58 y/o F with fluid and electrolyte imbalance post trans-sphenoidal surgery

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Disclosures:

I do not have any relevant financial relationships with any commercial interests.

HPI

58 year old female presents to OSH with nausea, vomiting and abdominal pain for past 1 week

- Found to have renal stones on CT abdomen pelvis at OSH and transferred here
- Discharged 8 days ago from UCMC after a trans-sphenoidal hypophysectomy for recurrent pituitary cyst
- Poor oral intake since discharge, family states she is ‘not herself’

March 2016

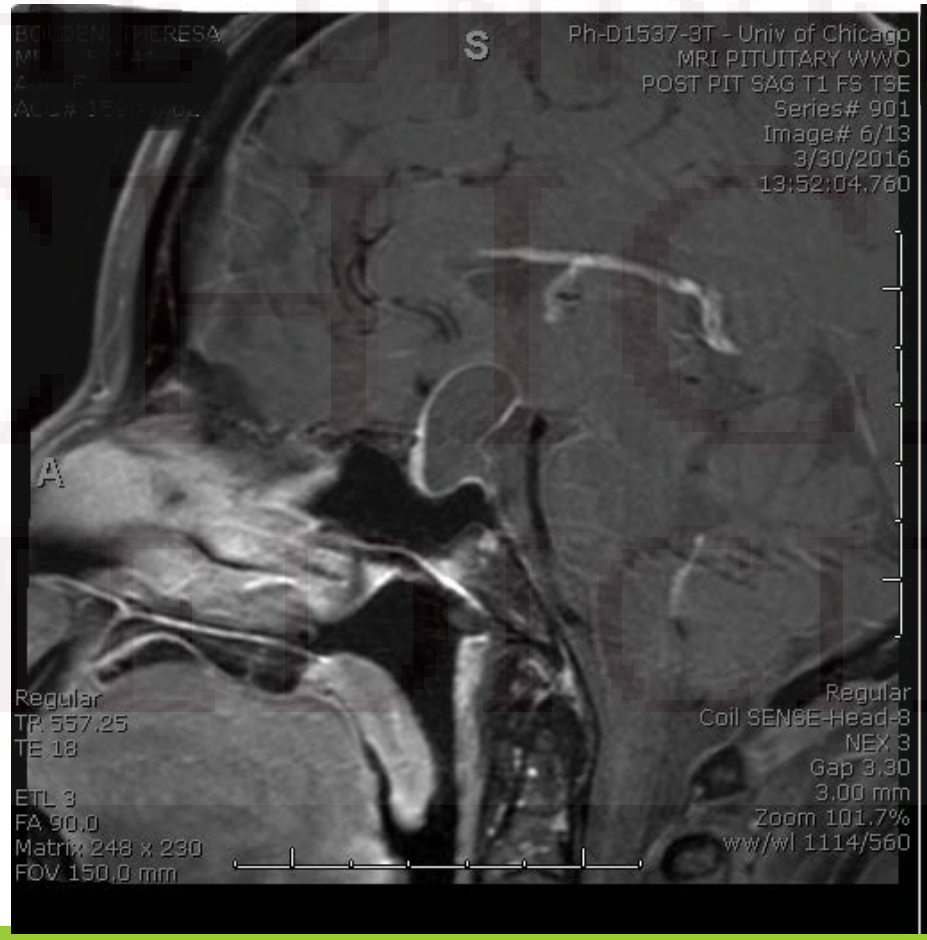
- She was referred to neurosurgery for progressive loss of peripheral vision
- Ophthalmic evaluation: bitemporal hemianopsia, worse right sided hemianopsia
- MRI Brain: 2.4 cm sellar, suprasellar cystic lesion compressing the optic chiasm
- Endocrine Labs: Non secretory pituitary lesion

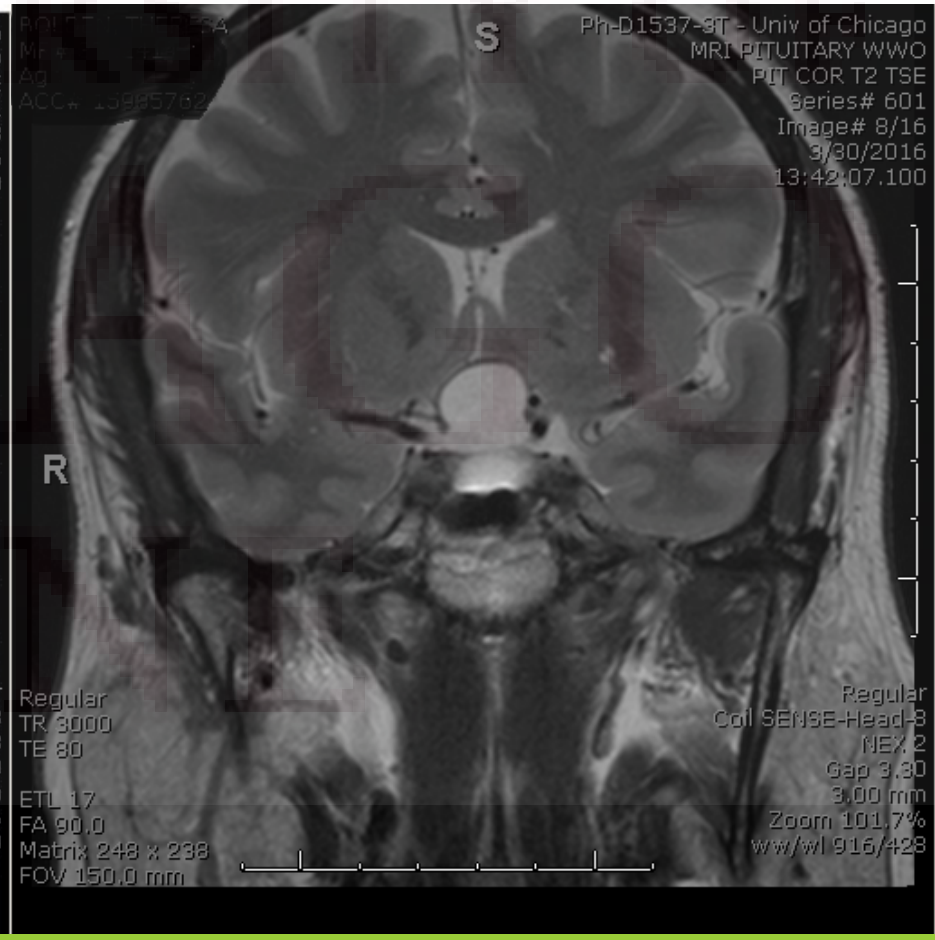
MRI Brain (March 2016)

….mildly expanded sella turcica with extension into the suprasellar cistern 24 mm x 16 mm x 16 mm …

…marked mass effect upon the optic chiasm and adjacent portions of the bilateral optic nerves…

The pituitary gland is markedly stretched and mainly displaced anteriorly and superiorly along with the infundibulum…





April 2016

- Transsphenoidal hypophysectomy for decompression of the cyst
- Pathology: Fragment of collagenous tissue consistent with part of a cyst wall
- Post op: no immediate complications except minor post op bleeding

