

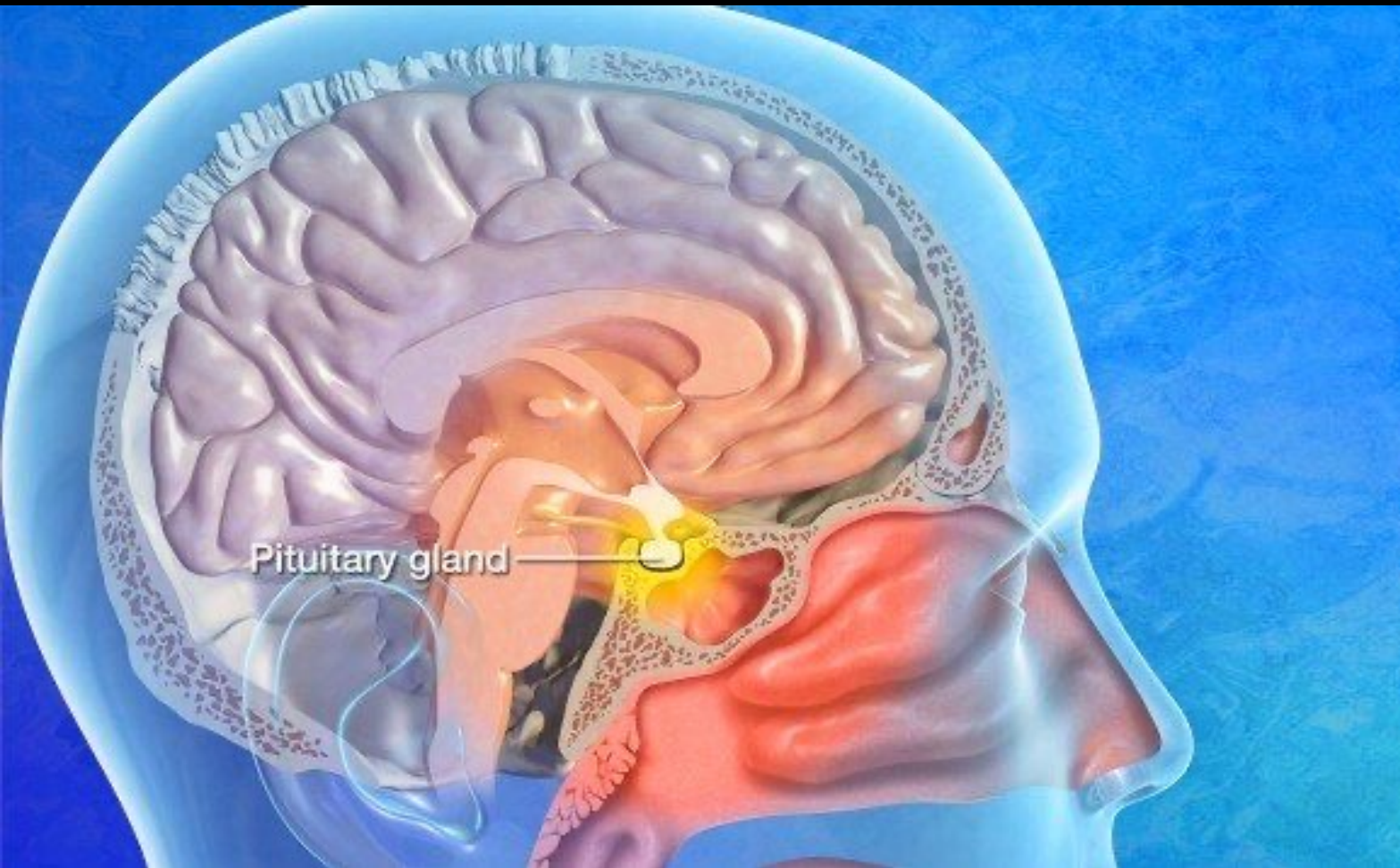
WHAT YOU NEED TO KNOW ABOUT PITUITARY SURGERY.....

Anesthesia Update 2023

Minh Hai Tran Neuroanesthesia Dept, UCSD



Your Case.....



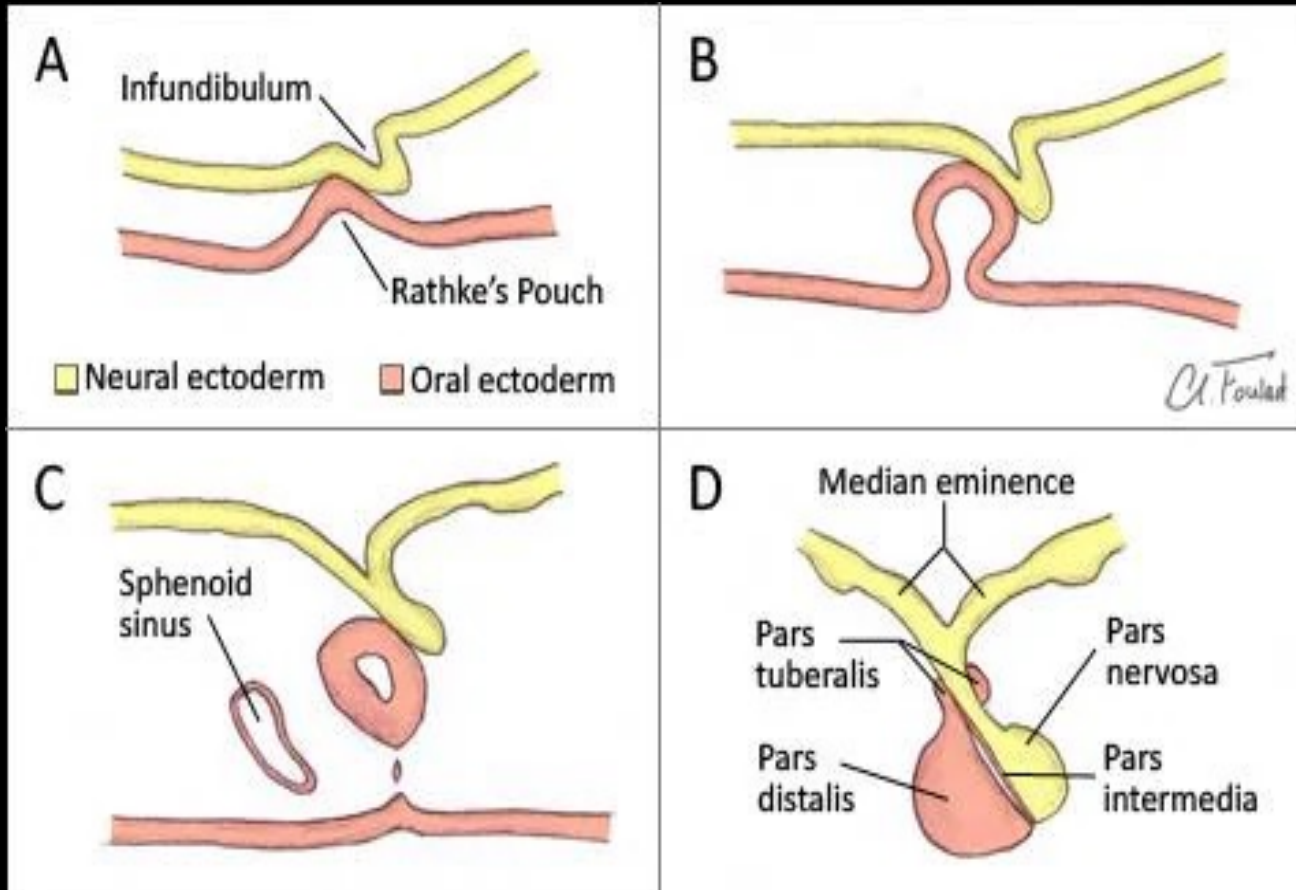
- 38 M
- BMI 45 , Ht 6''7' , Wt 180kg
- DM2, HT, OSA, Migraines
- Bitemporal hemianopia, severe headaches
- s/f Endoscopic endonasal transsphenoidal surgery for removal of a pituitary lesion



