Provincia Autonoma di Trento
Azienda Provinciale per i Servizi Sanitari

UNIVERSITÀ DEGLI STUDI DI TRENTO
CIMeC - Center for Mind/Brain Sciences

International Society for Neurovascular Disorders (ISNVD) - 2019

MR imaging of perivascular spaces in veno-obstructive diseases

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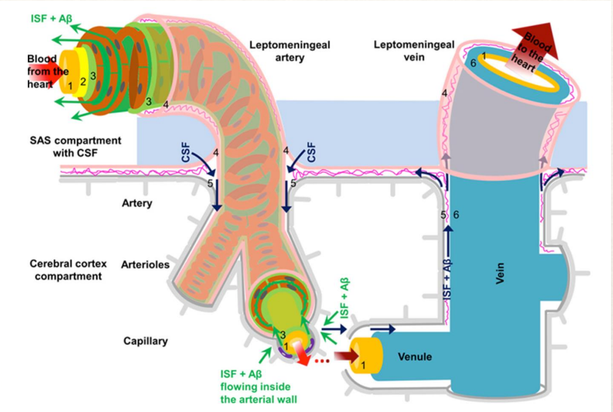
INTERNATIONAL SOCIETY OF NEUROVASCULAR DISEASE
9th annual meeting
May 30-31, 2019, University of Ferrara - Italy
AULA MAGNA - S. ANNA UNIVERSITY-HOSPITAL, CONA VIA ALDO MORO 8

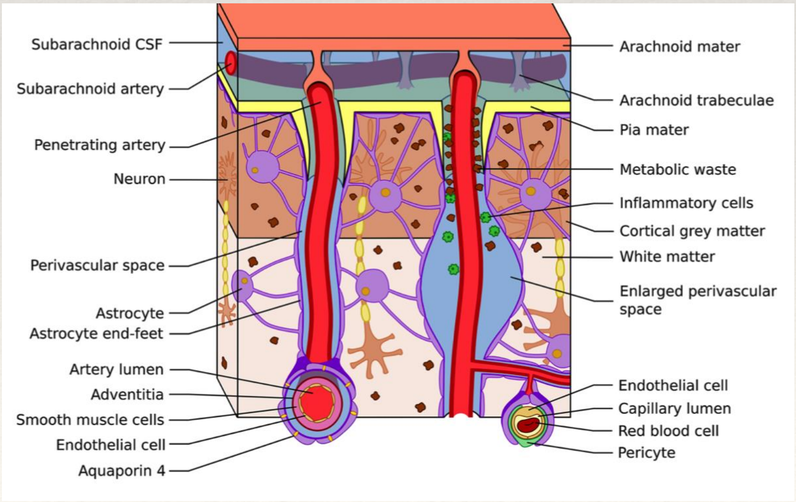
Why the fuss? What do PVS do?

- CSF recirculation
- Pathway for waste/solute removal
- Immunological function (presence of lymphocytes/macrophages)



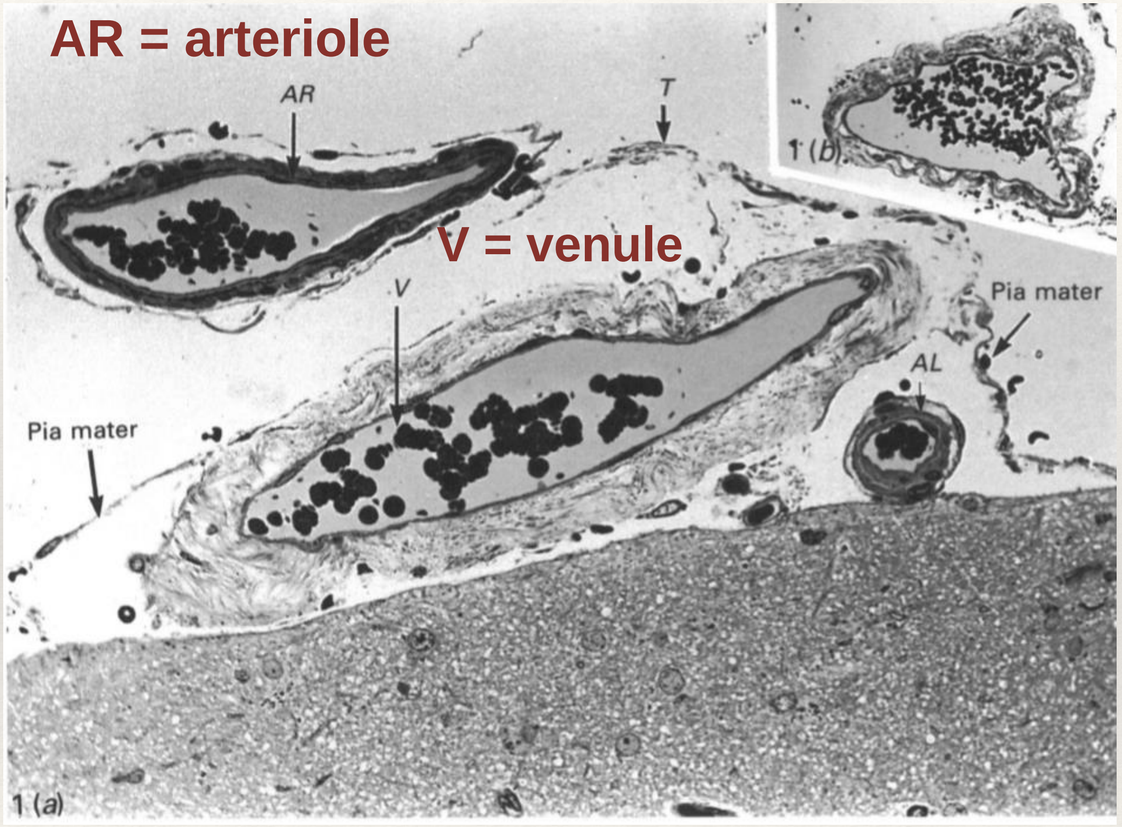
E. Bakker et al. Cell Mol Neurobiol. 2015