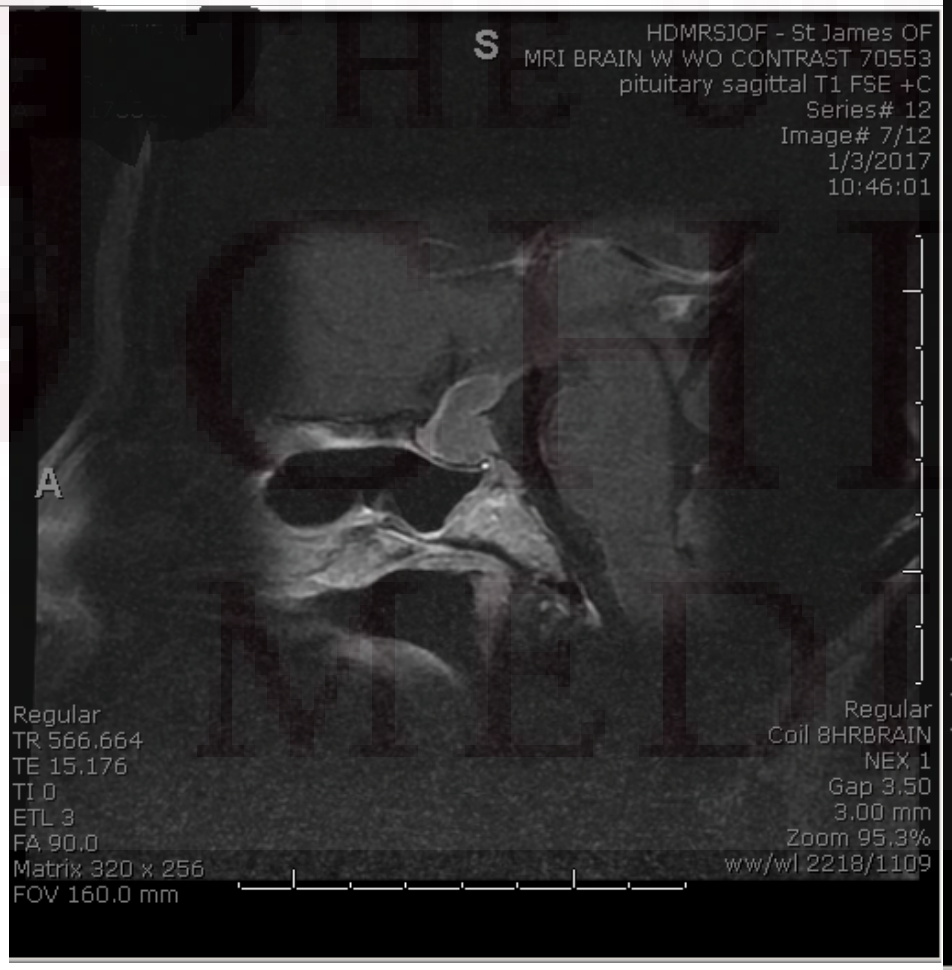
Feb 2017

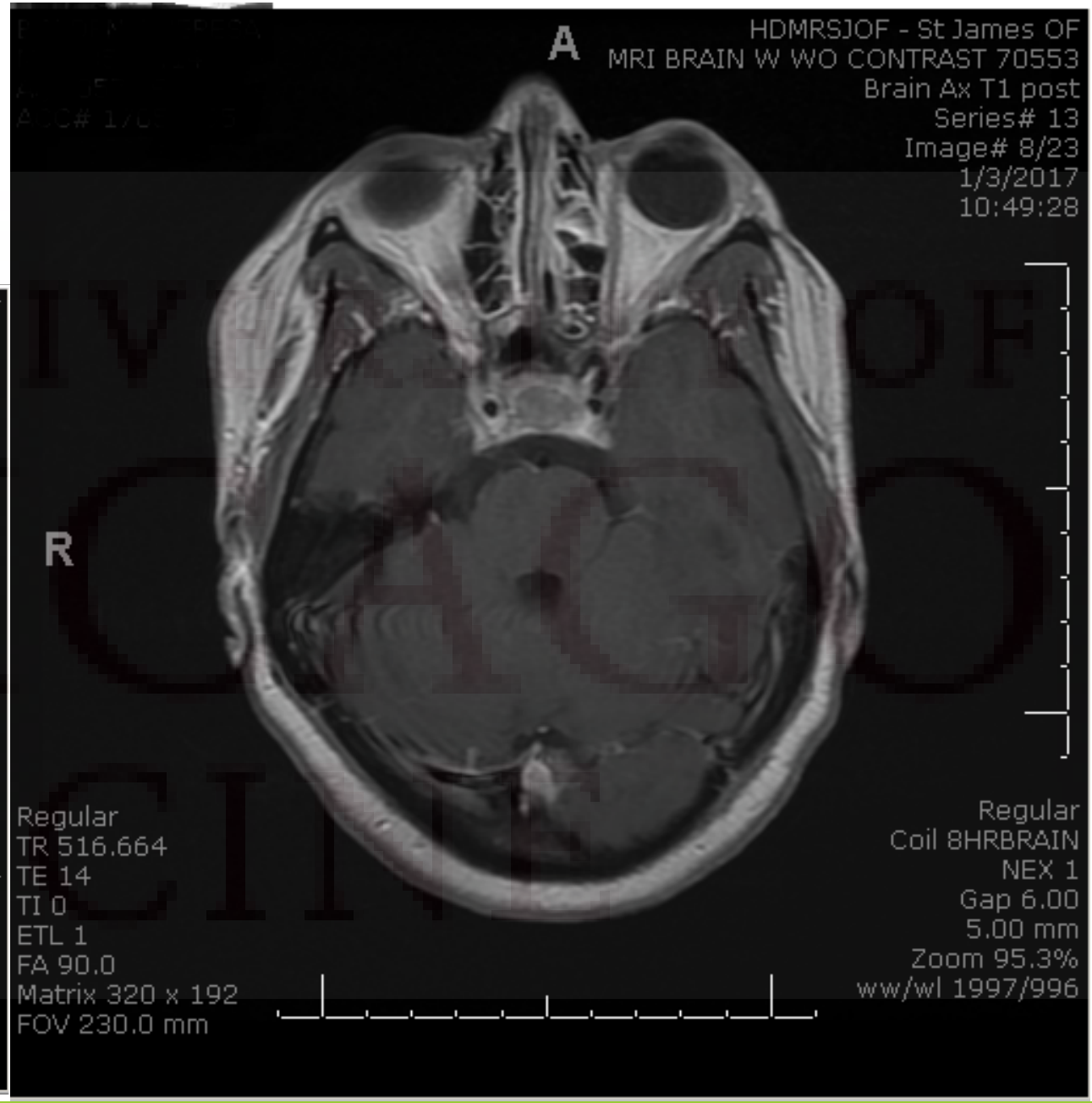
- MRI brain: (Done at OSH)
- Increase in size of sellar/ supra sellar cyst
- Suggested formal ophthalmic evaluation: pt felt vision was stable then

June 2017

- Formal ophthalmic evaluation revealed increase in scotoma size, patient felt the vision had slightly worsened
- Decision to re operate after discussion with tumor board

MRI Brain (Feb 17)





