

The Chicken, The Egg, & The Herniated Brain Parenchyma



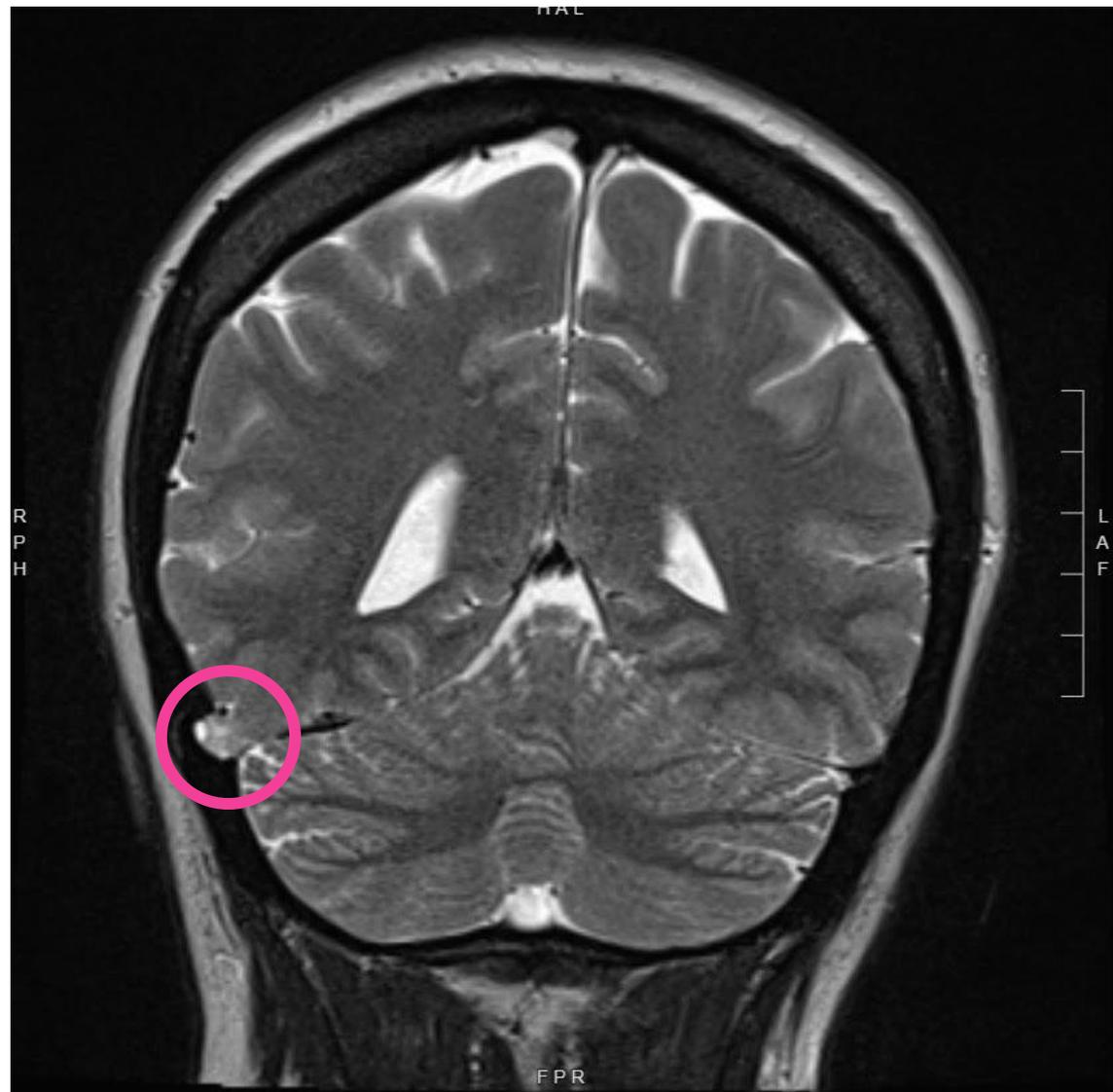
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THE CASE

- 36y/o woman seen in the ED for 2 months of worsening headaches with associated blurred vision
- Past medical history significant for
 - Obstructive sleep apnea
 - Episodic migraines
 - No tetracyclines, OCP, IUDs, retinoids
- BMI = 34.6 kg/m²
- Exam
 - Bilateral grade 1+ optic disc edema
 - Left heminasal field deficit
 - Otherwise, normal neurological exam

