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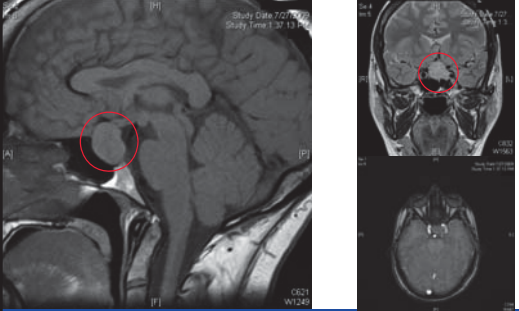
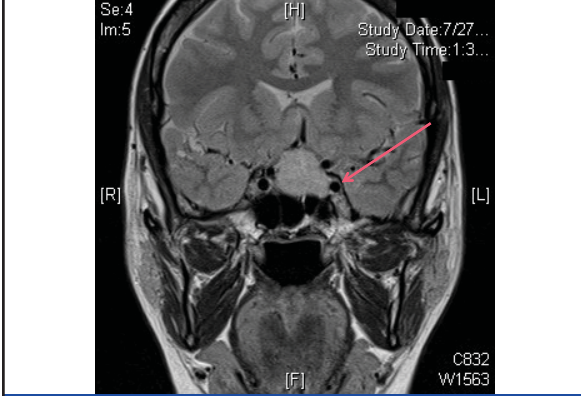
Pituitary Tumors and Surgery

Paul Mongan MD

The Case

- 37 yo female with known pituitary mass.
- 2-3 years ago went camping developed cold, fever, and headache.
- Pituitary mass was discovered during the workup. Diagnosed adenoma.
- Saw endocrinologist and neurologist outside hospital. No notes on these visits. Pt does not recall the results or discussions at that time.

Radiographic imaging

Consistent with adenoma

- Most pituitary tumors are noncancerous, nonspreading adenomas.
- Adenomas remain confined to the pituitary gland or surrounding tissues and do not metastasize.
- Generally adenomas divided into two groups:
 - Functional (secretes prolactin, ACTH, Growth Hormone, or rarely: TSH, LH, or FSH)
 - Nonfunctional (symptoms will be caused by mass effect)

Is this worrisome?

- No. Not by itself.
- Pituitary adenomas are exceedingly common at autopsy and on pituitary imaging, with a prevalence of 15-25%.
- In 2006, Buurman and Saeger reported 334 pituitary adenomas in 3048 autopsy cases and the mean adenoma diameter was only 1.97 mm.
- The majority of these will have no clinical relevance.
- However if the patient presents with symptoms it is a different matter.

Epidemiology

- Pituitary tumors account for 10-15% of all primary brain tumors
- Highest incidence between the 3rd and 6th decade
- More common in women
- Genetic predisposition seen only in MEN-1.
 - Although this accounts for only 3% of pituitary tumors
- Unique challenges to anesthesiologist
- Require multidisciplinary approach
- Dependent on quality of perioperative care



Back to the patient...

- Did she present with symptoms?
 - Following complaints were noted at the first visit in July:
 - baseline headache
 - weight gain of 30-40 lb over the last 6 months
 - cold intolerance
 - intermittent visual blurriness
 - easily fatigued
 - daytime sleepiness
- These are all consistent with secreting adenoma
 - symptoms can be secondary to ACTH secretion.
- Except the visual blurriness, which might be due to a mass effect on the optic chiasm. This is however not likely as the optic deficits would present as field deficits.

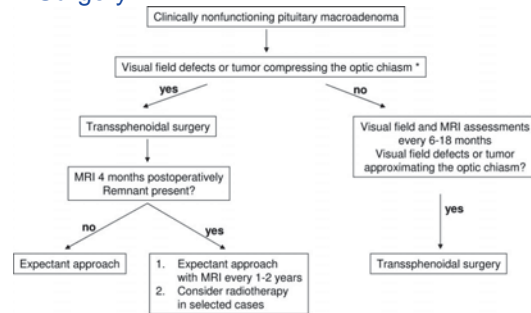


Endocrinologic evaluation

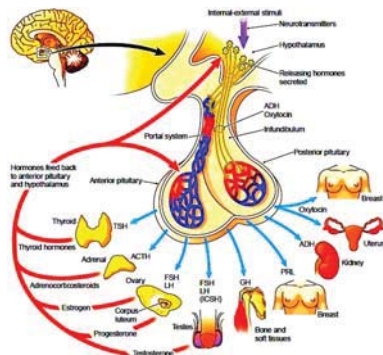
- Laboratory Results
 - Notable for low prolactin of 55
 - Consistent with stalk compression"
 - LH < 1
 - FSH 3
 - TSH 1.6
 - T4 0.96
 - Cortisol 4.2
- ACTH stimulation test: normal at 9.8 mcg/24h
- "consistent with a non-secreting pituitary macroadenoma"



