Imaging The Turkish Saddle

Russell Goodman, HMS III
Dr. Gillian Lieberman
Learning Objectives

- Review the anatomy of the sellar region
- Discuss the differential diagnosis of sellar masses
- Discuss typical clinical presentations of sellar masses
- Review the menu of radiologic tests available for imaging sellar masses
- Demonstrate the radiologic features of a number of different sellar masses
Anatomy of the Sella Turcica

- The sella turcica, literally “Turkish saddle”, is a saddle-shaped depression of the sphenoid bone.
- It forms the caudal border of the pituitary gland.
- Anatomically complex area, with a number of different potential pathologies, especially neoplastic processes.
- Pathologies can lead to important clinical presentations, such as hormonal imbalances (from pathologies affecting the pituitary gland) and neurological symptoms.

From Grey’s Anatomy
Sellar Anatomy (Coronal)

1. Optic Chiasm
2. Pituitary Gland
3. Internal carotids
4. Cavernous sinus and cranial nerves
5. Sphenoid sinuses

Modified from Access Medicine
Sellar Anatomy (Coronal)

1. Optic Chiasm
2. Pituitary Gland
3. Internal carotids
4. Cavernous sinus and cranial nerves
5. Sphenoid sinuses

Coronal MRI, T1 C-

PACS, BIDMC

Coronal MRI, T1 C-
Differential Diagnosis of Sellar Masses

- Differential diagnosis is large!

- Neoplastic processes
  - Pituitary adenoma
  - Meningioma
  - Craniopharyngioma
  - Germ cell tumor
  - Metastatic disease

- Cystic Lesions
  - Rathke’s cleft cyst
  - Arachnoid cyst
  - Dermoid/Epidermoid cyst

- Infectious and inflammatory lesions
  - Pituitary abscess
  - Lymphocytic hypophysitis
  - Granulomatous hypophysitis

- Other masses
  - Aneurysms
  - Pituitary hematoma
  - Pituitary hyperplasia
Presentation of Sellar Masses

Three common presentations:

1. Incidental finding
   - Huge number of head images taken each year
   - Autopsy series demonstrate that asymptomatic pituitary microadenomas are present in as high as 27% of autopsy series

2. Hormonal Imbalances
   - Pituitary gland is responsible for much of the body’s hormonal regulation.
   - In principle can have excess production of any of the hormones in the anterior pituitary (Prolactin, GH, ACTH, TSH, FSH/LH) from a pituitary adenoma
   - Prolactin (most common), ACTH (cushingoid), GH (acromegaly),
   - Decreased production: usually from mass effect on pituitary gland

3. Neurological symptoms
   - Headache from mass effect, cranial nerve symptoms from compression, visual disturbances (classically bitemporal hemianopsia) from compression of optic chiasm
Menu of Radiologic Tests

2 most common methods of imaging:

- Head CT
  - Excellent imaging of bony structures, particularly useful in preparing for surgical resection of sellar masses
  - Also good at demonstrating calcifications (present in certain masses)
  - Poor soft tissue resolution
  - Ionizing radiation

- MRI
  - Superb soft-tissue resolution
  - Workhorse of pituitary imaging
  - No ionizing radiation
Our Patient... History

- **A. N., a 47 y/o local Boston man**

- **HPI:**
  - Presented to his PCP for f/u of abnormal laboratory values. 2 weeks prior he had been treated at OSH ED for acute abdominal pain and vomiting. He had been diagnosed with a duodenal ulcer and discharged on high-dose PPIs, but encouraged to f/u for high levels of blood calcium
  - At PCP, ROS endorsed headaches, decreased libido

- **PMH:**
  - Duodenal ulcer
  - Hypertension
  - Dyslipidemia
  - Chronic diarrhea

- **FMH:**
  - Strong family history of MEN1 in mother and maternal uncle
Lab values notable for elevated calcium, prolactin levels.

Given his family history of MEN1 and current problems, what are you concerned about?
- MEN1 typically presents with neoplastic processes in the pituitary gland, parathyroid gland, and pancreas
- (3 midline Ps)

He was scheduled for a number of imaging studies, which included a brain CT and MRI to look for a pituitary adenoma

Imaging demonstrates the classic features of a pituitary macroadenoma

From endocrine.niddk.nih.gov
Our Patient... CT

- Characteristic features of pituitary macroadenoma
  - 1) Remodeling of sellar floor (scalloping, erosions, increased size) -> Best seen on CT
  - 2) Large intrasellar mass > 1 cm in diameter) which extends beyond boundaries of sella turcica, often with “snowman appearance”
  - 3) Hypointense-isointense on T1
  - 4) Enhance slightly with contrast, often heterogeneously

Sagittal Head CT, C-Sella Turcica, displaying increased size and scalloping of wall.
Our Patient… CT

Sagittal Head CT, C-Sella Turcica, displaying normal size

Sagittal Head CT, C-Sella Turcica, displaying increased size and scalloping of wall.
Our Patient… MR

- Characteristic features of pituitary macroadenoma
  - 1) Remodeling of Sellar Floor (scalloping, erosions, increased size) -> Best seen on CT
  - 2) Large intrasellar mass (> 1 cm in diameter) which extends beyond boundaries of sella turcica, often with “snowman appearance”
  - 3) Hypointense-isointense on T1
  - 4) Enhance slightly with contrast, often heterogeneously

Sagittal Head MRI, T1 C-, showing a pituitary mass.
Our Patient... MR

- Characteristic features of pituitary macroadenoma
  - 1) Remodeling of Sellar Floor (scalloping, erosions, increased size) -> Best seen on CT
  - 2) Large intrasellar mass (> 1 cm in diameter) which extends beyond boundaries of sella turcica, often with “snowman appearance”
  - 3) Hypointense-isointense on T1
  - 4) Enhance slightly with contrast, often heterogeneously

Sagittal Head MRI, T1 C+, showing a pituitary mass.
Medical therapy for prolactinoma (bromocriptine) was tried and failed.

