Pituitary Tumor Surgery

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Goals

- Understand surgical approaches to pituitary tumors and minimally invasive modifications of these approaches
- Learn about potential improved outcomes using endoscopic methods
- Better appreciate advantages of minimally invasive and endoscopic methods for pituitary and skull base tumors
Where is it and what does it do?

- “Master Gland”
- Regulates all other hormone pathways
  - Thyroid
  - IGF-1
  - Cortisol
  - Testosterone/ Estrogen
  - Prolactin
  - ADH
- Sits at base of brain just below optic nerves
Symptoms of Pituitary Tumors

- **Hormone deficits**
  - Due to compression of gland

- **Hormone Excess**
  - Due to hormone-secreting tumors
    - GH = Acromegaly
    - ACTH = Cushing’s Disease
    - PRL = Prolactinoma
    - TSH = TSH-oma

- **Visual Deficits**
  - Due to compression of optic chiasm or nerves
  - Due to compression of cranial nerves in cavernous sinus
When is Surgery Appropriate

- Functional Adenoma
  - Surgical Cure
  - Debulking
  - Intolerant to Medical Therapy

- Nonfunctioning Adenoma or RCC
  - Mass Effect
  - Visual Defect
  - Progressive Endocrinopathy

- Unclear Diagnosis
Macroadenoma
When is Surgery NOT Appropriate

- True “incidentaloma”
- Most microadenomas that do not make hormones
- Most small cysts
- Most prolactinomas
- Can’t remove at least 75%
- Unclear biochemical diagnosis
- Headache as ONLY symptom??
Pre-surgical Workup

- LH/FSH, TSH, T4, PRL, IGF-1, GH, Testosterone
  - Every patient
  - Cortisol and ACTH stimulation only when suspected

- PRL > 100 ng/ml
  - Consider prolactinoma
  - ? medical therapy trial

- IGF-1 > ULN suspect acromegaly (even in absence of overt features)
  - OGTT

- 24 hour urinary free cortisol > 2X ULN suspect Cushing’s Disease
  - Biochemical diagnosis BEFORE MRI
  - IPSS for majority of cases

- Visual Fields
Surgical Options

- Transcranial
- Transsphenoidal
- Combined
Craniotomy

- Tumors that extend out to the sides
- Tumors that encase major blood vessels
- Tumors that could not be removed via TS approach
- Giant tumors
- Technical issues preventing TS approach

Typically less than 5% of pituitary tumors require a craniotomy
Supra-orbital Craniotomy: A Minimally Invasive Alternative
Transsphenoidal Surgery

- Initially developed in 1907 (Schloeffer) and 1909 (Cushing)
- Abandoned until 1960’s due to poor visualization
- Rebirth in early 70’s (Hardy, Wilson, Laws) with operating microscope
- Revolution in technique in late 90’s with endonasal surgery
- Introduction of endoscopic methods in 2000-2005

- Technology moves slowly - most surgeons still use the microscope
Standard Sublabial Microscopic Transsphenoidal Operation
Endonasal Transsphenoidal Approach

- Preferred approach for most pituitary tumors
- Approach pituitary through back of nose
- Minimal tissue destruction
- Utilize a rigid endoscope to illuminate and magnify
Endonasal TS Approach

- Direct access to sphenoid sinus through back of nostrils
- Avoids destruction of normal anatomy and rhinological complications
- Has widely replaced the sublabial method
  - >95% active pituitary surgeons use endonasal method

- Utilizing microscope results in a **dramatically smaller** field of view and operating space than traditional sublabial approach
  - “worst of all worlds” even though most practiced
Endoscopic Transphenoidal

- Utilize a rigid endoscope to illuminate and magnify in place of microscope
- Minimal disruption of nasal tissues
- Binasal technique provides larger dissection space
- Accomplishes same goal—safe tumor removal
Field of view: Endoscope v. Microscope

Spencer et al, Laryngoscope, 1999
Endoscope and Camera
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<tr>
<th>Microscope</th>
<th>Endoscope</th>
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Transsphenoidal Approach

Pre-op

Post-op
Improved CS Resection

Pre

Post
Advocates of endoscopy argue that it improves extent of resection for pituitary tumors.

Advocates for microscopy say it is faster and works as well.

Demonstration of this advantage can be very difficult due to:
- Multiple surgeons in a single practice
- Difficulty assessing residual tumor on MRI
- Lack of regular and systematic follow up of patients

Consensus (and growing) is that endoscopy is better for:
- Patients: Comfort/Recovery
- Surgeon: View, access, extent of removal, safety
- For simple cases outcomes similar
Summary of Endoscopic Pituitary Surgery

- Extent of resection seems better
  - Several studies with more coming on a monthly basis
- Patient comfort excellent
- Length of stay averages 2 days
- Endocrine outcomes at least as good as with microscope
- Evolving technology allowing surgeons to accomplish more, including cavernous sinus resections.

SO…. Most surgeons who perform endoscopy are convinced it gives more complete resections.
Post-operative Issues

- Nasal Care
  - Packing rarely needed
  - Saline solution irrigations
  - Nose bleeds in 3-5%, usually managed conservatively
    - Blood thinners can cause delayed bleeding

- Hormone replacement
  - As need basis only, not empiric
  - Less that 3% patients need new hormone replacement

- Loss of smell/taste
  - Extremely common but typically transient
  - May take 3-6 months to resolve
Post-operative Issues

- Sodium fluctuations
  - Sodium levels can get very low about 1 weeks after surgery
  - Monitor with blood draw and endocrine follow up
  - DO NOT force fluids

- CSF leaks
  - Uncommon but must be caught
  - “dripping faucet”

- Headaches

- Sinus Infections/ Chronic Sinusitis
  - About 5% of patients
  - May require antibiotics and/or ENT evaluation
Extended Endonasal Approaches

- Use nasal corridor as access to skull base
- Useful for tumors from cribiform plate to C1
- Primarily midline
  - Meningioma
  - Chordoma
  - Craniopharyngioma
- Extensive learning curve
Cystic Cranioparyngioma
Post-op
EEA Issues

- CSF leak in 10+% cases
- Control of bleeding
- Instrumentation and visualization
- Very steep learning curve
  — Strongly consider referral to experienced surgeon
- Cooperation between ENT and Neurosurgery helpful for repair

EXPERTISE
— Surgeon should be performing at least 50 pituitary surgeries per year and over 10 EEA to be comfortable
Conclusions

- Surgery remains a mainstay treatment for most pituitary adenomas, with the exception of Prolactinomas.

- Endoscopic transsphenoidal surgery results in more complete surgical removals with less complications, and is the preferred approach when available.

- Expanded endonasal surgery is a growing field and offers significant advantages over traditional craniotomy for many tumors.

- Due to the substantial learning curve for these methods, as well as data supporting better outcomes with more experienced surgeons, referral to a surgeon who performs at least 30 pituitary surgeries yearly is advised when feasible.

- Close cooperation between Neurosurgery and Endocrinology will avoid many post-operative issues and facilitate more rapid return to normal life.