Surgery



(From: Dekkers et al. Nonfunctioning Pituitary Macroadenomas J Clin Endocrinol Metab, October 2008, 93(10):3717-3726)



Functioning Tumors

- Microadenomas=no mass effects
 - Excessive hormone production
 - GH secreting
 - gigantism (prepuberty)
 - acromegaly (postpuberty)
 - ACTH secreting
 - Cushing's, bilateral adrenal hyperplasia
 - Prolactinomas
 - amenorrhea/galactorrhea syndrome (fem); impotence, decreased libido(male)
- CT scan and MRI will eval ICP
- Perioperative short term steroids
- Visual exam to evaluate optic chiasm



Prolactinoma

- 20–30% of pituitary tumors
- Prolactin levels > 200 ng/ml (if less worry about stalk effect)
 - women
 - amenorrhea, galactorrhea, loss of libido, infertility
 - men
 - decreased libido, impotence, premature ejaculation, erectile dysfunction, oligospermia
- microadenoma : 20:1 female predominance
- macroadenoma : 1:1
- 90% response to medical therapy
 - bromocriptine

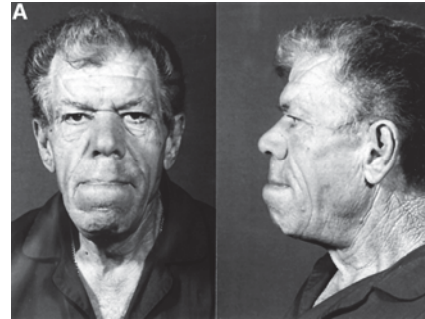
Growth Hormone Secreting Tumor

- Most commonly macroadenoma
- Occur in the 4th and 5th decade
- 50% death before 50 years
- GH level > 5 ng/ml
- Initial treatment is surgery

Acromegaly - Excess GH (somatotropin)

- Enlargement hands and feet (bone)
- HTN, diabetes, heart disease
- Cardiomyopathy, CHF
- Obstructive Sleep Apnea
- Enlarged soft tissue
 - Lips, tongue, epiglottis, vocal cords
 - Connective tissue overgrowth leads to recurrent laryngeal nerve paralysis
 - Subglottic tracheal narrowing
 - Peripheral nerve/artery entrapment
- Enlarged membranous bones
 - Cranium, nose, supraorbital ridges, lower jaw, kyphosis

Clinical Features Of Acromegaly



Smith M., and Hirsch N P Br. J. Anaesth. 2000;85:3-14

Clinical Features Of Acromegaly



Smith M., and Hirsch N P Br. J. Anaesth. 2000;85:3-14

Corticotroph Secreting Adenomas

- 8-10% of pituitary tumors
- Cushing's Disease
 - Hypercortisolemia
 - ACTH-secreting pituitary tumor.
 - Weight gain, truncal obesity, buffalo hump
 - Free cortisol level
 - no cortisol suppression on low-dose dexamethasone testing, cortisol suppression on high-dose dexamethasone testing, and moderately elevated ACTH levels
 - Surgery is best option

Clinical Features Of Cushing's Syndrome

Appearance	Redistribution of body fat; 'moon' face; truncal or 'buffalo' obesity
Musculoskeletal	Proximal myopathy; vertebral collapse; osteoporosis and pathologic fractures -caution during positioning
Skin	Purple striae on abdomen, buttocks, thighs; easy bruising and fragile skin; hirsutism; acne
Endocrine	Impaired glucose tolerance; diabetes
Cardiovascular	Hypertension; ECG abnormalities; left ventricular hypertrophy
Metabolic	Hyponatremia; hypokalemia; alkalosis
Other	Sleep apnea; gastrointestinal reflux; renal stones; masculinization; mental disturbance



Thyrotropic (TSH-Producing) Adenoma

- Less than 1-2% of pituitary adenomas
- Pituitary hyperthyroidism
 - High TSH with high Free T4
- Can be quite large upon diagnosis
 - >60% locally invasive : risk of blood loss
 - propylthiouracil or octreotide
- Surgery is usually first option