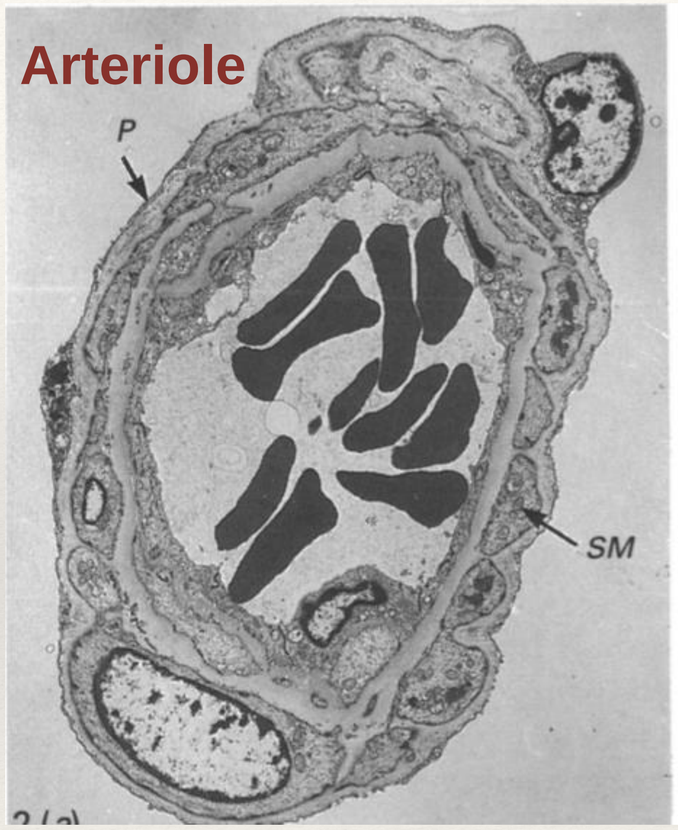
- MRI shows dilation of PVS in pathological states
- EPVS correlate with cognitive impairment and age
- EPVS correlates with increased load of WML
- EPVS are differentially located in amyloid angiopathy wrt hypertensive angiopathy