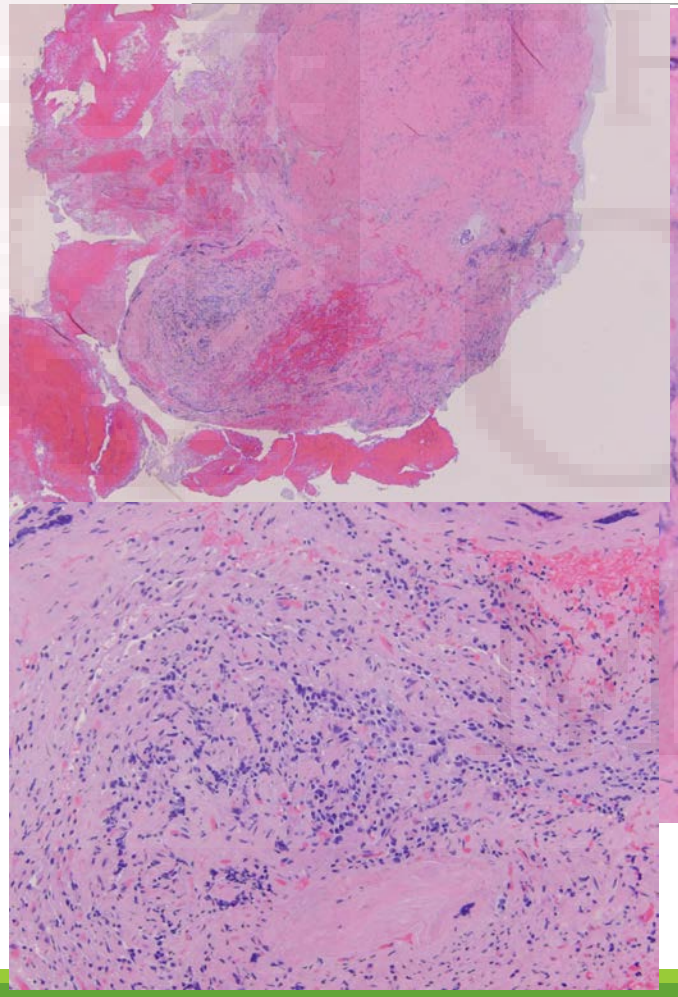
Oct 31st 2017

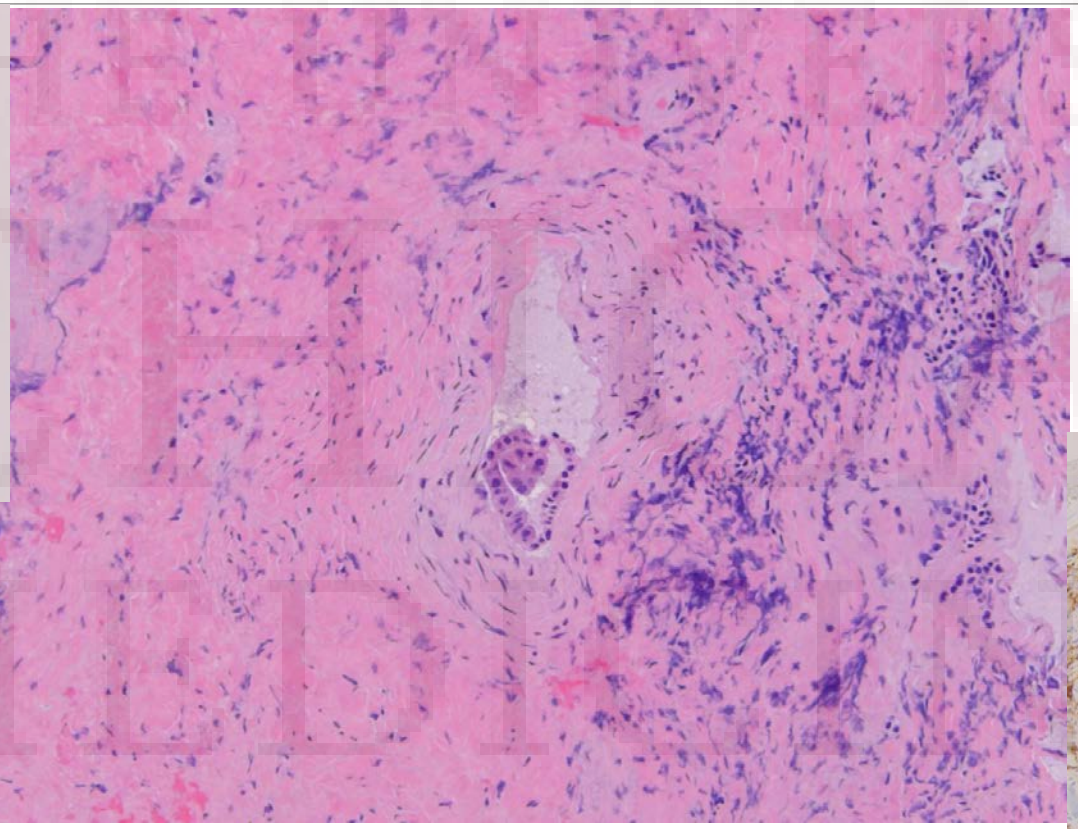
Trans-sphenoidal hypophysectomy for re- decompression and marsupialization of sella

Complications:
CSF leak present, packed with surgicel and merogel

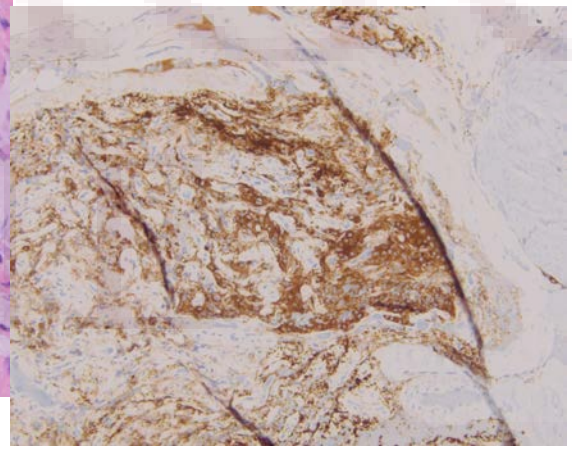
CT head post op: There is intracranial air present including intraventricular air and a small amount of blood in the third ventricle.