Pituitary Dwarfism

- Presentation:
 - Slow growth before age 5
 - Short stature (child <5th percentile, adult <5 ft)
 - Absent/delayed sex develop (adolescent)
 - Excessive thirst & increased urine volume (DI)
- Associated with deficiencies in
 - Thyrotropin
 - Vasopressin
 - Gonadotropin
 - ACTH
 - Facial development abnormalities (cleft palate/lip)



Pituitary Apoplexy

- Sudden hemorrhage into or infarct of pituitary
- LIFE THREATENING
- Leads to
 - Rapid development of acute neurological deficits
 - Rapid decline in pituitary function
- RX
 - Corticosteroids
 - Emergency decompression



Perioperative Management of Patients Undergoing Transsphenoidal Pituitary Surgery

Preoperative Evaluation

- Imaging:
 - MRI brain with and without IV contrast (include thin cuts through pituitary)
 - Tumor enhances less than gland
 - Vasculature is black
- Labs:
 - Prolactin, FSH, LH, GH, ACTH, testosterone, GH, cortisol, IGF-1 (insulin like growth factor)
 - CBC, electrolytes, glucose
- Visual Fields:
 - Performed by an ophthalmologist



Pituitary Dwarfism and Anesthesia

- Small airway
- No anatomic abnormalities
- Tracheal tree is similar to pediatric patient of similar size
- Replacement RX with appropriate hormones
 - Euthyroid
 - Steroids
 - Vasopressin
 - All hormones preop to optimize



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Pituitary Apoplexy and Anesthesia

- Surgical indications:
 - The abrupt and catastrophic acute hemorrhagic infarction of a pituitary adenoma
 - Present with acute headache, meningismus, visual impairment, ophthalmoplegia, and alteration in consciousness
 - Glucocorticoid replacement
 - adrenal insufficiency
 - Urgent surgical decompression



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Acromegaly and Anesthesia

- Airway issues
 - Difficult mask fit /ventilation
 - May be difficult intubation
 - Bone growth
 - Soft tissue
 - Prone to subglottic stenosis
 - May require awake FOB
- Monitor glucose
- Titrate muscle relax if skeletal muscle weakness
- Consider HTN, Cardiac Disease/Dysfunction, Sleep Apnea



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Cushings Perioperative Corticosteroid Administration

- Stress dose
 - 50-100mg hydrocortisone
 - 6-8hr for several days
 - Rarely required beyond 24hrs
- Dexamethasone: use in Cushing's disease
 - no interference with postop. serum cortisol assay
- Postop 6hr serum cortisol
 - rapid lab



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Surgical Approaches to Pituitary Tumors

- Transsphenoidal
 - Endoscopic
 - Endonasal microscopic
 - Sublabial transseptal
- Transcranial
 - Pterional
 - Subtemporal
 - Supraorbital



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Pituitary Surgery - Transcranial

- Large invasive tumors or tumors with significant suprasellar extension
 - Direct visualization of suprasellar structures
 - Vascular
 - Optic chiasm
 - Hypothalamus
 - Pituitary stalk
 - Disadvantages are potential damage to:
 - olfactory nerve, frontal lobe, vasculature, optic nerve & chiasm.
 - Increased incidence of permanent DI & ant pituitary deficiency



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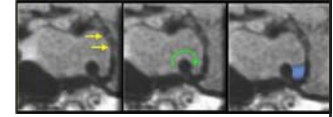
Pituitary Surgery - Transcranial

- Basic considerations of neuroanesthesia
 - Control of ICP
 - Mannitol, ETCO₂
 - Possibility of large amount blood loss
 - A-line
 - Smooth extubation



Pituitary Surgery - Transsphenoidal

- Advantages
 - Lower incidence of DI
 - Eliminates frontal retraction and scars
 - Tissue sparing
 - Less transfusions
 - Shorter hospitalization
- Disadvantages
 - CSF leak & meningitis
 - Less visualization of sella
 - Possibility of bleeding
 - cavernous sinus or carotid artery
 - intracranial hemorrhage
 - brain stem compression



Pituitary Surgery - Transsphenoidal

- Did the pt have a pneumoencephalogram?
- Head pinned with 30-40° head up (risk of VAE minimal)
- Make room for the C-arm, table turned, away arm tucked
- Leg prepped for fat pad
- Lumbar intrathecal catheter
 - inject saline or remove CSF
 - inject intrathecal air
 - push the tumor down
 - outline a tumor
 - discontinue nitrous oxide
- ENT surgeon starts (maybe)
 - Vasoconstricting locals!
 - Prepares the way for the neurosurgeon