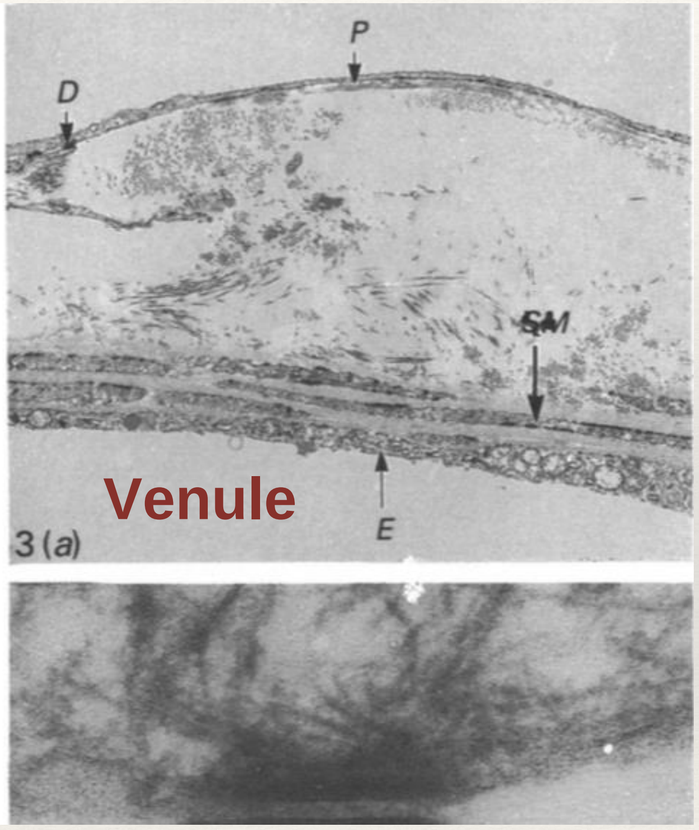


Ramirez et al. Cell Mol Neurobiol 2016

Perivascular spaces or Virchow-Robin space







Subpial space (SPS)

Subarachnoid space (SAS)

Zhang et al. J. Anatomy 1990

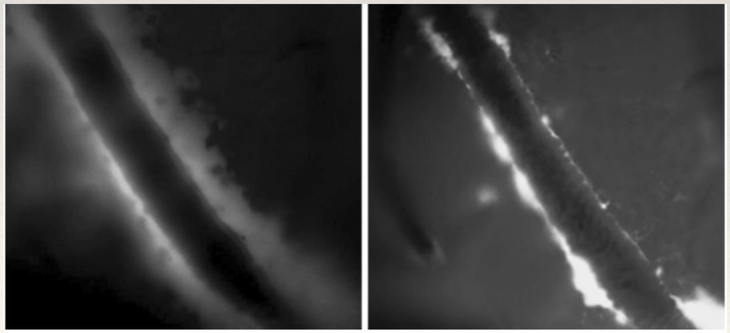
Definition of Perivascular spaces

FLUID FILLED SPACES that follow the typical course of a vessel as it goes through grey or white matter . The spaces have signal intensity similar to CSF on all sequences.

