors
- Metastatic tumors
  - Lung
  - Breast
- Pituitary hyperplasia
- Cyst
  - Rathke’s cleft
- Abcess
- Lymphocytic hypophysitis
- Carotid AV fistula
Imaging the pituitary

- Macroadenomas easily detected on imaging
- Microadenomas more difficult to detect because of smaller size
  - Appear as a focal area of low signal on non-contrast T1.
  - Peak enhancement of the microadenoma occurs after normal tissue.
  - Therefore, scanning immediately after giving contrast bolus, in a method called ‘dynamic’ MR imaging, increases test sensitivity.
- Functional adenomas not distinguishable on MRI.
Dynamic imaging of microadenomas

Companion patient 2: Advantage of dynamic MRI in imaging microadenomas

A small area of low signal intensity within the pituitary gland prior to contrast (left image) is more distinguishable immediately after gado is given (right image).
Pituitary apoplexy: a sequela of macroadenoma

- Acute onset of neurologic symptoms caused by tumor hemorrhage and expansion of gland
- Occurs in 3-26% of macroadenomas
- T1 and T2 weighted images together suggest age of hemorrhage
- Treatment includes steroids, endocrine evaluation, surgical decompression

Coronal T1 image shows areas of high and moderate intensity, suggestive of hemorrhage.

Surgical treatment and post-op imaging

- Immediately post-op, mass size may appear unchanged due to packing materials
- Volume of mass decreases over next few months

Transsphenoidal approach to pituitary surgery

http://www.pituitarysociety.org/public/specific/acromegaly/images/pituitarysurgery.gif
Conclusions

- Functional tumors present with symptoms, signs related to excess hormone.
- Panel of hormonal tests helps determine type of tumor.
- Functional tumors are challenging to detect radiographically because they are more likely microadenomas at time of detection.
- Nonfunctional pituitary masses present due to mass effects and are more easily detected on imaging.
References

- Snyder PJ. *Causes, presentation, and evaluation of sellar masses*.
  www.uptodate.com
- www.neurosurgery.medsch.ucla.edu
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