DIAGNOSTICS

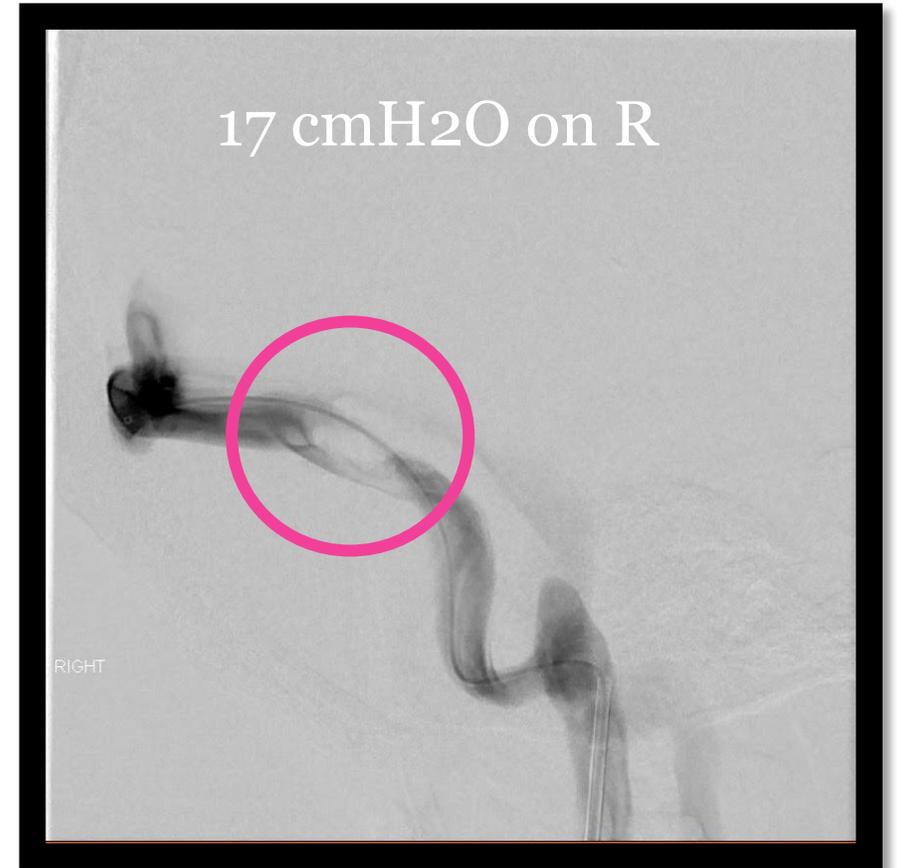
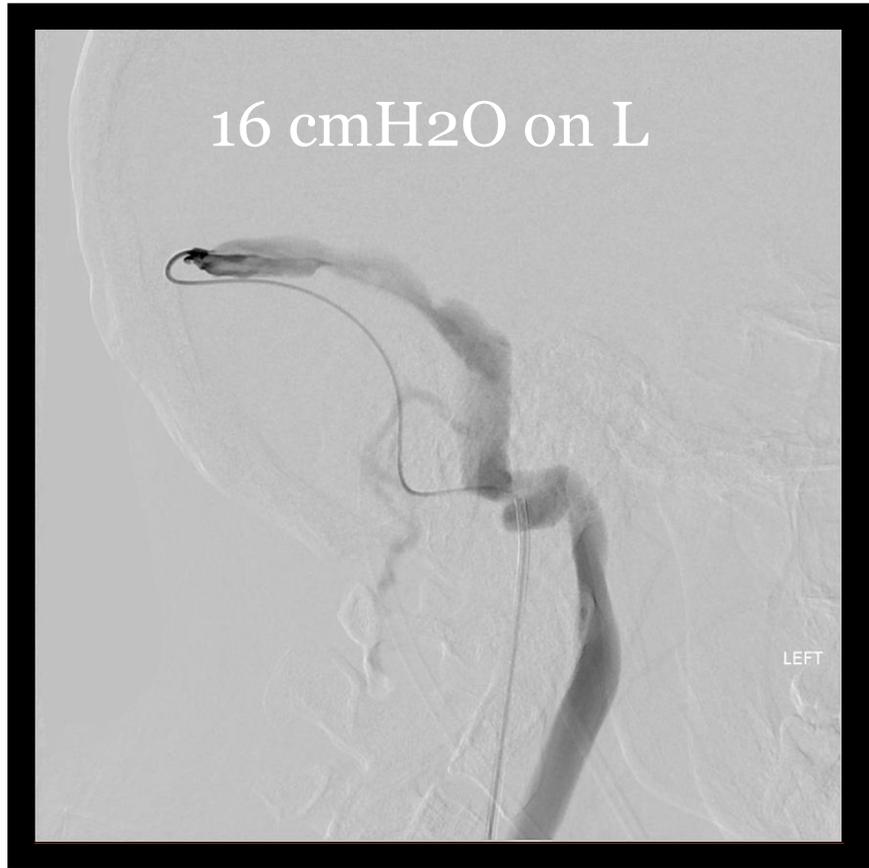
- CT scan negative
- Lumbar puncture
 - OP: 25 cmH₂O
 - Protein/cell count/glucose unremarkable
- MRI brain
 - Herniated brain in arachnoid granulation
- CTV
 - Right transverse-sigmoid junction occluded by arachnoid granulation