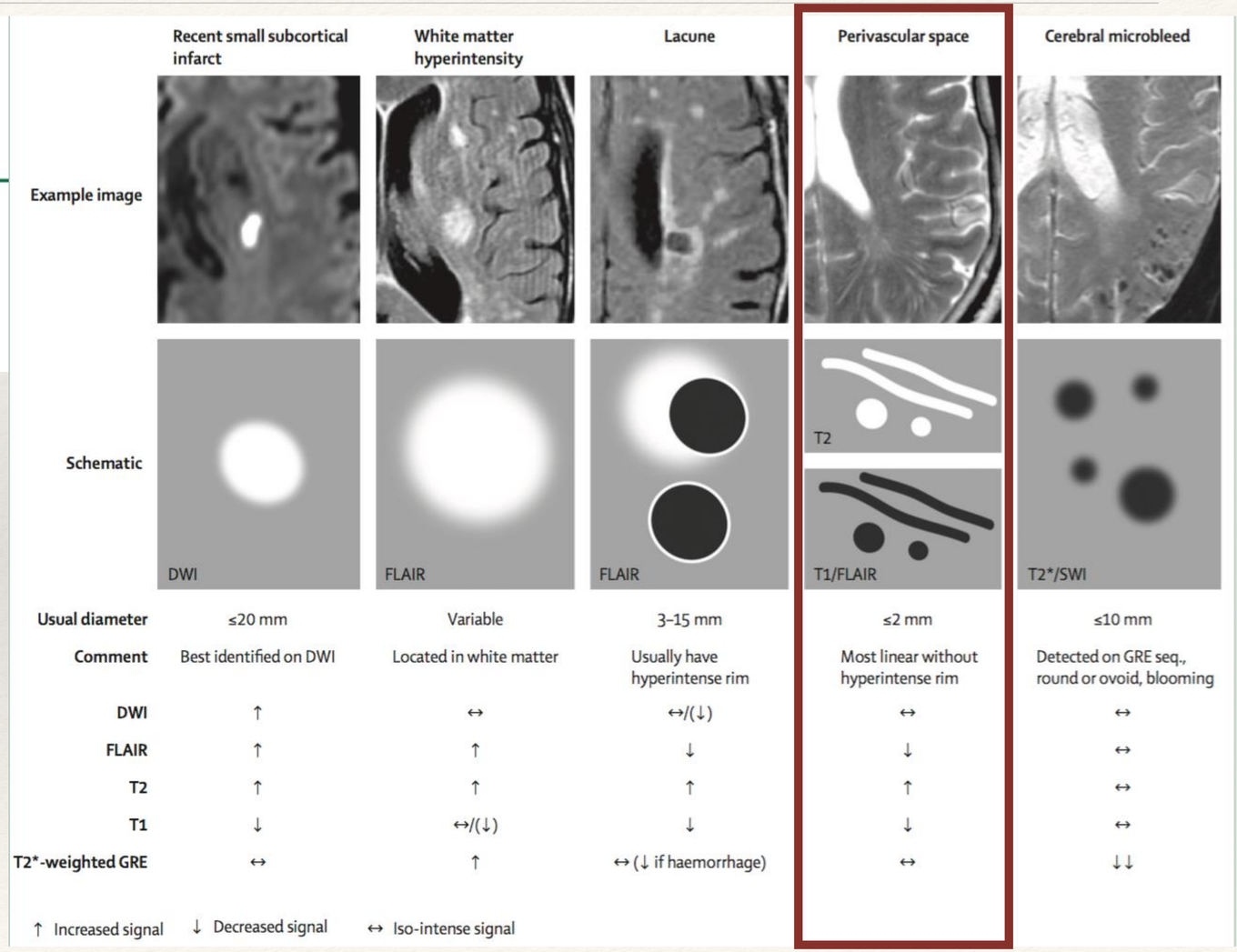
Position Paper

Neuroimaging standards for research into small vessel disease and its contribution to ageing and neurodegeneration