Pathology





Rathke’s cleft cyst

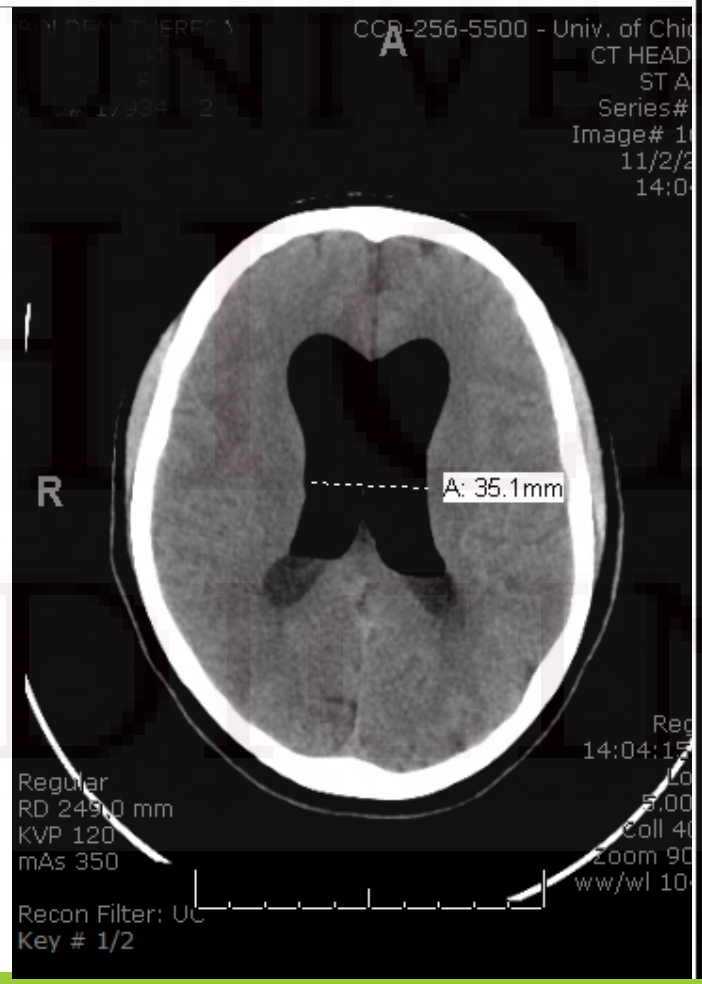


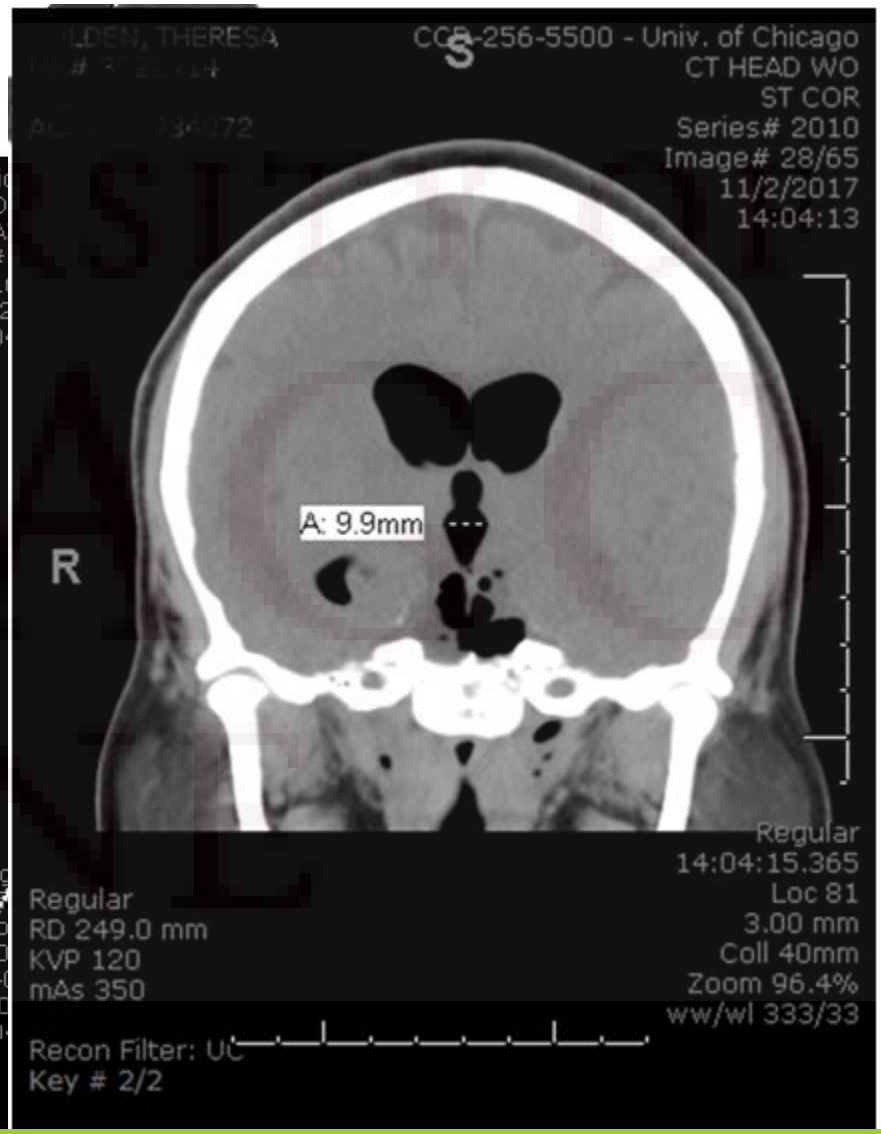
Nov 2nd

Patient was noticed to be progressively lethargic throughout the day, not oriented to the president or daughter's job

CT head ordered emergently

… prolapse of the fat graft from the sella into the sphenoid sinuses, as well as increased pneumocephalus and dilatation of the cerebral aqueduct and lateral ventricles…





Nov 2nd:

Taken emergently to OR

Endoscopic repair of the sella CSF leak using abdominal fat

Nov 3rd :

Increased Urine output with specific gravity 1.003. Up trending Na 145> 153> 157 . Urine output 6075

Dx: DI; treated with DDAVP (sporadic doses, almost 2 doses last on Nov 5th)

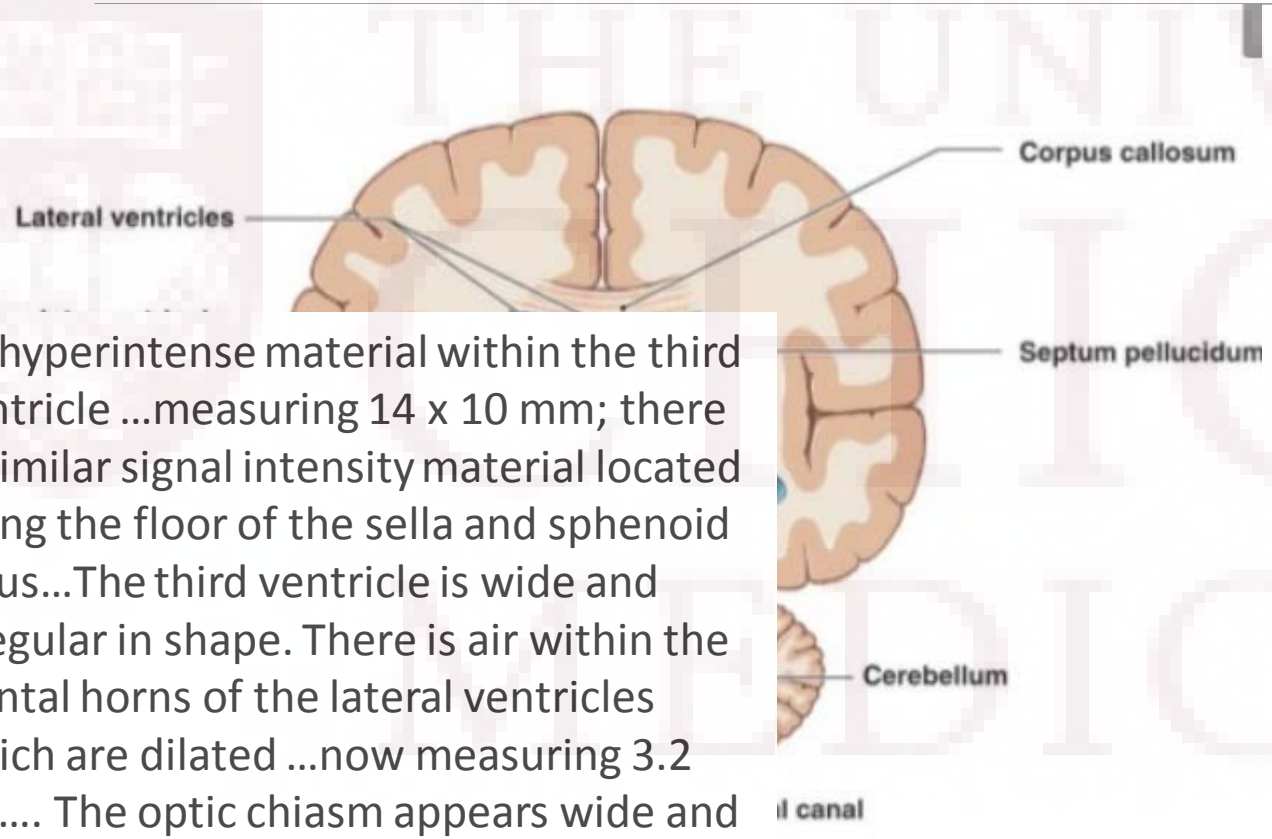
Mental status improved

Nov 5th :