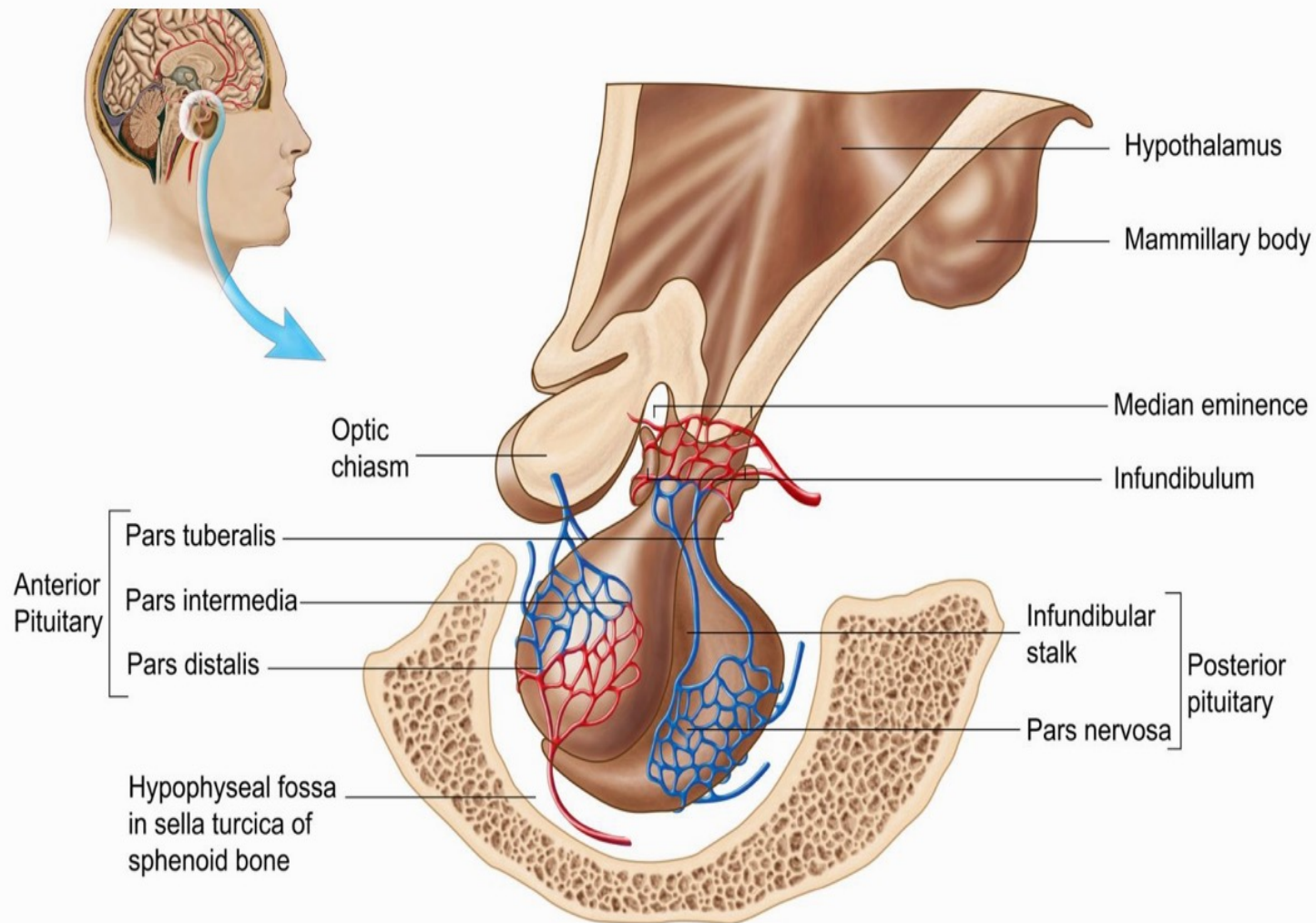
How do you prepare for this case?

- What type of pituitary mass is it? Is this a secreting or non secreting pituitary mass?
- What are the current neurological deficits?
- Look at the imaging
- How do I set up this case?
- Will they be using neuromonitoring?
- What complications should I be prepared for?

Embryology of the Pituitary Gland



- Consists of both neural tissue and mucosal tissue.



Anatomy of the Pituitary Gland

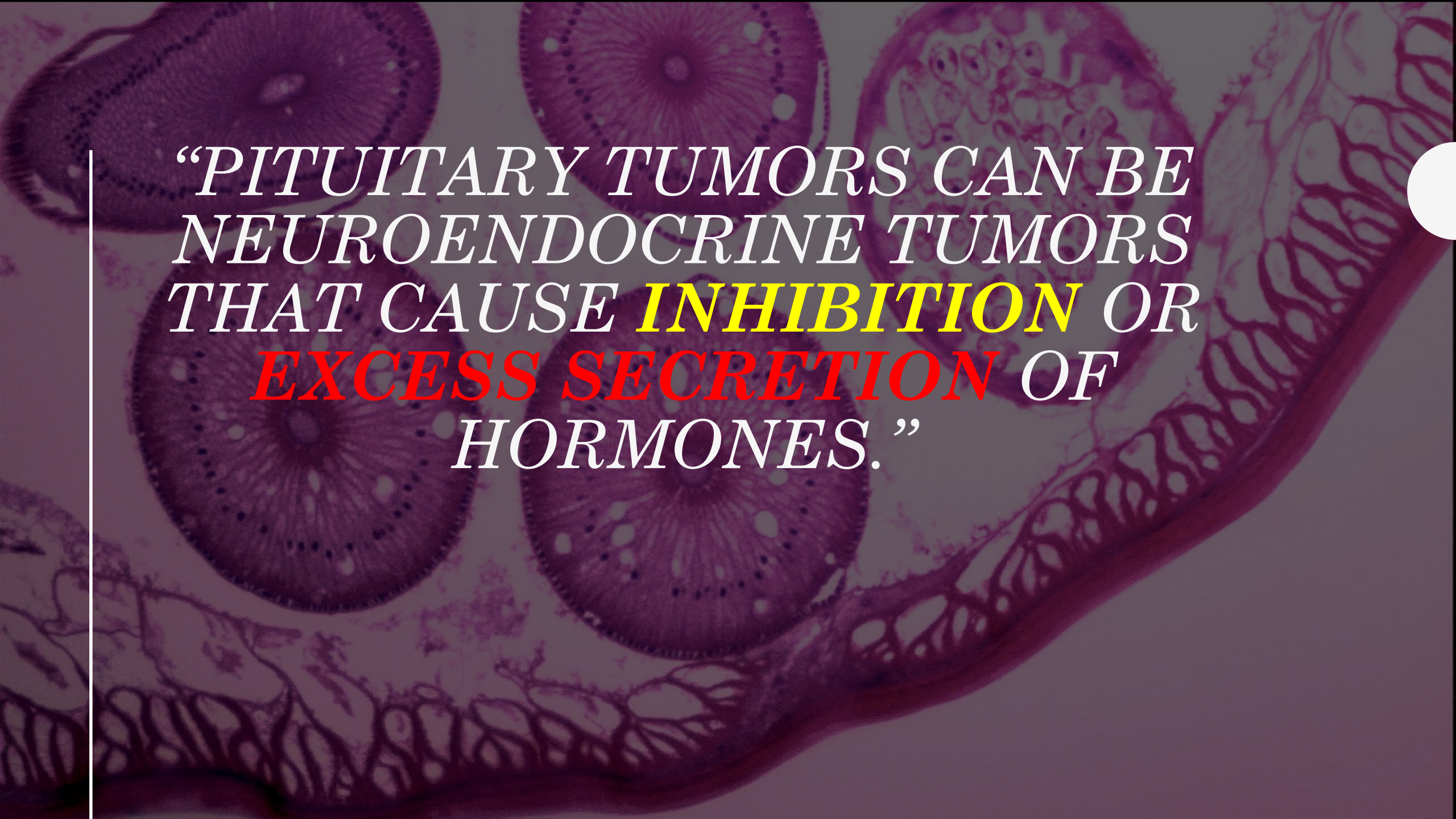
- Pea sized 0.5-1.0 g, <1cm
- Anterior glandular adenohypophysis 80%
- Infundibulum
- Posterior hypophysis
- Hypophyseal portal circulation