THERAPEUTICS

- Acetazolamide 500mg BID eventually increased to 750mg BID
- LP if headaches persist
- Follow-up with IR for venous sinus pressure assessments

Venous Sinus Pressure Assessment



Bilateral transverse sinus stenosis with near occlusion on R

FOLLOW-UP

- Partial response to acetazolamide

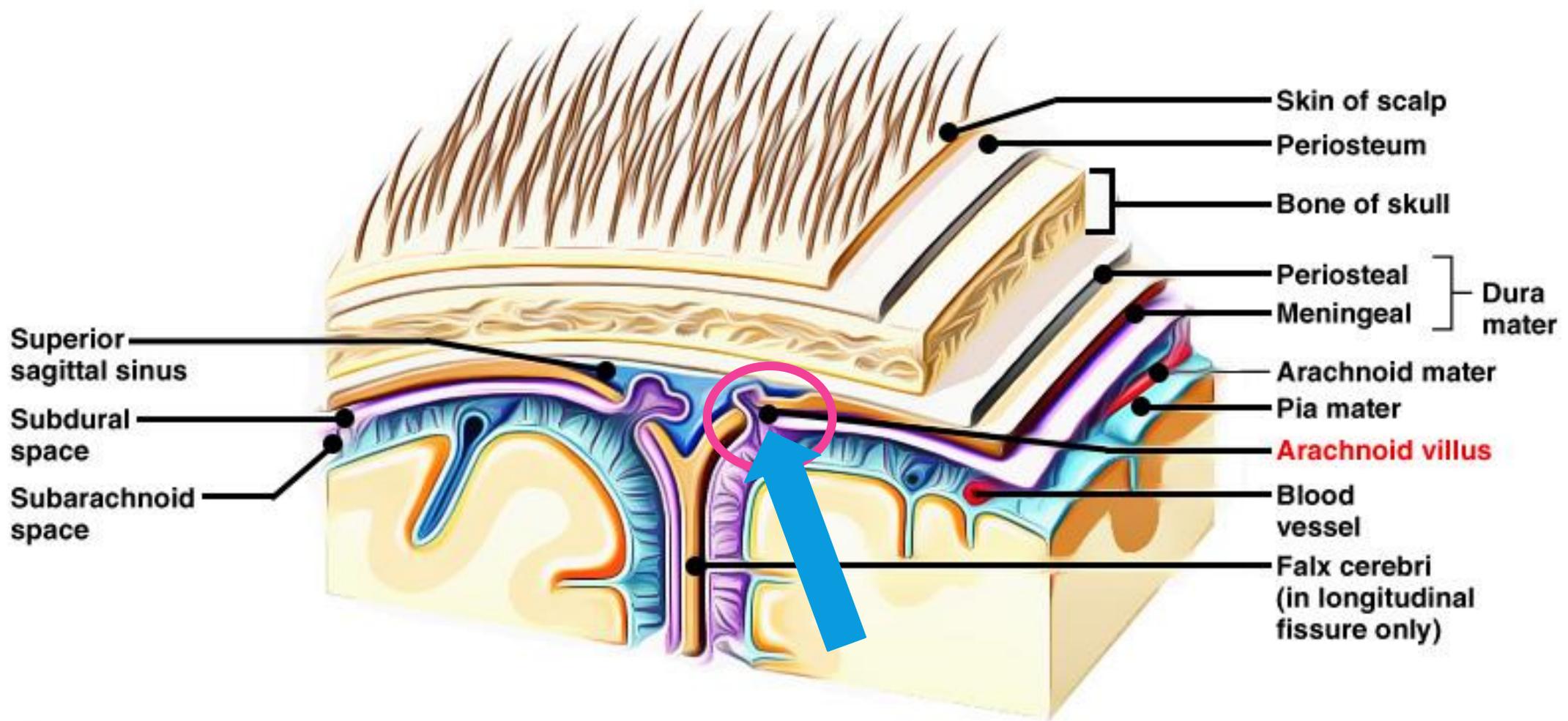
IDIOPATHIC INTRACRANIAL HYPERTENSION

Modified Dandy Criteria

- Symptoms and signs of increased intracranial pressure (eg, headache, transient visual obscurations, pulse synchronous tinnitus, papilledema, visual loss)
- No other neurologic abnormalities or impaired level of consciousness
- Elevated intracranial pressure with normal cerebrospinal fluid (CSF) composition
- A neuroimaging study that shows no etiology for intracranial hypertension
- No other cause of intracranial hypertension apparent

ARACHNOID GRANULATIONS

- Structures filled with CSF that extend into the venous sinuses through openings in the dura mater
- Allow the drainage of CSF from subarachnoid space into venous system
- Giant AG are >1 cm
- Enlarge with age and increased CSF pressure



BRAIN PARENCHYMA HERNIATIONS

- Prevalence is 0.32%¹
- Most common sites by frequency²
 - Occipital squama
 - Transverse sinus
 - Lateral lacunae of the superior sagittal sinus
 - Straight sinus
- Can occur spontaneously or due to increased intracranial pressure³
- Usually, incidental finding with patient asymptomatic⁶

DDX

○Thrombosis

- Involves large segment or multiple sinuses, can extend into cortical veins
- AG produce defined defects

○Intrasinus tumors

- Misshapen, no diffusion restriction
- AG rounded, CSF-like signal intensity, intrinsic vessels

PROCEDURAL OPTIONS

- Serial LPs

- Shunt

- Optic nerve sheath fenestrations