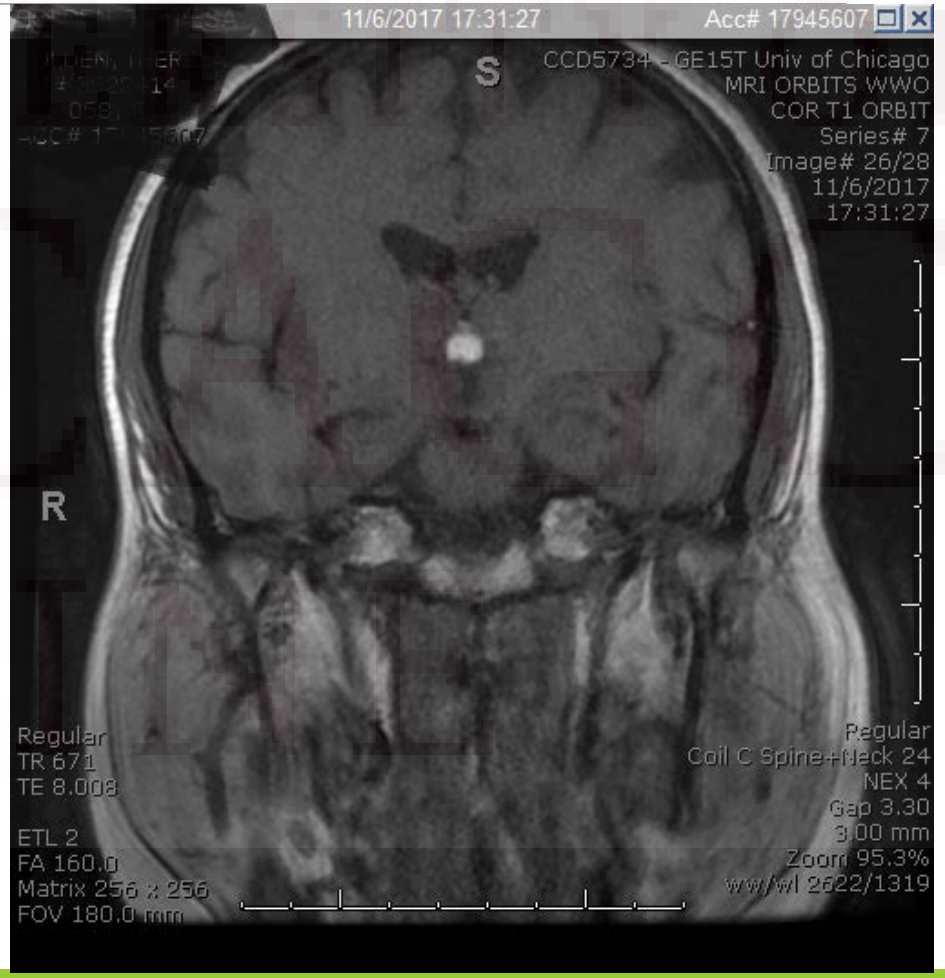
Pt complained of film over right eye, loss of peripheral vision both eyes, double vision, lethargy

MRI pit with orbits

MRI pituitary & orbits: Nov 6th



T1 hyperintense material within the third ventricle …measuring 14 x 10 mm; there is similar signal intensity material located along the floor of the sella and sphenoid sinus…The third ventricle is wide and irregular in shape. There is air within the frontal horns of the lateral ventricles which are dilated …now measuring 3.2 cm…. The optic chiasm appears wide and flattened and the left optic tract appears atrophic.



Post op course

Sodium levels were stable off DDAVP for several days

Attempting to transfer to inpatient rehab – not covered by insurance

Discharged home with outpatient PT on Nov 11th

Presented with current complaints on Nov 18th

PMH:

- Asthma
- Prediabetes
- HTN

Social Hx:

Works as a nurse , non smoker, no alcohol. Live alone but children nearby and supportive

MEDICATIONS:

1. Triamterene-hydrochlorothiazide (MAXZIDE) 37.5-25 mg Oral tab
2. Simvastatin (ZOCOR) 20 mg Oral tablet
3. Montelukast (SINGULAIR) 10 mg Oral tablet
4. Hydrocodone-acetaminophen (NORCO) 5-325 mg Oral tablet 1-2 Tabs route every 4 hours as needed (pain).
5. Ibuprofen 800 mg by Oral route.

ROS

Limited by illness
Pertinent : blurry vision abdominal pain, nausea, vomiting, weakness, film over her R eye, double vision , and loss of peripheral vision in both eyes, slow cognition

Physical Exam

Vitals BP 117/63 Pulse 88 Temp 36.9 °C (98.4 °F) Resp 18 SpO2 99% RA
Weight 76.7 kg (169 lb) **BMI** 30.9 kg/m2
Physical Exam:
Constitutional: **lethargic, slow, in distress**
HEENT: EOMI, oropharynx clear, **loss of peripheral visual fields by confrontation**
Neck: supple, no thyromegaly
Cardiovascular: **regular rate and rhythm**, nl S1/S2
Pulmonary/Chest: good respiratory effort, clear to auscultation bilaterally
Abdomen: soft, non-tender, non distended **? CVA tenderness**
Extremities: no edema
Neurological: **slow but able to understand all questions and answer appropriately , oriented to place, person , bilateral + brachioradialis reflex**
Skin: **warm, dry**
Psychiatric: **not agitated, speaking slowly**

Labs

CBC:
WBC 12.4 (H)
RBC 4.24
Hemoglobin 12.1
Hematocrit 35.8 (L)
Platelet Count 189

Urine osmolality: 168
Urine Na: 46
Urine Cr: 71, Uurea 107, FeUrea 39.07
Urine Sp gravity: 1.006
UA: blood 1+, Protein 1+, Ketones trace, PH 5, WBC 5-10

Chemistries:
Sodium 127 (L)
Potassium 4.0
Chloride 86 (L)
Carbon Dioxide 18(L)
BUN 27 (H)
Creatinine 7.3 (H)
Glucose, 105
Calcium 8.6
GFR Estimate 6(L)
Total Protein 7.1
Albumin 3.7

Plasma osm: 274

Thyroxine, Free: 0.67 (L)

Thyrotropin: 0.18 (L)

Triiodothyronine: 50 (L)

Reverse Triiodothyronine :408 (N)