TYPES OF PITUITARY MASSES

- PITUITARY ADENOMAS **
- RATHKE'S CLEFT CYSTS*
- SELECTED PARASELLAR MENINGIOMAS*
- CRANIOPHARYNGIOMAS*
- CLIVAL CHORDOMAS*

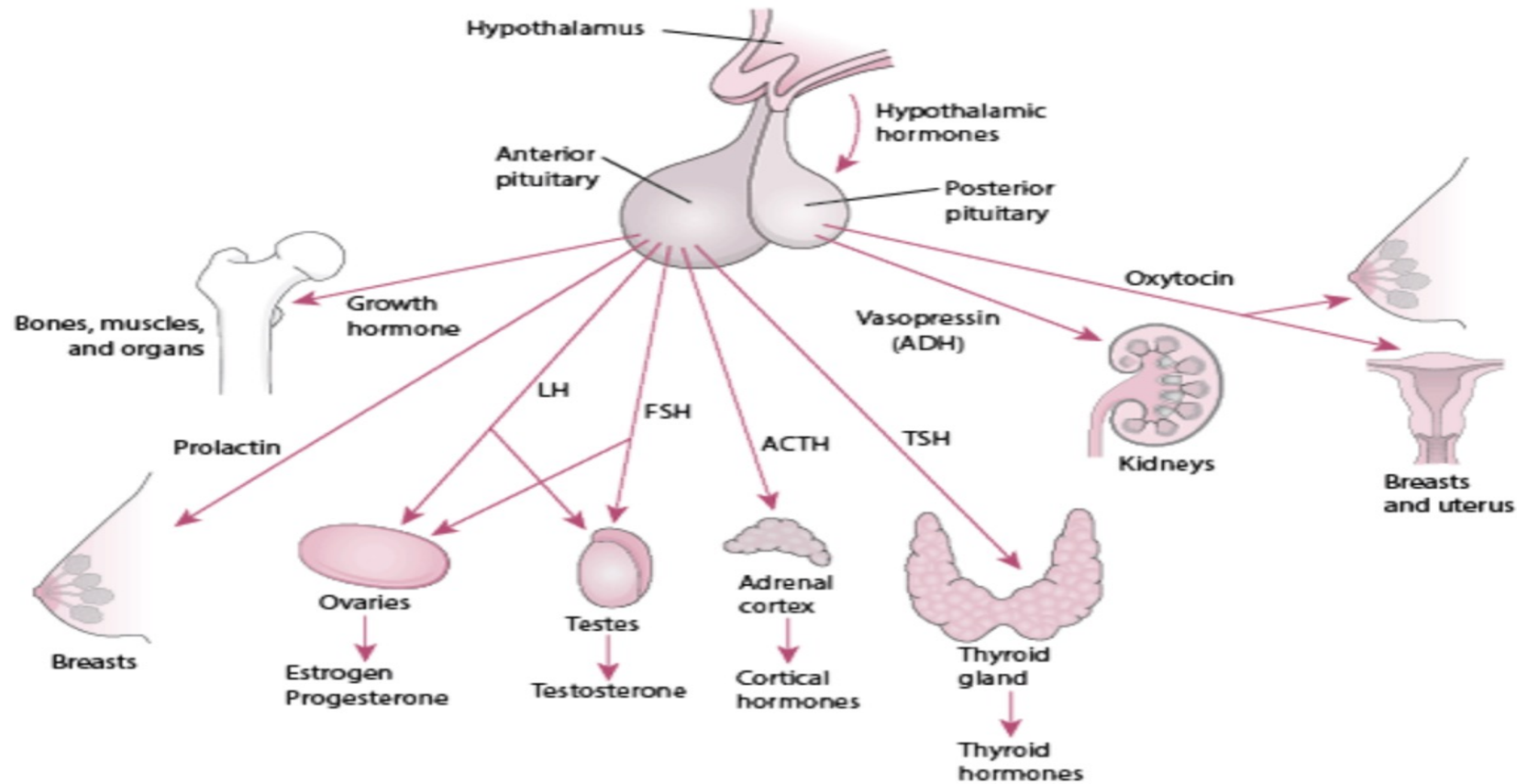
Pituitary Adenomas

- 25% Non-Secretory
 - Function lost in decreasing order FSH/LH→GH, ACTH→TSH
- 75% Secretory
 - Most to least common PRL (50%)→GH (20%)→ACTH (20%)→Mixed (10%)

