Suprasellar Mass
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September 3, 2010

What comes to mind?

- S - Sarcoidosis
- A - Adenoma/ Aneurysm/ Arachnoid Cyst
- T - Teratoma
- C - Craniopharyngioma (v Rathke)/ Cephalocele
- H - Hypothalamic Glioma, Hamartoma/ Histiocytosis X/ Hemachromatosis/ Hypertrophy
- M - Meningioma/ Mets/ Meningitis (TB)
- O - Optic Nerve Glioma
- L - Lymphocytic Hypophysitis/ Lipoma/ Lymphoma/ Leukemia
- E - Epidermoid (v Dermoid)

Non Contrast CT

Contrast Enhanced CT

T2*

T1 Pre and Post Contrast
**Nodule, Pre and Post Contrast**

**Normal Caliber of the Carotids**

**Anteriorly Located ACA**

**Review the Imaging Characteristics**

**Calcifications**

- **Intra-Axial Tumors:**
  - Oligodendroglioma (90%)
  - Ependymoma (50%)
  - Ganglioglioma (40%)
  - Choroid Plexus Papilloma (25%)
  - Astrocytoma (20%)
  - Metastasis

- **Extra-Axial Tumors:**
  - Craniopharyngioma (90%)
  - Meningioma (25%)
  - Chordoma
  - Chondrosarcoma

**High Intensity on T1**

<table>
<thead>
<tr>
<th>Methylene Blue</th>
<th>Pituitary Apoplexy</th>
<th>Hemorrhagic Mass</th>
<th>Thrombosed Aneurysm</th>
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<tbody>
<tr>
<td>High Protein</td>
<td>Proteinaceous Cysts</td>
<td>Neurenteric Cyst</td>
<td>Dermoid Cyst</td>
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<td>Fat</td>
<td>Lipoma</td>
<td>Dermoid Cyst</td>
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<td>Cholesterol</td>
<td>Colloid Cyst</td>
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<td>Melanin</td>
<td>Melanoma</td>
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<td>Flow Effects</td>
<td>Slow Flow</td>
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<td>Paramagnetic Cations</td>
<td>Cu, Mn...</td>
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</table>
Low Intensity on T2

Hypercellularity
Meningioma
PNET
Germinoma
GBM
Oligodendroglioma
Mucinous AdenoCA mets
Calcification
Blood
Protein
Melanin
Flow Void
Hemangioblastoma
Vascular Malformation

Appears Cystic...
Differential for Cystic Sellar Masses
- Craniopharyngioma
- Rathke Cleft Cyst
- Colloid Cyst
- Arachnoid Cyst
- Cystic Pituitary Adenoma
- Xanthogranuloma
- Epidermoid Cyst
- Dermoid Cyst
- Ependymal Cyst

Craniopharyngioma and other cystic epithelial lesions of the sellar region: a review of clinical, imaging, and histopathological relationships. Neurosurg Focus 28 (4):E4, 2010

Embryologic Development

- Rathke’s pouch
- 4th week of Embryologic Development
- Rostral Outpouching from Roof of Primitive Oral Cavity
- Anterior Wall of the Pouch: Anterior Lobe of the Pituitary (Pars Distalis)
- Posterior Wall of the Pouch: Intermediate Lobe of the Pituitary (Pars Intermedia)
- Rathke’s Cleft: Normally Regresses
- Persistence of this Cleft with Expansion: Rathke’s cleft cyst
- Cyst wall lined by single columnar cell layer of epithelium, often containing goblet cells, and is often ciliated

Rathke’s pouch

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Adenohypophysis:
- Pars distalis: the largest section
- Pars tuberalis: a collar of tissue that surrounds the infundibular stalk
- Pars intermedia: a narrow band that is usually separated from the pars distalis by a hypophyseal cleft

Neurohypophysis:
- Pars nervosa: the bulk of the posterior pituitary
- Median eminence: the upper section of the neurohypophysis above the pars tuberalis
- Infundibular stalk: the “stem” that connects the pars nervosa to the base of the brain

Embryologic Development

- Two hypotheses:
  1. Development of the Adenohypophysis During Embryogenesis: Consistent with Pediatric Tumor Development
  - Although ~1/3 of all craniopharyngiomas occur in children, the percentage of embryonal childhood tumors ranges from 75 to virtually 100%
  2. Residual Squamous Epithelium from the Adenohypophysis Undergoes Metaplasia: Adult Tumors
- No Consensus
Rathke’s Cleft Cysts
- Rathke’s Cleft Epithelium
- Sellar (40%)/ Suprasellar (60%)
- Asymptomatic
- 13 - 22% of Autopsies
- Fluid-Filled with very Thin Walls (only 1-2 cell layers thick)
- Secrete Fluid → Grow / Compress Adjacent Structures