15:23
Cortisol: 8.0

Prolactin: 85.84 (H)
ACTH: 3.1

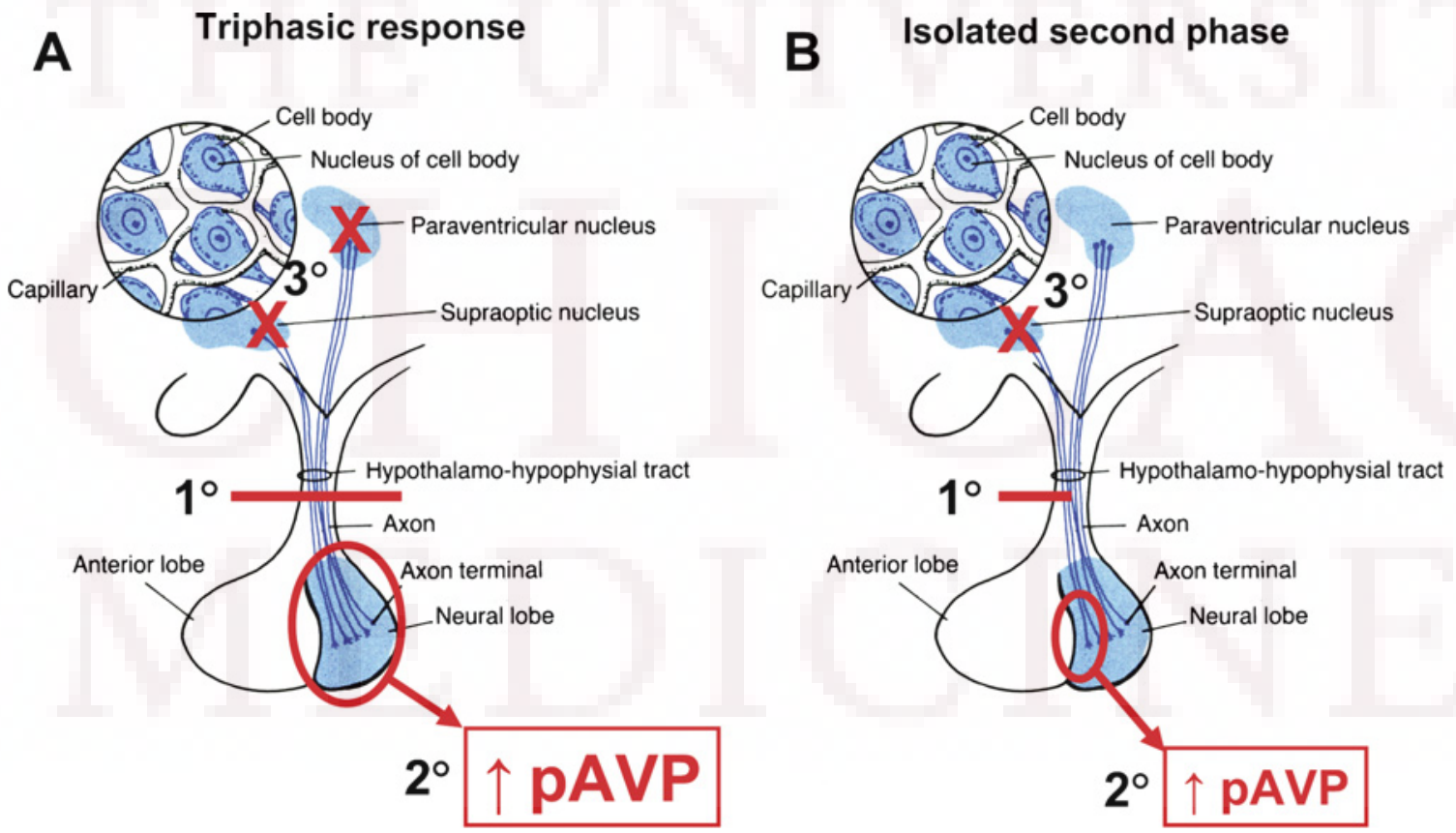
Imaging

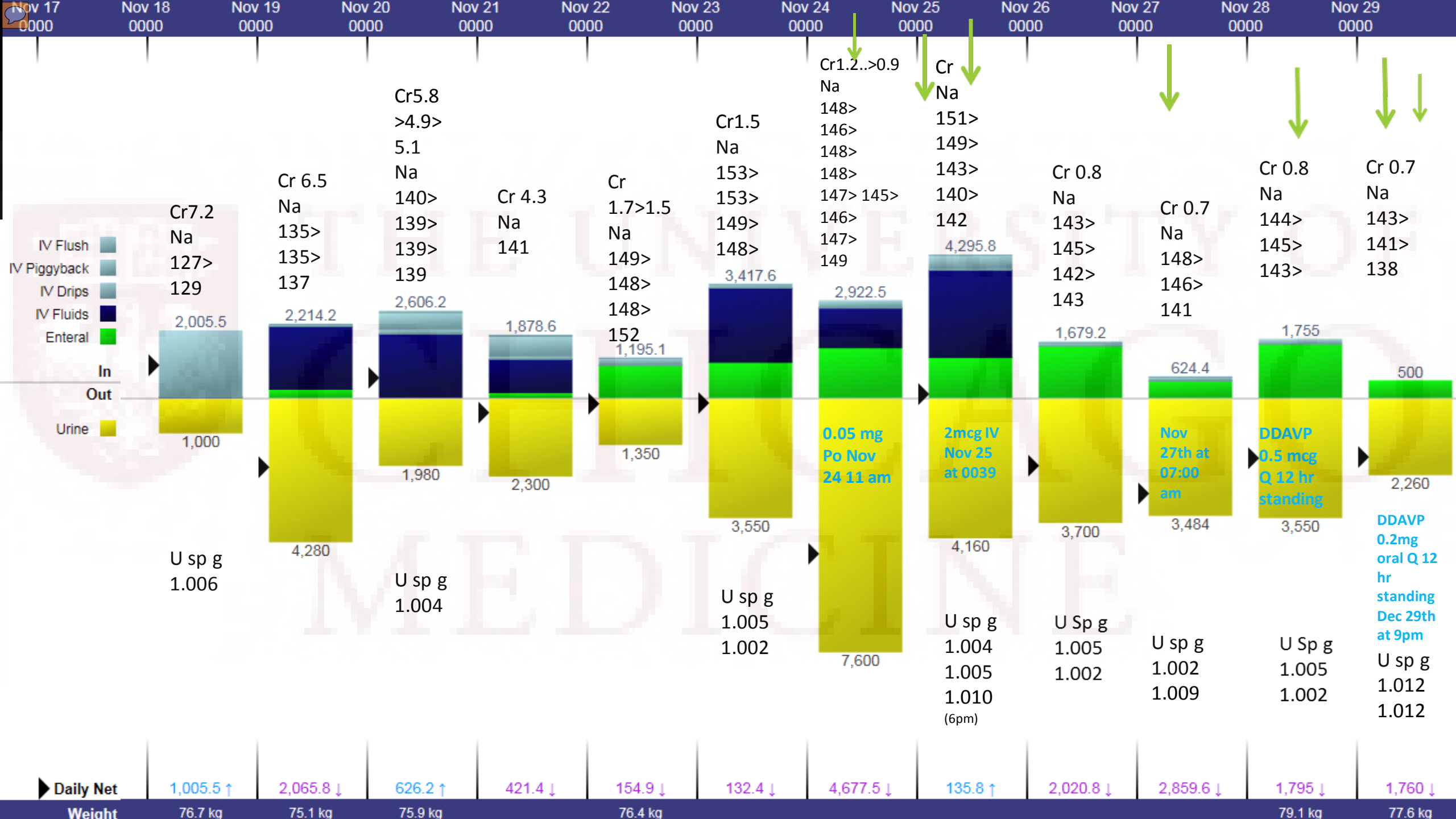
Renal US:

Bilateral nonobstructing nephrolithiasis suggested. No hydronephrosis. Increase dcortical echogenicity with findings compatible with medical renal disease.

Echogenic liver, likely reflecting underlying hepatic steatosis/parenchymal dysfunction.