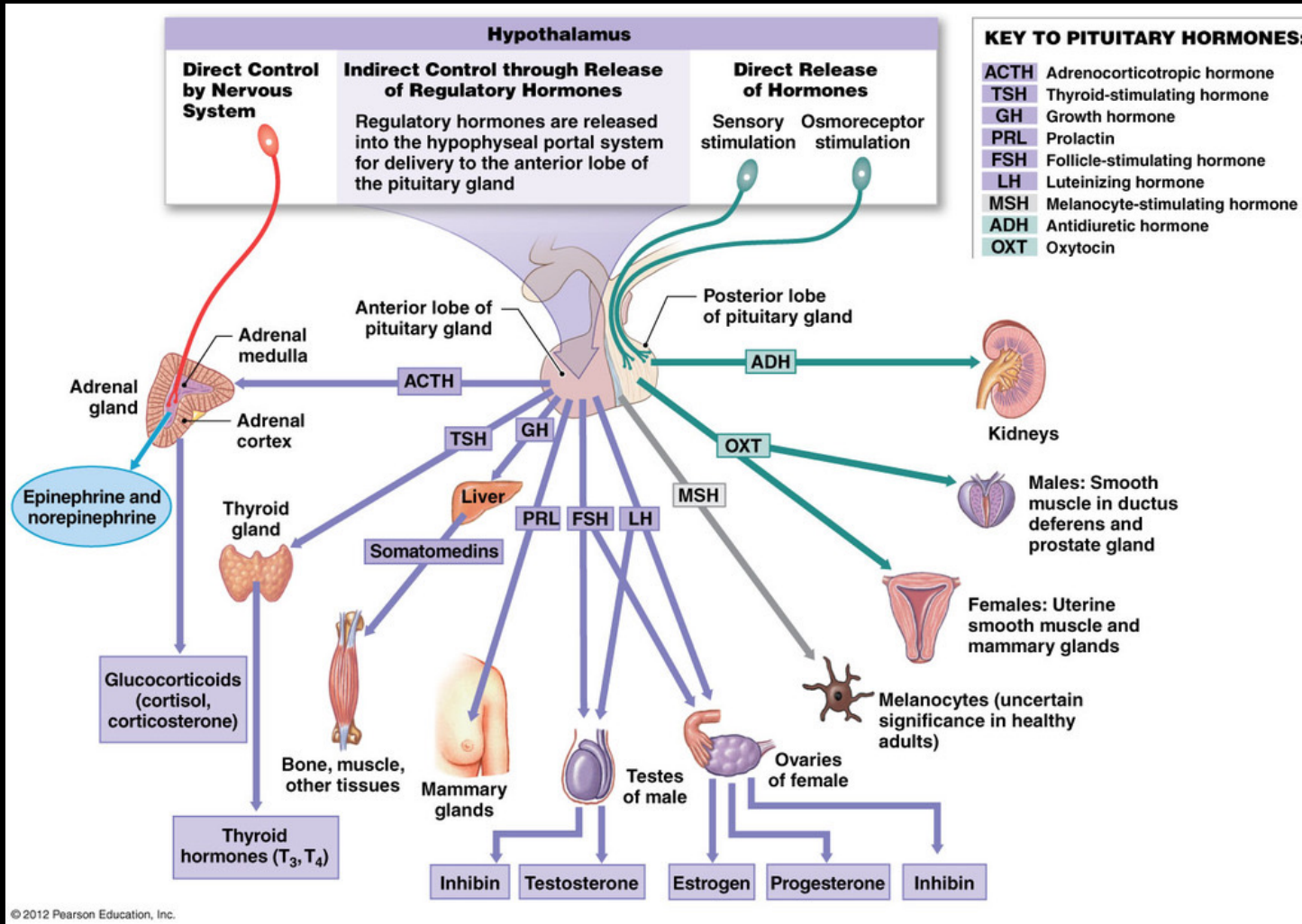


*“PITUITARY TUMORS CAN BE
NEUROENDOCRINE TUMORS
THAT CAUSE **INHIBITION** OR
EXCESS SECRETION OF
HORMONES.”*

The Pituitary and Its Target Organs



Lab Tests



- TSH
- PRL
- FSH, LH
- ACTH
- IGF-1
- Oral Glucose Tolerance Test with GH.

Anesthesia Concerns

Excess Hormone

- Cushing's Disease
(↑ACTH leading to ↑Cortisol)
- Acromegaly
(↑GH leading to ↑IGF-1)

Lack of Hormone

- Hypothyroidism
(↓TSH leading to ↓Thyroxine)
- Central Diabetes insipidus
(↓ADH or vasopressin)

Hormonal Syndromes – Cushing's Disease

- ↑ACTH from anterior pituitary leading to raised cortisol
- Treated with medication, radiation +/-surgery.

Medications

1. Block adrenal synthesis (Ketoconazole)
2. Glucocorticoid Receptor antagonists (Mifepristone)
3. Block ACTH secretion (Dopamine agonists- Bromocriptine)

Cushing Syndrome

Due to excess cortisol-like medication (prednisone) or tumor that produces or results in production of excessive cortisol
[Cases due to a pituitary adenoma = Cushing disease]



Anesthesia Considerations – Cushings Disease

Central obesity

- Buffalo hump and moon facies may increase difficulty with airway management

OSA

- Likely related to obesity, but also with myopathy of airway muscles

Cardiovascular

- Hypertension, dyslipidemia, increased risk of MI, stroke, and thromboembolism
- Preoperative blockade of mineralocorticoid activity with spironolactone may help Rx HTN

Endocrine

- Glucose intolerance

Renal

- Electrolyte abnormalities

Hormonal Syndromes – Acromegaly

- ↑GH from anterior pituitary leading to raised IGF-1
- Treated with medication, radiation +/- surgery.

Medications

1. Dopamine Agonist. (Bromocriptine)
2. Dopamine precursor (L-DOPA)



Figure 1: Cushing maintained an intense interest in pituitary surgery throughout his career. In these rare photos of Cushing with a patient, he demonstrates the features of acromegaly (Courtesy of the Cushing Brain Tumor Registry at Yale University).

Acromegaly & the Difficult Airway

- Mandibular and maxillary enlargement
- Macroglossia
- Prognathism
- Swelling of soft palate and pharyngeal wall
- Thickening of true and false vocal cords
- Vocal cord paresis
- Tracheal compression
- Hypertrophy of epiglottis and peri-epiglottic tissues





Acromegaly & the Difficult Airway

- Reported incidence of difficult intubation varies between 9-40% compared to 2-6% in patients without acromegaly
- Soft tissue changes associated with acromegaly MAY be reversible with medical management
- Bony changes are irreversible; regression of soft tissue changes does not guarantee easier airway management
- Patients without hoarseness or dyspnea and overall favorable airway exam are typically approached in a routine manner
- **If airway difficulties are suspected, it is always prudent to secure the airway by awake techniques**

Anesthesia Considerations - Acromegaly

Cardiovascular

- Hypertension, LV hypertrophy, arrhythmias, cardiomyopathy (depressed EF)
- Preoperative cardiac testing and intraoperative monitoring should be based on preoperative signs and symptoms

Obstructive sleep apnea (OSA)

- OSA occurs in up to 50% of patients with acromegaly
- More sensitive to respiratory depressant effects of sedative and opioids
- Use of CPAP/BPAP post-operatively should be discussed with surgeon
- Positive pressure increases risk of pneumocephalus and meningitis

Diabetes Mellitus

- Occurs in up to 15% of patients with acromegaly

Difficult Access

- Thick skin and connective tissue. Consider having ultrasound available.

LOOK AT MEDICATIONS

Are they on replacement therapy?

Thyroxine

Steroids

Are they on suppressive therapy?