Rathke’s Cleft Cysts
- CT
  - Non contrast: typically non-calcified as homogenous low attenuation
  - Post contrast: typically non enhancing although the cyst wall may enhance in some cases
- MRI
  - T1: ~ 50% are hyper intense (protein contents) and 50% are hypo intense.
  - T2: ~ 70% are hyper intense and 30% are iso or hypo intense.
  - T1 C+ (GAD): no contrast enhancement of the cyst is seen, however a thin enhancing rim of surrounding compressed pituitary tissue may be apparent
  - T2: ~ 50% of cases a small non-enhancing intracystic nodule can be identified which is virtually pathognomonic of a Rathke’s cleft cyst.
    - When seen it is hyper intense to surrounding fluid on T1 and hypointense on T2
    - Occasionally a fluid - fluid level may be seen (particularly if there has been a hemorrhage)

Craniopharyngioma
- Rathke’s Cleft Epithelium
- Sellar (15%)/ Suprasellar (85%, Anywhere Along the Infundibulum)
- Enlarged Sella
- Rare / Ectopic Locations
  - Floor of 3rd Ventricle, Nasopharynx, Posterior Fossa, Extension Down the Cervical Spine
- "Benign" Tumor (WHO Grade I)
- Locally Invasive
- Symptomatic Hydrocephalus & Endocrine Disturbances
- ~3% Of All Intracranial Tumors
- Pediatric (5-14 yrs) ~6-13%
- Adult (65-74 yrs)
- Thick Walls
- Complex Mass with Multiple Nodules at the Base of the Brain, Simulating Along the Fissures

Craniopharyngioma
- CT
  - Heterogeneous Mass /Suprasellar Region
  - Calcification (Except Papillary Type) / Cysts Very Common:
    - Calcification
      - Overall 80 - 87% Of Craniopharyngiomas Calcified
      - Adamantinomatous: 90%
      - Papillary: Rare
    - Cysts: Seen in 70 - 75% Of Cases (More Frequently in Adamantinomatous Type)
Craniopharyngioma

MRI
- **T1**:  
  - Classic Adamantinomatous Type:  
    - Signal Intensity Varies Depending on Cyst Contents, And  
      - Hyper Intense Due To Protein, Blood Products, &/or Cholesterol  
  - Papillary Type:  
    - Solid Components Appears Iso-Intense  
  - Contrast Enhanced T1:  
    - Thin Enhancement of the Cyst Wall  
    - Diffuse Heterogeneous Enhancement of the Solid Components  
- **T2**:  
  - Signal is High in Both Solid and Cystic Components, but is Variable Depending on Content of Fluid  
- **T2**:  
  - ± Calcification  
- MR Angiography: ± A1 Segment of ACA

Surgery: Tumor Management
- Controversial  
  - GTR  
  - STR + XRT  
  - STR without adjuvant XRT  
  - ~70% Recur/ Progress

Surgery: 3 goals
1. Diagnosis
2. Decompression  
  - Hydrocephalus  
  - OEV v VPS  
3. Prevent Recurrence  
  - Surgery TOC  
  - Small Tumors → GTR

Compare
- Gross Total Resection x Subtotal + XRT
  - Progression Free Survival
    - 2 yr: 88%  
    - 5 yr: 67%  
    - Overall Survival
      - 5 yr: 98%  
      - 10 yr: 98%
- Subtotal + XRT
  - Progression Free Survival
    - 2 yr: 91%  
    - 5 yr: 69%  
    - Overall Survival
      - 5 yr: 99%  
      - 10 yr: 95%

Surgical approaches
- Bifrontal  
- Unilateral  
- Subfrontal  
- Pterional  
- Transcallosal  
- Transventricular  
- Subtemporal
Surgical approaches

- Transsphenoidal
  - Intranasal
  - Intrasellar intradipthermic
- Extended Endoscopic Transsphenoidal
- Extended Endoscopic Transnasal
  - Planum Sphenoidale
  - Olfactory Groove
  - Clivus
  - Craniovertebral Junction
  - Anterior Portion of the Foramen Magnum

Surgical Complications

- Endocrine Function
  - DI, up to 60-93%
  - Hypogonadism
  - Panhypopituitarism
- Visual Deterioration
  - Obesity ~40%
  - Somnolence
  - Neuropsychologic Disturbance
- Cardiovascular Events
  - Estrogen Deficiency

Radiotherapy

- Adjuvant Treatment
- Radiosensitive tumor
- Used as adjuvant or with tumor recurrence
- Total dose
  - 50 to 65 Gy divided into fractionated doses of 180 to 200 cGy per day
- Utility evident for large residual/recurrent tumors and lesions in close proximity to OC

Intracavitary Therapy

- Instillation of an agent through surgically placed catheter directly into cavity
- First used 1952
- Used for both primary and adjuvant therapy for recurrent cases
- Radioisotopes
  - Yttrium90, phosphorus32, or rhenium186