Triple phase response




Nov 17 0000
Nov 18 0000
Nov 19 0000
Nov 20 0000
Nov 21 0000
Nov 22 0000
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Nov 24 0000
Nov 25 0000
Nov 26 0000
Nov 27 0000
Nov 28 0000
Nov 29 0000
IV Flush
IV Piggyback
IV Drips
IV Fluids
Enteral
In
Out
Urine
Cr7.2
Na
127>
129
2,005.5
1,000
U sp g
1.006
Cr 6.5
Na
135>
135>
137
2,214.2
4,280
Cr5.8
>4.9>
5.1
Na
140>
139>
139>
139
2,606.2
1,980
U sp g
1.004
Cr 4.3
Na
141
1,878.6
2,300
Cr
1.7>1.5
Na
149>
148>
148>
152
1,195.1
1,350
Cr1.5
Na
153>
153>
149>
148>
3,417.6
3,550
U sp g
1.005
1.002
Cr1.2..>0.9
Na
148>
146>
148>
148>
147> 145>
146>
147>
149
2,922.5
7,600
0.05 mg Po Nov 24 11 am
Cr
Na
151>
149>
143>
140>
142
4,295.8
4,160
2mcg IV Nov 25 at 0039
U sp g
1.004
1.005
1.010
(6pm)
Cr 0.8
Na
143>
145>
142>
143
1,679.2
3,700
U Sp g
1.005
1.002
Cr 0.7
Na
148>
146>
141
624.4
3,484
Nov 27th at 07:00 am
U sp g
1.002
1.009
Cr 0.8
Na
144>
145>
143>
1,755
3,550
DDAVP 0.5 mcg Q 12 hr standing
U Sp g
1.005
1.002
Cr 0.7
Na
143>
141>
138
500
2,260
DDAVP 0.2mg oral Q 12 hr standing Dec 29th at 9pm
U sp g
1.012
1.012
Daily Net
1,005.5 ↑
2,065.8 ↓
626.2 ↑
421.4 ↓
154.9 ↓
132.4 ↓
4,677.5 ↓
135.8 ↑
2,020.8 ↓
2,859.6 ↓
1,795 ↓
1,760 ↓
Weight
76.7 kg
75.1 kg
75.9 kg
76.4 kg
79.1 kg
77.6 kg

Hospital course

Patient encouraged to take oral fluid intake

Placed her initially prn doses of DDVAP and once she was more stable standing dose of DDVAP 0.5mcg IV Q 12 hr, 9 am 9pm and later to oral DDAVP

Strict I/Os

Daily weights

Frequent surveillance Na checks

Hydrocortisone 20/10 mg

Levothyroxine 25mcg> 75 mcg oral daily

Osmoreceptor dysfunction

Primary osmoreceptors located in anterior hypothalamus

Lesions of this region in animals cause hyperosmolality through impaired thirst and osmotically stimulated AVP secretion

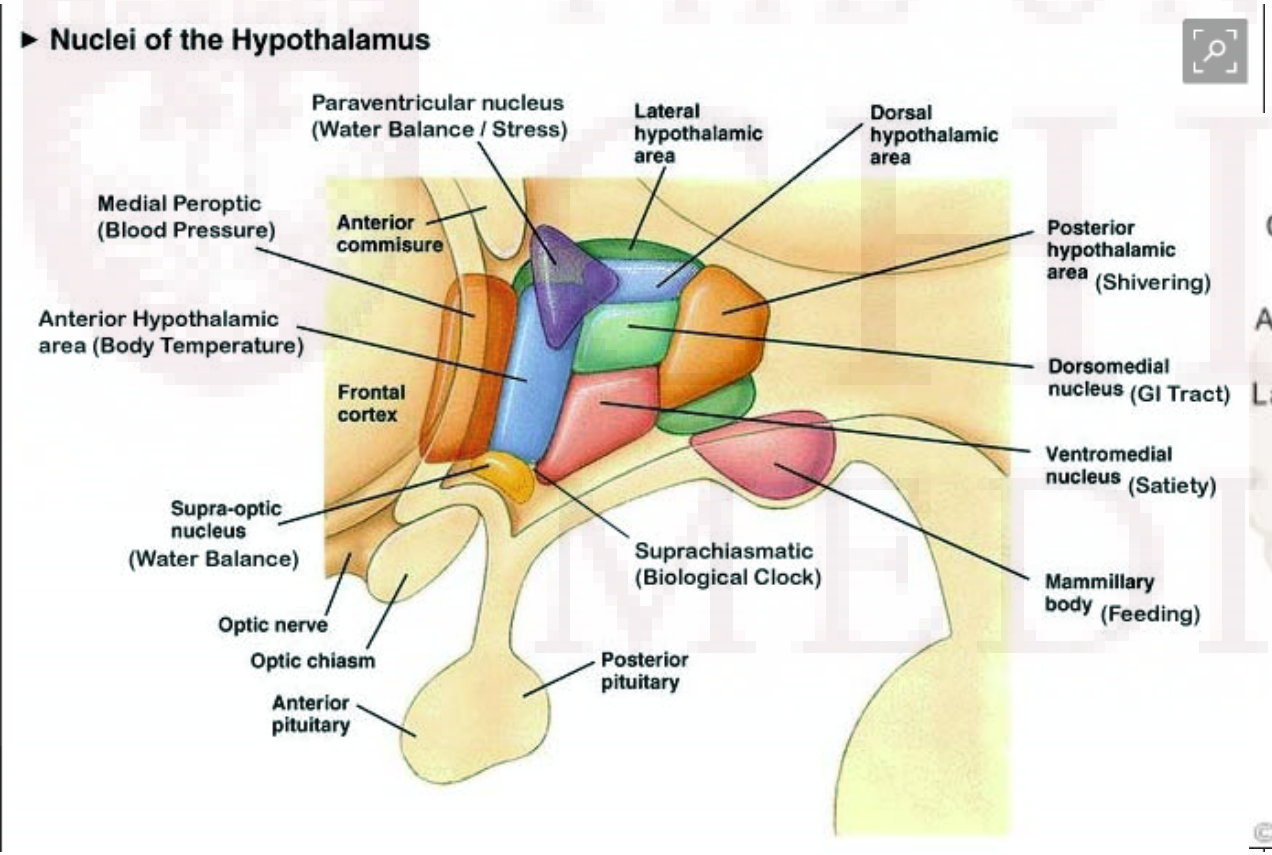
Aka Adipsic hypernatremia in recognition of the profound thirst defect noticed in the patients