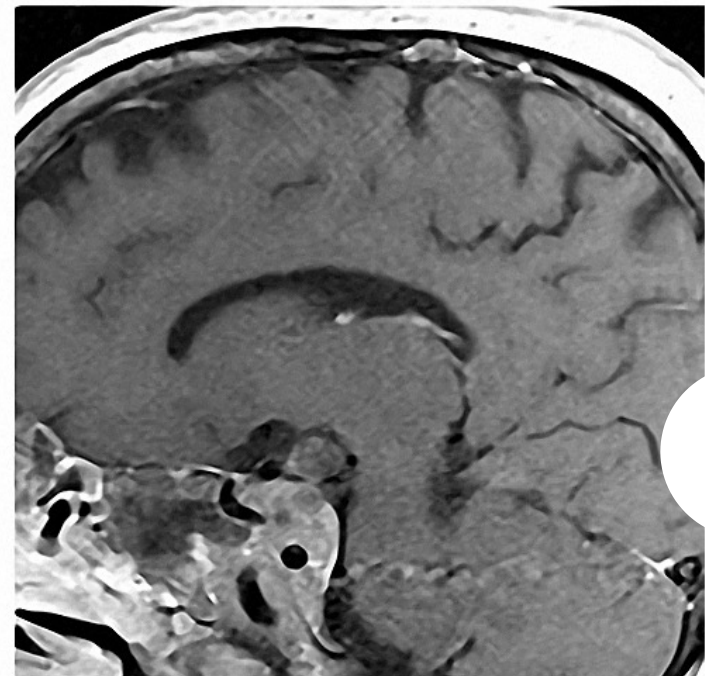
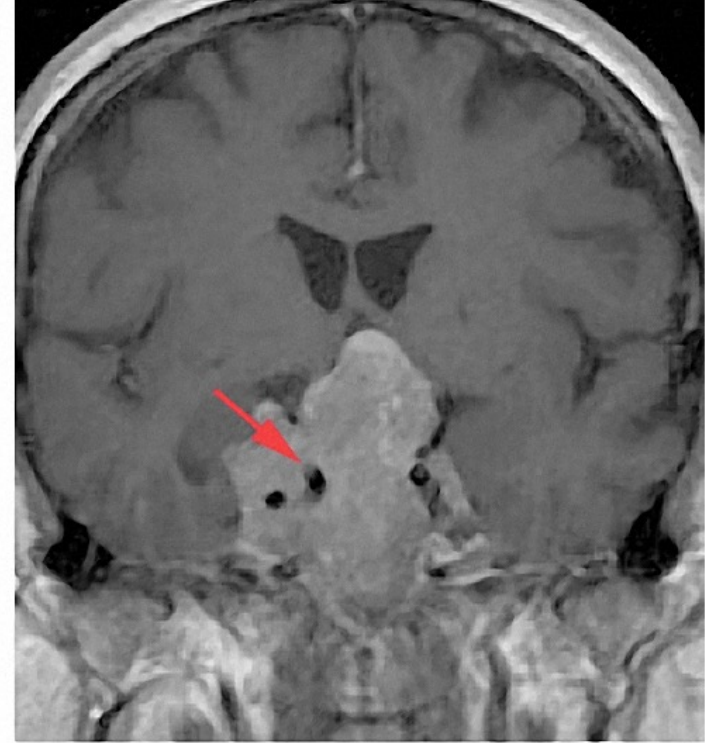
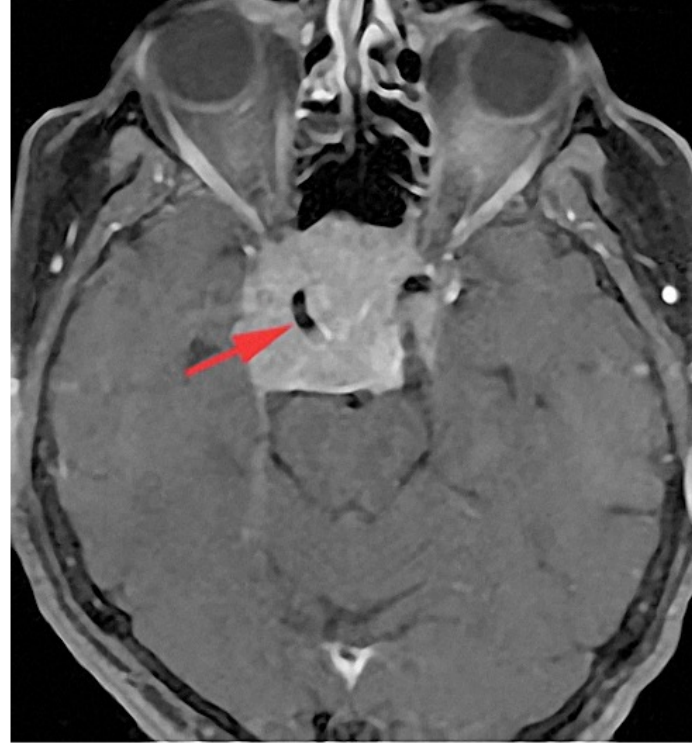
Bromocriptine

Ketoconazole



LOOK AT THE IMAGING

1. *Size?*
2. *Extension past the sella?*
3. *Compression of nearby structures*
4. *Are vascular structures at risk*



Surgical Approaches.

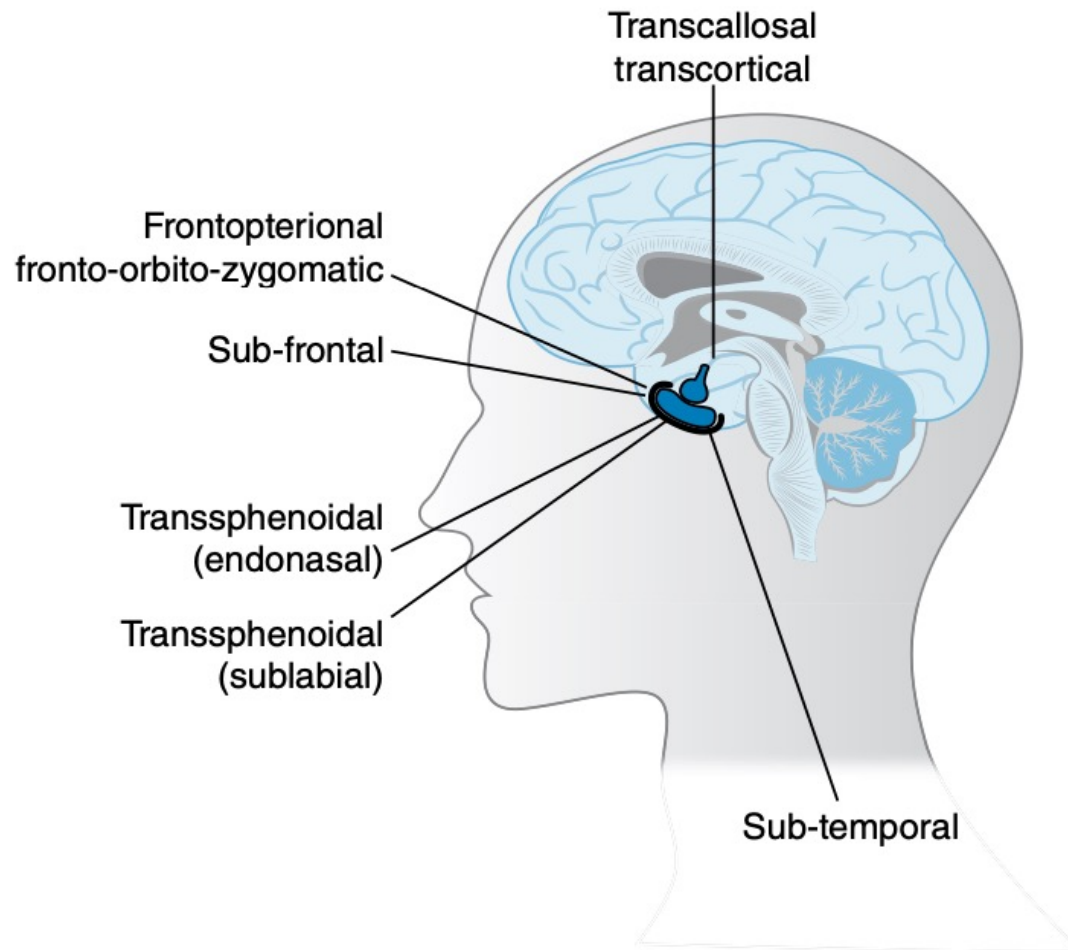
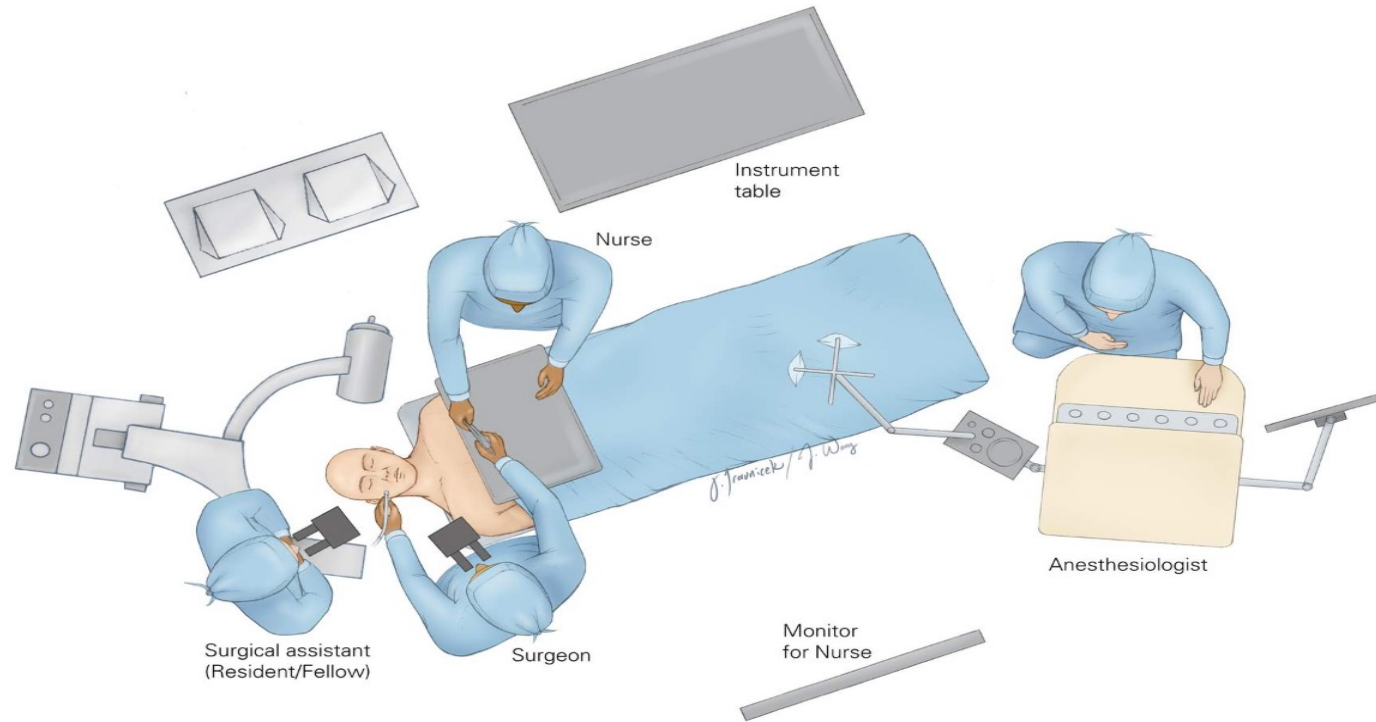