Nearly All Children With A Craniopharyngioma Will Have Significant Endocrine Problems After Surgery

Nearly All Have Anterior And Posterior Pituitary Deficiency Whether Or Not Complete Tumor Removal Is Achieved

Most Serious Complication Is Obesity That Develops In About ½ Of Patients Due To Hypothalamic Damage (VM)

DI Occurs In About 90% Of Postoperative Craniopharyngioma Patients

SRS

- Adjunct to surgery, cyst aspiration, & conventional radiation therapy
- Doses 9.5 to 16.5 Gy
  - Fractionate after 135 Gy?
- Control rates for residual or recurrence
  - 70-92%
- Low morbidity
- ODI, panhypopit., visual loss
  - <4%

Radiosurgery

- Long term studies not available for safety evaluation and effectiveness
- Utilized for small tumors <2 cm and >4 to 5 mm from optic apparatus

Intracavitary Therapy

- Review of literature by Blackburn et al: stereotactic intracavitary therapy
Chemotherapy

- Intracavitary instillation of Bleomycin
  - Tumor must be Entirely Cystic
- IFN-α
  - Squamous Cell Tumors

Survival & Prognostic Factors

- Benign histology and rarely disseminate
  - Survival function of local tumor control
  - Size of tumor & method of treatment
    - Tumors > 5cm have much higher recurrence rate
    - GTR vs. STR + radiotherapy
- Biologic factors
  - Adamantinomous-type higher rate of recurrence after GTR compared to squamous papillary type

Recurrent Craniopharyngiomas

- Recur at 2 to 5 years
- Previous radical surgery vs. irradiation
  - Recurrence after radical resection/radiation is more difficult, making gross total removal less likely
  - M&M is also higher
  - Primary radical surgery
    - Destroys natural planes between tumor and hypothalamus
    - Leads to more blunt dissection at reoperation
- GTR of recurrent lesion
  - 30 to 68%

Recurrence & Outcome

- Treatment for recurrence
  - Essentially approached in similar fashion as primary tumor
  - Radiation & surgery offers clear increased relapse-free survival over surgery alone

Recurrent Craniopharyngiomas

- Alternative strategy
  - Radiation therapy
  - Brachytherapy
- Initial Rx: STR + radiotherapy
  - Radical resection treatment of choice when feasible plus adjuvant radiation therapy
Questions?

On these unenhanced and enhanced T1-weighted sagittal images, a compressed pituitary gland can be identified. There is a large intrasellar and suprasellar mass with cystic and enhancing components as well as calcifications. These findings in a child are virtually pathognomonic for craniopharyngioma (perhaps with only a dermoid in the differential diagnosis).
Differential diagnoses
- craniopharyngioma
  - no gender difference
  - similar age group
  - usually suprasellar or have a suprasellar component
  - tend to calcify
  - cystic pituitary adenoma
  - arachnoid cyst
  - older patients
  - no gender difference
  - epidermoid cyst
  - usually suprasellar
  - restriction on DWI
- Rathke’s cleft cyst
- pituitary macroadenoma
- intracranial teratoma

Meningioma
- The most common intracranial tumor in adults is the meningioma with 20% of occurring at the skull base.
- This is an autopsy specimen with the brain removed, showing a meningioma sitting on the diaphragm sellae.
- Meningiomas are almost always solid lesions, sometimes with a cyst on the edge. They can lift up the arachnoid a little bit and enhance uniformly as a general rule.

Hypothalamic and Chiasm Glioma
- Gliomas can occur in any part of the brain and the optic chiasm is a common location, particularly in patients with neurofibromatosis type 1.
- This enhanced CT shows an example of an optic nerve glioma in a patient with neurofibromatosis.
- There is a suprasellar mass which is indistinguishable from the optic chiasm.
Craniopharyngioma

Treatment and prognosis
- Treatment is usually surgical with radiotherapy especially useful for incomplete resection. Although benign local recurrence is seen in 7 - 33% of patients

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- Rostral Outpouching from Roof of Primitive Oral Cavity
  - Anterior Wall of the Pouch → Anterior Lobe of the Pituitary (Pars Distalis)
  - Posterior Wall of the Pouch DOES NOT Proliferate
    - Intermediate Lobe of the Pituitary (Pars Intermedia)
  - Lumen of the Pouch Narrows to form a Cleft
    - Rathke's Cleft is a Normal Regress
    - Persistence of this Cleft with Expansion → Rathke's cleft cyst
  - Cyst wall lined by single columnar cell layer of epithelium, often containing goblet cells, and is often dilated
Surgery
Management of Hydrocephalus

- Use of preoperative permanent shunting is debatable
- Majority recommend placement of EVD just prior to craniotomy
  - If decompression needed
- Hydrocephalus often relieved with tumor removal/decompression