- Venous sinus stenting (VSS)

VSS:
INDICATIONS

Elevated maximal venous pressures

Or

Significant trans-stenosis pressure gradient
($>8\text{cmH}_2\text{O}$)

And

Medically refractory idiopathic intracranial
hypertension

Or

Intolerance of medication

Pre-Stent Evaluation

- Pretreat with Aspirin 325mg & Clopidogrel 75mg for 7 days
- Place Femoral artery and vein sheath in a sedated patient
- Use a 0.014" microwire in a 0.027" microcatheter to get to the SSS
- Perform an arteriography and venography
- Attach pressure transducer to venous microcatheter for venous pressures
- Get pre-stenosis and post-stenosis pressures
- If MVP is >8mmHg, proceed with stenting

Stenting

- Change the General Anesthesia
- Give Heparin bolus for ACT goal of 250-300sec
- Gain access to the SSS
- Start deploying the stent >10mm from the point of stenosis
- End of Stent deployment should be >10mm from point of stenosis
- Perform venogram to visualize flow improvement before closing
- Perform post placement CT scan to rule out hemorrhage

Post-Stenting

- Continue Dual antiplatelets for 1 month and Aspirin 3 months post-treatment
- Repeat Angiogram when symptoms worsen to rule out juxta-stent stenosis
- If there is juxta-stent stenosis, deploy new stent
- If no juxta-stent stenosis, proceed with CSF diversion

VSS: DATA

- No randomized data yet
- Reduced pressure gradients by 20.1 cmH₂O to 4.4 cmH₂O¹⁰
- Majority of patients had improvement in headaches, pulsatile tinnitus, papilledema, and vision over 2 years¹⁰
- Case report of correction of bilateral CNVI palsy within 8 hours of stenting¹¹

VSS: COMPLICATIONS

- Stent migration
- Venous sinus perforation
- In-stent thrombosis
- Subdural hemorrhage
- Recurrent stenosis proximal to the stent