Fig 19.4 Cottrell & Patel
Neuroanesthesia
(inpress). 2023

Endoscopic techniques vs open techniques

- **Endoscopic Endonasal Transsphenoidal**
 - Masses confined to the paramedian sellar and suprasellar territories medial to the carotid arteries and inferior to the subchiasmatic space
 - Vertical growth not a contraindication
- **Sublabial Transsphenoidal**
 - Surgical preferences
- **Open Craniotomy** (Subfrontal, Frontopterional, Transcallosal/Transcortical, Subtemporal)
 - sphenoid sinusitis
 - intrasellar vascular anomalies, ectatic midline carotid arteries,
 - significant lateral suprasellar extension of tumor, especially when the epicenter is lateral to the carotid artery



<https://www.neurosurgicalatlas.com/volumes/cranial-approaches/transnasal-transsphenoidal-approaches/microscope-guided-endonasal-transsphenoidal-approach>

OPERATING ROOM SET UP FOR TRANSSPHEROIDAL ENDOSCOPIC SURGERY

Anesthesia Management

- Standard ASA Monitors
- GETA
- 2x PIV: one in upper extremity, one in lower extremity
- Post-induction arterial line
- Foley Catheter for urine output monitoring (i.e risk of DI) and length of the case. Temperature monitoring if available.
- Type & Screen



Preparation

Anesthesia Management

- **Anxiolytics**
 - Preferable avoid if possible unless extremely high anxiety
 - Caution in patients at risk of respiratory depression
- Discuss with surgeon **Dexamethasone**
 - Can inhibit HPA axis over 24hrs
 - May give a false diagnosis of pituitary insufficiency which some surgeons use as a marker for successful tumor resection.



Preop

Anesthesia Management

- ICP are usually not an issue (slow growing tumor)
- UCSD surgeons prefer **neuromonitoring** so we use TIVA +/- 0.5 MAC, usually no neuromuscular blockade after induction.
- The majority of the surgery is not painful but anticipate **elevated hemodynamics** with nasal injection of LA with Epinephrine, and during the intranasal approach, drilling of the sphenoid bone
- Surgeons may ask for lower BP's to facilitate their view



Intraop



- Taping Methods
 - LEAVE VERMILLION BORDER FREE
 - ETT Midline
 - (Bilateral bite blocks for facial symmetry)
- Patient positioning in low reclined beach chair
- +/- Pins vs headrest



Anesthesia Management

- Oral gastric tube before extubation.
- (Our surgeons don't use a throat pack)
- Important to remind surgeons to let you know approximate time to surgical completion – no closure just packing the nose with fat.



Emergence

Anesthesia Management

- **Smooth emergence.**

- AVOID COUGHING, VOMITING, STRAINING
- AVOID HYPERTENSION



- ↑CVP can increase bleeding
- ↑ICP can exacerbate CSF leak
- Coughing and bucking can force nasopharyngeal flora into the wound leading to meningitis

Anesthesia Management

- **AVOID POSITIVE
PRESSURE VENTILATION
POST EXTUBATION!!!.**





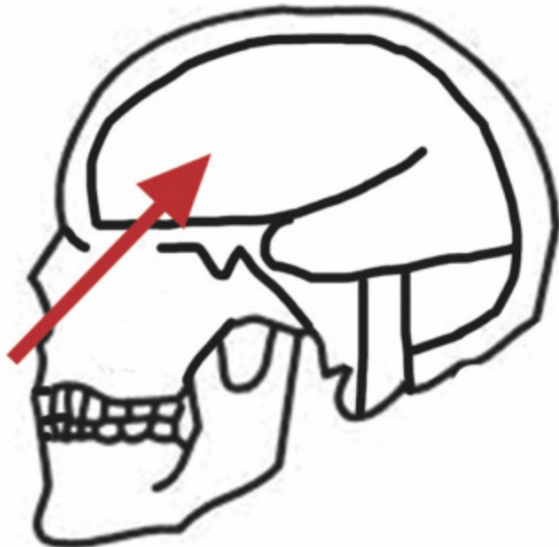
Case Report

Tension Pneumocephalus from Positive Pressure Ventilation Following Endoscopic Skull Base Surgery: Case Series and an Institutional Protocol for the Management of Postoperative Respiratory Distress

Mendel Castle-Kirsbaum¹, Yi Yuen Wang², James King³, Brent Uren⁴, Martin Kim⁵,
R. Andrew Danks^{1,6}, Tony Goldschlager^{1,6}

AVOID

Bag Mask Ventilation



- Background: Tension pneumocephalus (TP) is a rare but feared complication of endoscopic endonasal skull base surgery. In contrast to simple pneumocephalus, which is common after endoscopic transnasal approaches and managed conservatively, TP represents a neurosurgical emergency and mandates urgent decompression.
- Case description: Here we present 2 cases of TP as a consequence of positive pressure ventilation following endoscopic endonasal skull base surgery. Both occurred during resuscitation for postoperative hypoxia. These cases prompted the development of an institution-wide protocol to identify and manage patients at risk of TP after extended skull base approaches.
- Conclusions: To our knowledge, these are the only such cases of postoperative TP following positive pressure ventilation in the literature.