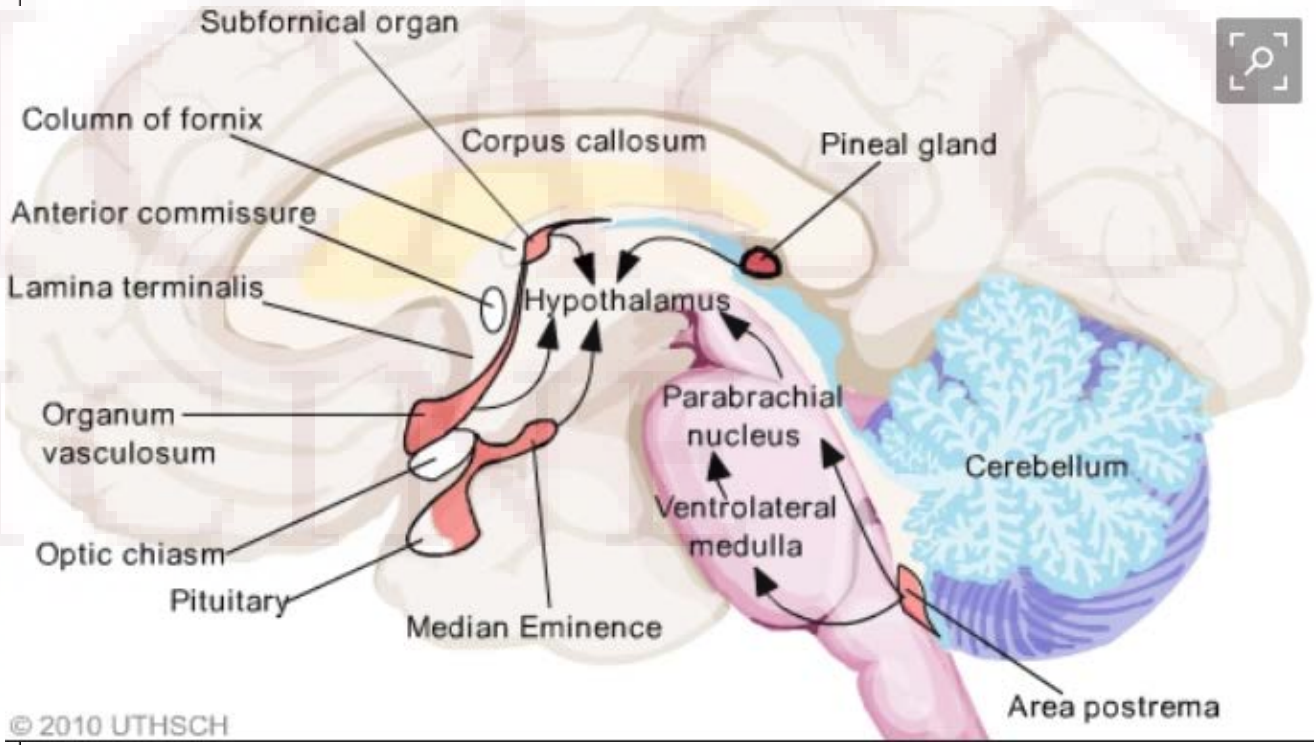
In contrast to the lesions that cause central DI , these lesions occur more rostral in the hypothalamus

Afferent pathways from the brainstem to the hypothalamus generally remain intact

These patients will usually have normal AVP and renal concentrating responses to baroreceptor-mediated stimuli such as hypovolemia and hypotension.

Vascular Organ of Lamina Teminalis (VOLT) & Sub fornical organ





Osmoreceptor dysfunction

Adipsic hypernatremia is usually due to lesions of the osmoreceptors that regulate thirst.

Causes of Osmoreceptor Destruction

1. Tumors: Craniopharyngioma, Meningioma, Metastatic tumor
2. Granuloma: Histiocytosis, Sarcoidosis
3. Vascular: Occluded
3. Trauma: Penetrating injury, Closed injury
5. Other: Hydrocephalus, Hypotrophy, Cysts, Inflammation, Aging
6. Idiopathic

Management

Central DI

Polyuria and polydipsia

Lesion in neurons producing or transferring AVP

+/- DDAVP

Drink to thirst

Adipsic Hypernatremia

Polyuria, Adipsia

Osmoreceptors are damaged

DDAVP usually Q12 hr dosing

Prescribe water, daily weights, much more challenging

Prescribing water based on the patient's urinary plus insensible fluid losses.

high rate of potentially fatal complications like OSA, Obesity, hypernatremia

Desmopressin conversion

Desmopressin is the used in treatment of DI

- Effective intranasal doses (10–20 microg) are 10 x parenteral doses (1–2 microg)
- Effective oral doses (100–200 microg) are 10 x intranasal doses
- Oral doses should not be administered with food to decrease proteolytic destruction of desmopressin
- The major potential complication of desmopressin treatment is hyponatremia, which can be prevented by avoiding excessive fluid ingestion/administration in patients taking desmopressin.

Prognosis in Adipsic Diabetes Insipidus

- High rate of mortality in ADI
- Often have associated obesity, OSA , seizures and thermoregulation dysfunction
- ADI is usually a lifelong condition, recovery of thirst appreciation has been reported.
- However, pattern of recovery of ADI is heterogeneous

Table 2 A comparison of the percentage (%) of abnormal plasma sodium measurements in 10 patients with ADI and 137 with diabetes insipidus (DI) and normal thirst. Reproduced from Behan LA et al. [1]

	ADI 385 samples in 10 patients (%)	DI (normal thirst) 2148 samples in 137 patients (%)	P
Outpatients			
pNa< 135 mmol/l	13.1	10.6	0.22
pNa> 145 mmol/l	18.7	1.8	<0.0001
Inpatients			
pNa< 135 mmol/l	20.5	23.6	0.38
pNa> 145 mmol/l	27.3	22.1	<0.0001

Two patients with craniopharyngioma had full recovery of thirst with persistent DI
One patient progressed to develop compulsive water drinking with recurrent hyponatremia, and on one occasion, hyponatremia seizures.
One patient recovered both thirst and partial AVP secretion several years following clipping of an ACOM aneurysm

Table 3 Associated conditions in adipsic diabetes insipidus. Reproduced from Crowley RK et al. [3]

Age	Diagnosis	Sex	OSA	BMI Kg/m^2	Associated conditions and clinical outcome
39	ACAA	F		25	Nil
30	ACAA	M		24	Hemiparesis
28	ACAA	M		28	Seizures, hypothermia
51	ACAA	M	Yes	37	Eventual recovery of thirst. Residual partial DI
66	ACAA	M		29.7	Nil
22	TBI	M		26	Nil
14	Toluene	M	Yes	36	Hypothermia, hypothalamic seizures
15	Cranio	F		57	PHP, hypercholesterolaemia
16	Cranio	F	Yes	34	PHP, Seizures, hydrocephalus, pulmonary emboli on death at 24 years (respiratory failure)
36	Cranio	M		35	PHP, seizures
41	Cranio	F	Yes	28	PHP, hypernatraemic seizure. Eventual recovery of thirst
27	Cranio	F	Yes	26	PHP, thermoregulatory disorder, seizures, reversal of adipsia, developed compulsive water drinking
14	PRLoma	M	Yes	53	PHP
33	N/sarcoid	M	Yes	57	Diabetes mellitus, seizures, PHP, death at 36 yrs (respiratory failure)
Birth	Congenital	F	Yes	32	Behavioural disorders, seizures, acute pancreatitis, death at 18 years (respiratory failure)

ACAA anterior communicating artery aneurysm, *TBI* traumatic brain injury, *Cranio* craniopharyngioma, *PRLoma* prolactinoma, *N/sarcoid* neurosarcoidosis, *PHP* panhypopituitarism, *OSA* obstructive sleep apnoea

Dec 7th:
She woke up and had a coughing episode. She coughed what she described as a "large clot" that appeared to be nasal packing. She also described feeling a dripping sensation in the back of her throat. She developed worsening mental status.
Taken to OR urgently
Intra- op: Repair using fat, a rotational nasoseptal flap, and fat packing in the sphenoid

Dec 9th:
After coughing and emesis, she re-developed a leak quite rapidly, which did not respond to nasal cavity packing.
Taken to OR
Intra op findings: High-flow CSF leak through the cyst, from a hole in the roof of the cyst, and likely a second lower flow leak from the right side.
Treated with multilayered approach to sealing the sellar defect, while also adding a lumbar drain for diversion of fluid from the repair.

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Thank you