185 total patients

221 total stents placed

5.4% complication rate

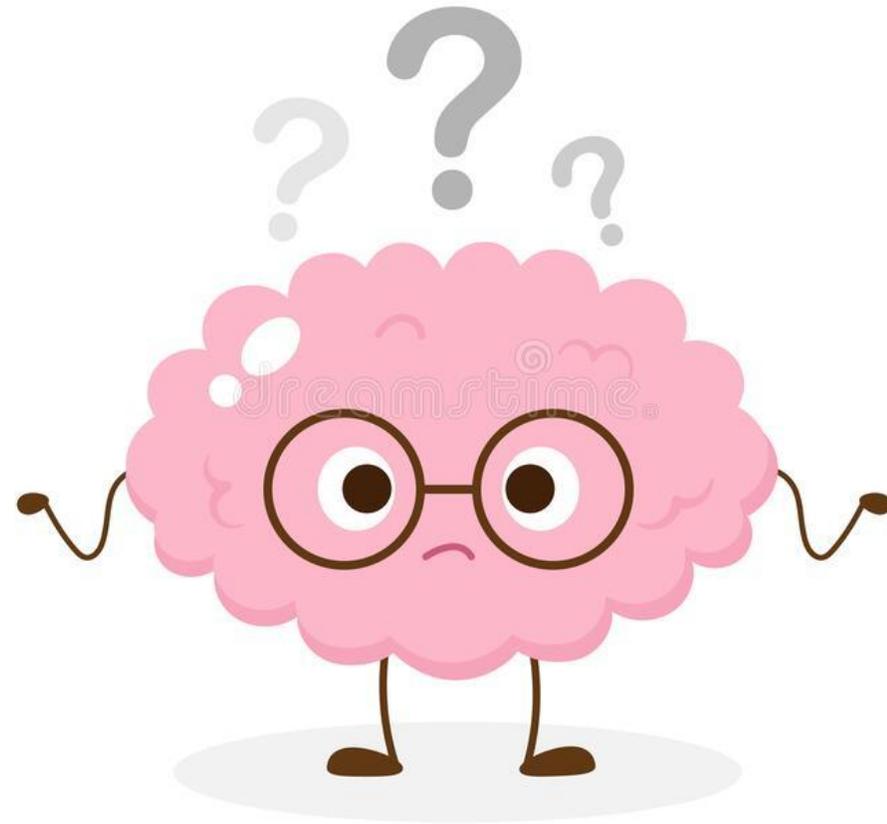
Author/year	Number of patients	Number of stentings	Complications	Complication rate	Complications requiring additional procedure
Higgins et al. 2002 [4]	1	1	0	0%	N/A
Owler et al. 2003 [5]	4	4	0	0%	N/A
Higgins et al. 2003 [6]	12	14	0	0%	N/A
Ogungbo et al. 2003 [7]	1	1	0	0%	N/A
Rajpal et al. 2005 [8]	1	1	0	0%	N/A
Donnet et al. 2008 [9]	10	11	0	0%	N/A
Paquet et al. 2008 [10]	1	1	0	0%	N/A
Arac et al. 2009 [11]	1	1	0	0%	N/A
Bussière et al. 2010 [12]	10	13	0	0%	N/A
Zheng et al. 2010 [13]	1	1	0	0%	N/A
Ahmed et al. 2011 [14]	52	60	2 major (SDH); 2 minor (transient hearing loss)	7.7%	2 (1 SDH, 1 SDH/ICH/SAH both requiring emergent craniotomy)
Albuquerque et al. 2011 [15]	15	30	1 minor RPH not requiring transfusion	3.3%	0
Kumpe et al. 2012 [16]	18	19	1 major (SAH/SDH); 2 minor (UTI and syncope)	16.7%	1 (SAH/SDH hematoma requiring EVD)
Teleb et al. 2012 [17]	1	1	0	0%	N/A
Radvany et al. 2013 [18]	12	12	0	0%	N/A
Fields et al. 2013 [19]	15	15	1 minor (femoral pseudoaneurysm)	6.7%	0 (femoral pseudoaneurysm resolved compression)
Ducruct et al. 2014 [20]	30	36	1 minor (femoral pseudoaneurysm)	2.8	1 (femoral pseudoaneurysm requiring femoral artery stent)



REVIEW OF MAJOR POINTS

- Pathologic positive feedback loop in IIH
- Differentiating herniation through AG vs. other pathology
- VSS indications and current data

QUESTIONS?



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THANK YOU!