Asystole, Bradycardia

CSF Leak, Meningitis

Adrenal suppression, Panhypopituitarism

Bleeding (extracranial/intracranial) - arterial and cavernous sinus bleeding

Pneumocephalus

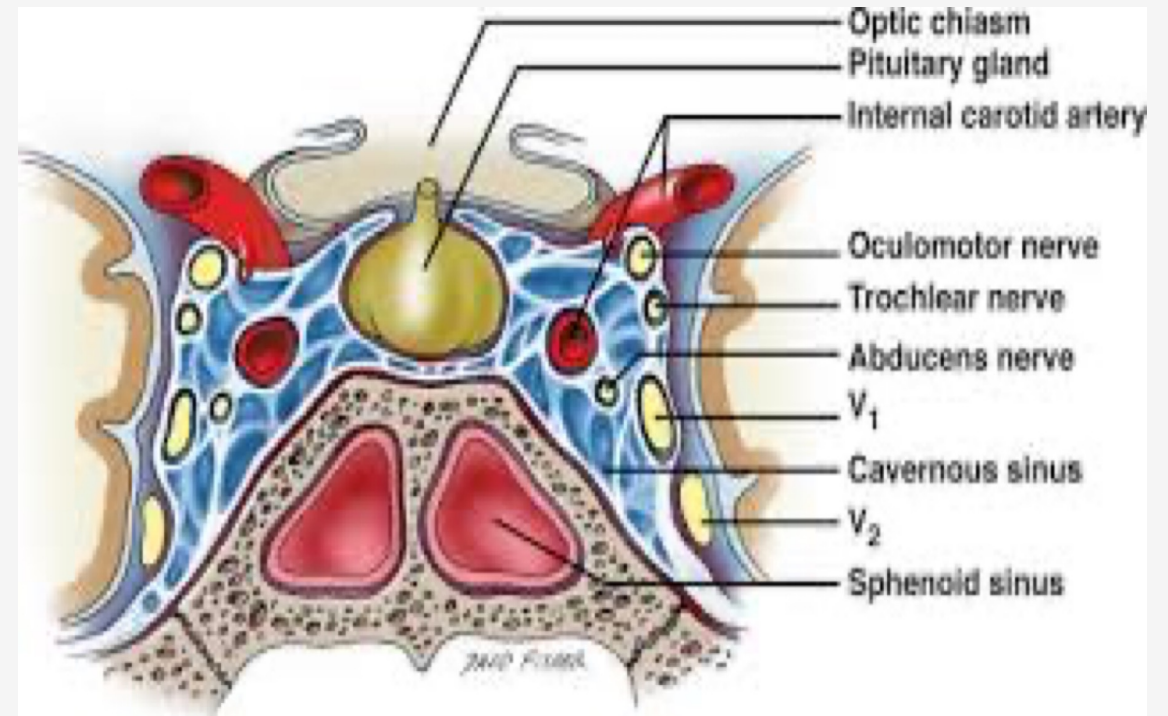
ICA occlusions and nerve compression of CN 3, 4, 5, 6 with nasal packing

Aspiration

Vision loss

Diabetes insipidus

SIADH



Complications

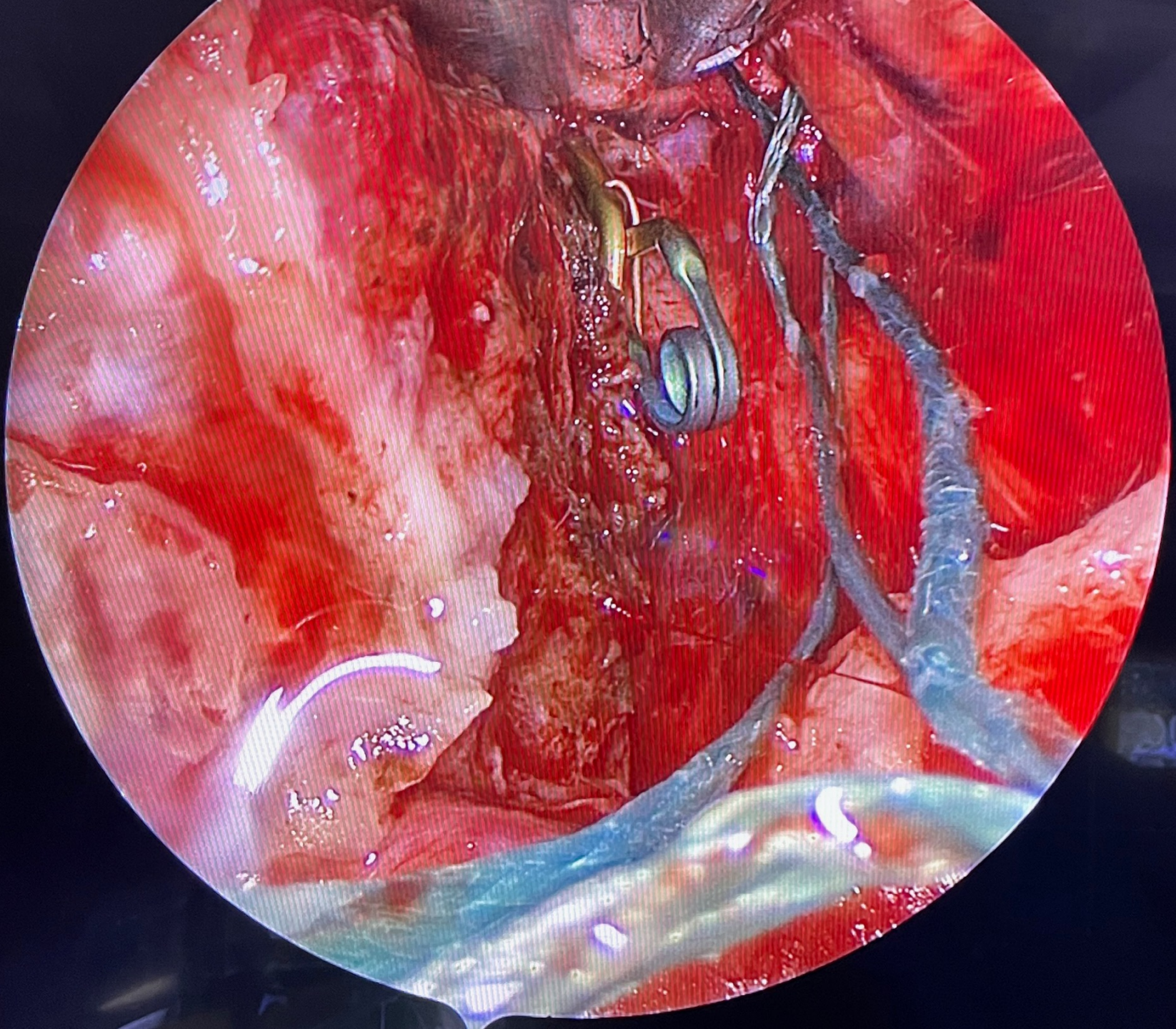


Table 19.2. Differential Diagnosis of, Diabetes Insipidus, Syndrome of Inappropriate Antidiuretic Hormone and Cerebral Salt Wasting.

	DI	SIADH	CSW
Volume status	hypovolemia	normo- or hypervolemia	hypovolemia
Urine output	increased	low to normal	increased
Serum sodium	increased	decreased	decreased
Urine Sodium	decreased	increased	increased
Serum osmolality	increased	decreased	decreased
Urine osmolality	decreased	increased	increased