Transphenoidal resection of tumor was conducted.

Multiple other operations to remove other MEN neoplasias, including parathyroid adenomas and gastrinoma.

Closely followed by endocrinology and GI.
47 y/o Female who presented to her PCP with progressive temporal visual field cuts and galactorrhea

- Prolactin-secreting Macroadenoma
- Macroadenomas can present with visual changes due to compression of the optic chiasm
- Classically this is in the form of bitemporal hemianopsia

Coronal Head MRI, T1 C-, showing compression of the optic chiasm by a large pituitary mass.
Companion Patient #1…
“Snowman Sign”

Coronal Head MRI, T1 C-, showing the “Snowman Sign”.

PACS, BIDMC
Pituitary apoplexy is a complication of macroadenomas that occurs when they grow too large for their blood supply and infarct, or spontaneously bleed.

This is Sheehan’s syndrome when it occurs postpartum due to hormonally driven pituitary enlargement in pregnant women.

This results in a sudden change in tumor size from either ischemia-related swelling or acute hemorrhage.

Often associated with acute neurological symptoms such as nausea, headache, sudden visual loss.

Classical features are a hemorrhagic fluid level, demonstrated nicely on this image.
Companion Patient #3…

Microadenoma

- Patient is 81 y/o male with prolactinoma
- Pituitary microadenoma is the most common pituitary mass
- Benign neoplastic process of anterior pituitary
- Up to 10% of all intracranial neoplasms
- Radiologic features include
  - 1) Round or oval shape
  - 1) Small size (< 1 cm) which normally preserves anatomy
  - 2) Isointense to hypointense on non-contrast MRI
  - 3) Hypointense post contrast
- Location can be a clue to tissue of origin
  - Prolactinoma and GH-secreting are lateral
  - ACTH-secreting tend to be more medial
Companion Patient #3…

Microadenoma

- Patient is 81 y/o male with prolactinoma
- Pituitary microadenoma is the most common pituitary mass
- Benign neoplastic process of anterior pituitary
- Up to 10% of all intracranial neoplasms
- Radiologic features include
  - 1) Round or oval shape
  - 1) Small size (< 1 cm) which normally preserves anatomy
  - 2) Isointense to hypointense on non-contrast MRI
  - 3) Hypointense post contrast
- Location can be a clue to tissue of origin
  - Prolactinoma and GH-secreting are lateral
  - ACTH-secreting tend to be more medial

Coronal head MRI T1, C-, with isointense mass.

Coronal head MRI T1, C+, with hypointense mass.
Other Masses…

- We’ve seen several examples of adenomas
- Now we’ll see examples of several other pathologies
Companion Patient #4…
Craniopharyngioma

- Slow growing tumor that arises from epithelium derived from Rathke’s pouch
- Abundant calcifications in ~93% of cases
- Suprasellar in location
- Heterogeneous with cystic and solid components
- Cyst wall often enhances after contrast

Images courtesy of Dr. Moonis
Companion Patient #4…
Craniopharyngioma

- Slow growing tumor that arises from epithelium derived from Rathke’s pouch
- Abundant calcifications in ~93% of cases
- Suprasellar in location
- Heterogeneous with cystic and solid components
- Cyst wall often enhances after contrast

Images courtesy of Dr. Moonis
Companion Patient #5...
Rathke’s Cleft Cyst

- 56 y/o Male with chronic headache
- Benign cyst in the sellar region
- Remnants of derivatives of Rathke’s cleft
- Normally asymptomatic, but can cause neurological symptoms
- Common finding in autopsy (13-22%)
- Usually intrasellar, located between anterior and posterior lobes
- Hyperintense on T1, intermediate to reduced T2-weighted signal
- Take up contrast less than surrounding tissue

Sagittal Head MRI, T1 C-, showing cyst, anterior and posterior pituitary
Companion Patient #5…
Rathke’s Cleft Cyst

Sagittal Head MRI, T1 C-, showing pituitary gland with cyst.

Sagittal Head MRI, T1 C+, showing pituitary gland with cyst.
Summary and Take-Home Points

- The sella turcica is formed by a depression in the sphenoid bone and houses the pituitary gland, with many proximal important anatomical structures.
- The differential diagnosis for sellar masses is long, but most frequently is a neoplastic process such as a pituitary adenoma.
- Masses in the region commonly present with either hormonal abnormalities or neurologic symptoms, such as vision impairment.
- The superb soft-tissue resolution of MRI makes it the imaging method of choice for evaluation of these masses.
- Provided examples of pituitary microadenoma, macroadenoma, craniopharyngioma, Rathke’s cleft cysts.
Acknowledgements

Thank you to:

- Dr. Gillian Lieberman
- Maria Levantakis
- Dr. Gul Moonis
References


Ashraf K. Surgical Pathology of Endocrine and Neuroendocrine tumors. 2009