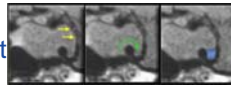
Pituitary Surgery - Transsphenoidal

- Dysrhythmias & severe HTN b/o epi in local
- Air embolism (rare)
- DI is a postop concern
- Smooth emergence
 - Minimize coughing and bucking
- Blood in airway
- EBL usually <500 cc
- Pain not a major factor

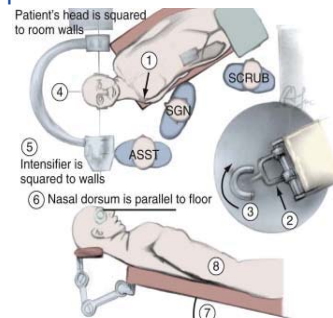


Intraoperative Management

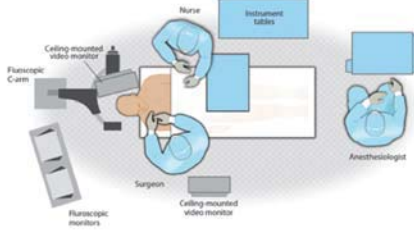
- Monitoring – routine, a-line rarely used
- Rapidly cleared drug or anesthetics
 - propofol, remifentanyl, desflurane
- Proximity of ICA : risk of hemorrhage
- Cushing's disease: difficult IV, avoid steroids
- Acromegaly
 - prone to upper airway obstruction
 - extubation in a semi-seated position



Transsphenoidal



The Fully Endoscopic Endonasal Approach



Early Post-operative Remission Rates Endoscopic vs. Microscopic Results

	Hormonally Active Adenomas			Non-functioning Adenomas
	ACTH	PRL	GH	
Endoscopic Series	84%	78%	88%	93%
Microscopic Series ^a	81%	66%	77%	82%

^a Calculated from several published microscopic series

COMPLICATION RATES

Complication (%)	Endoscopic	Microscopic ^a
Ant. Pit. Insufficiency	2.1	19.4
Diabetes Insipidus	2.5	17.8
Carotid Injury	0	1.1
CNS Injury	0	0.6
Intrasellar Hemorrhage	0.4	2.9
Cerebrospinal Fluid Leak	0.7	3.9
Postoperative epistaxis	0.6	10
Meningitis	0	1.5

Reference: Kabil MS, Eby JB, Shahinian HK: Fully Endoscopic Endonasal vs. Transseptal Transsphenoidal Pituitary Surgery. *Minim Invasive Neurosurg.* 2005 Dec; 48(6):348-54. (An earlier series, 300 patients)

Reference: Kabil MS, Eby JB, Shahinian HK: Fully Endoscopic Transnasal vs. Transseptal Transsphenoidal Pituitary Surgery. *Neurosurg. Q* 15(3):2005. (An earlier series, 300 patients)



Pituitary Surgery Post-Operative Complications

- Diabetes Insipidus
 - Follow urine output and Na levels
- SIADH
- CSF leak
 - Check for rhinorrhea
- Hemorrhage/Apoplexy
 - Worsening vision



Diabetes Insipidus (DI)

- Presentation
 - Polydipsia
 - Polyuria
 - Poorly concentrated urine despite high plasma osmolality
- Typically manifests 24-48h after surgery
- Posterior pituitary-vasopressin deficiency
- Careful monitoring urine, urine & plasma osmolality
 - Isotonic fluids until osmolality >290
 - Osmolality >290 then hypotonic fluids
 - Desmopressin : 0.1mg by orally or 1ug SQ



SIADH

- Syndrome of inappropriate antidiuretic hormone
- Characterized by hyponatremia
 - H₂O retention
 - Serum: low Na, low osmolality
 - Urine: high osmolality (concentrated)
- HALLMARK: hyponatremia in presence of high urinary osmolality
- Fluid restriction: important therapy (0.5 to 1.5 L/day)
- Severe Hyponatremia (<120 meq/L)
 - 3% NaCl
 - lasix



Hypopituitarism

- Should be screened for signs of hypopituitarism
- Corticosteroid supplement after discharge
- Rapid wean and assay morning cortisol on a daily basis



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Thank you

QUESTIONS???



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