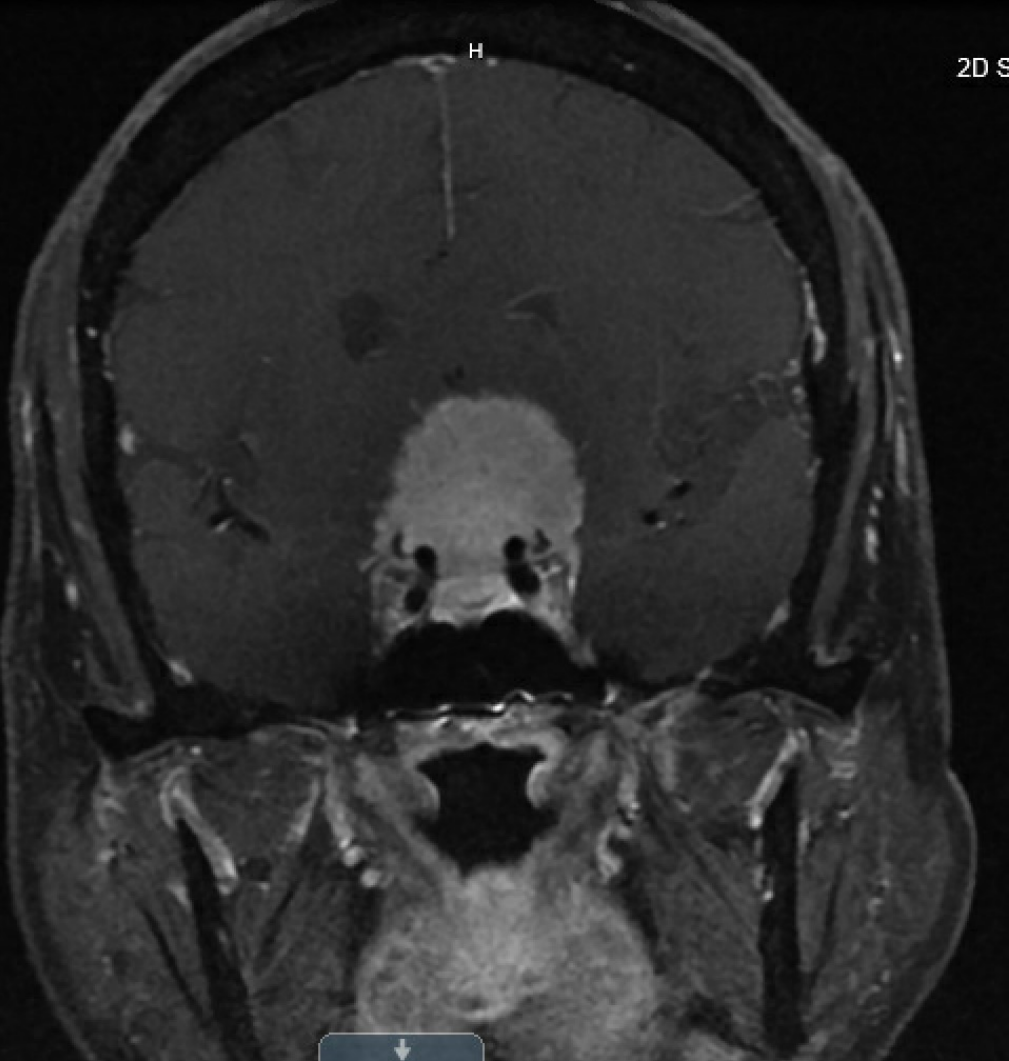
Table 19.2.

Differential Diagnosis of Diabetes Insipidus (DI), Syndrome of Inappropriate Antidiuretic Hormone (SIADH) and Cerebral Salt Wasting (CSW).

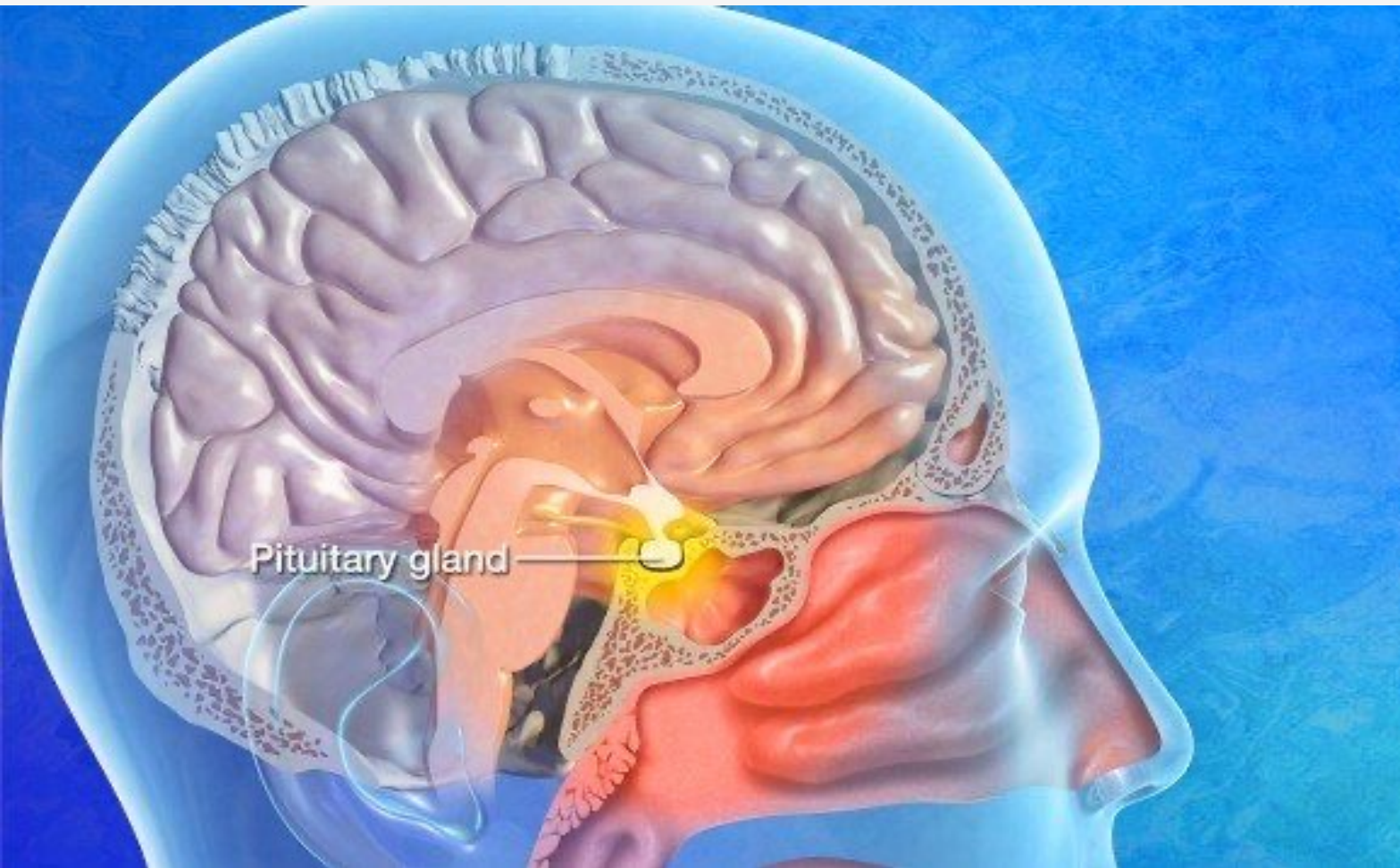
Diabetes insipidus

- Dilute polyuria of central DI is caused by diminished or absent antidiuretic hormone (ADH) synthesis and/or release
- Causes: Direct hypothalamic injury, pituitary stalk edema, high pituitary stalk dissection
- Symptoms: polydipsia (if awake), polyuria, high serum osmolarity
- DDx: Diuresis from mannitol, hyperglycemia, excessive fluid administration
- Dx: Urine specific gravity <1.002
- Management: Increased oral intake (if awake), IV fluids (2/3 previous hour urine output plus maintenance), DDAVP 1-2 ug IV or subQ every 6-12 hours if urine output excessive





Your Case.....



- 48 M
- BMI , Ht 6''7' , Wt 150kg
- DM2, HT, OSA, Migraines
- Bitemporal hemianopia, severe headaches
- s/f Endoscopic endonasal surgery



Take home points?

- Investigate type of mass. Is it secretory or not? Do I need to plan for endocrine effects.
- What are the current neurological deficits?
- Look at the imaging
- Ask if neuromonitoring is involved.
- Do I need to plan for a difficult airway
- Quick finish with smooth emergence avoiding PPV.

References

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