J. Wardlaw et al. Lancet Neurology 2013



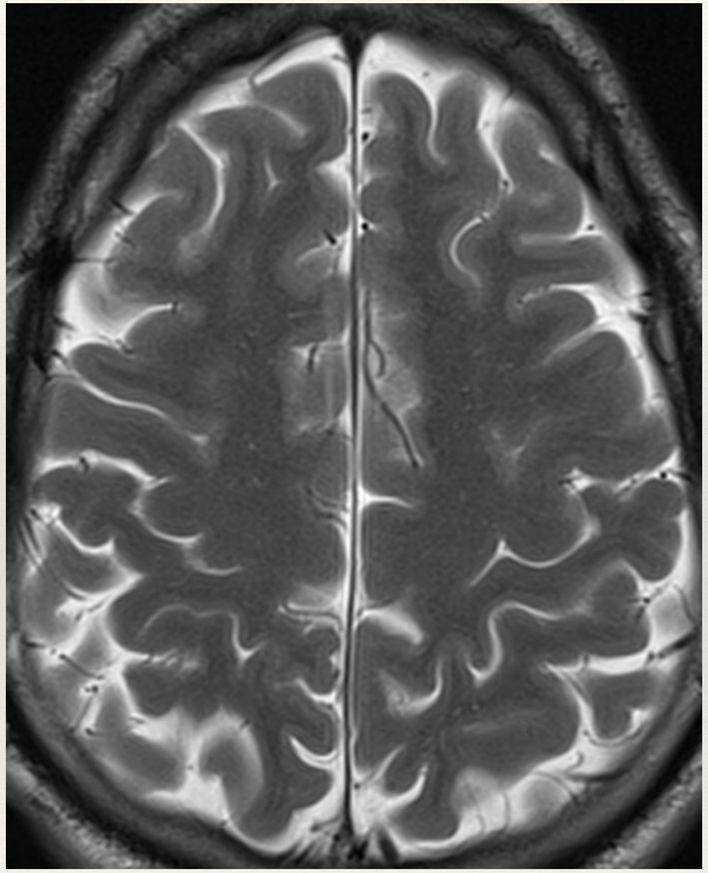
Bakker et al. 2016 Cell Mol Neurobiol



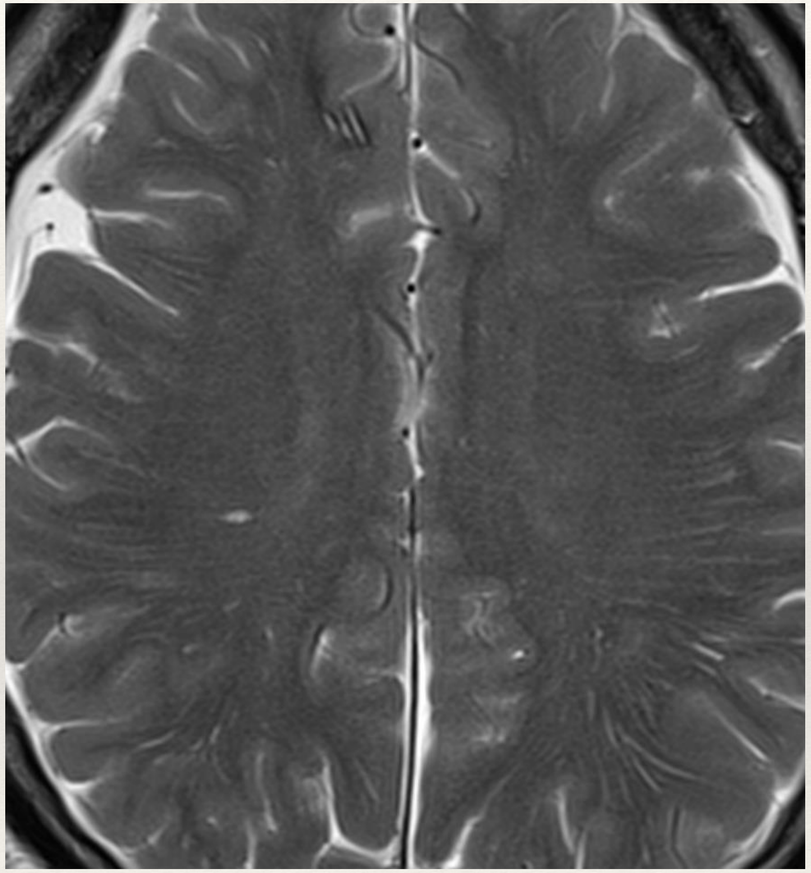
	Recent small subcortical infarct	White matter hyperintensity	Lacune	Perivascular space	Cerebral microbleed
Usual diameter	≤20 mm	Variable	3–15 mm	≤2 mm	≤10 mm
Comment	Best identified on DWI	Located in white matter	Usually have hyperintense rim	Most linear without hyperintense rim	Detected on GRE seq., round or ovoid, blooming
DWI	↑	↔	↔/(↓)	↔	↔
FLAIR	↑	↑	↓	↓	↔
T2	↑	↑	↑	↑	↔
T1	↓	↔/(↓)	↓	↓	↔
T2*-weighted GRE	↔	↑	↔ (↓ if haemorrhage)	↔	↓↓

↑ Increased signal ↓ Decreased signal ↔ Iso-intense signal

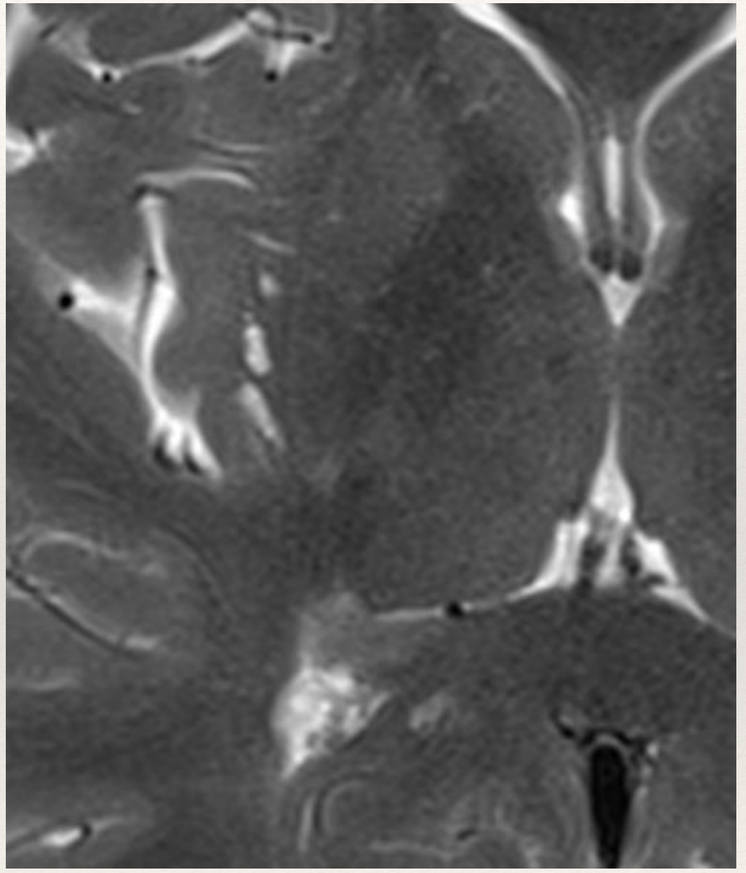
MR images of PVS



No PVS

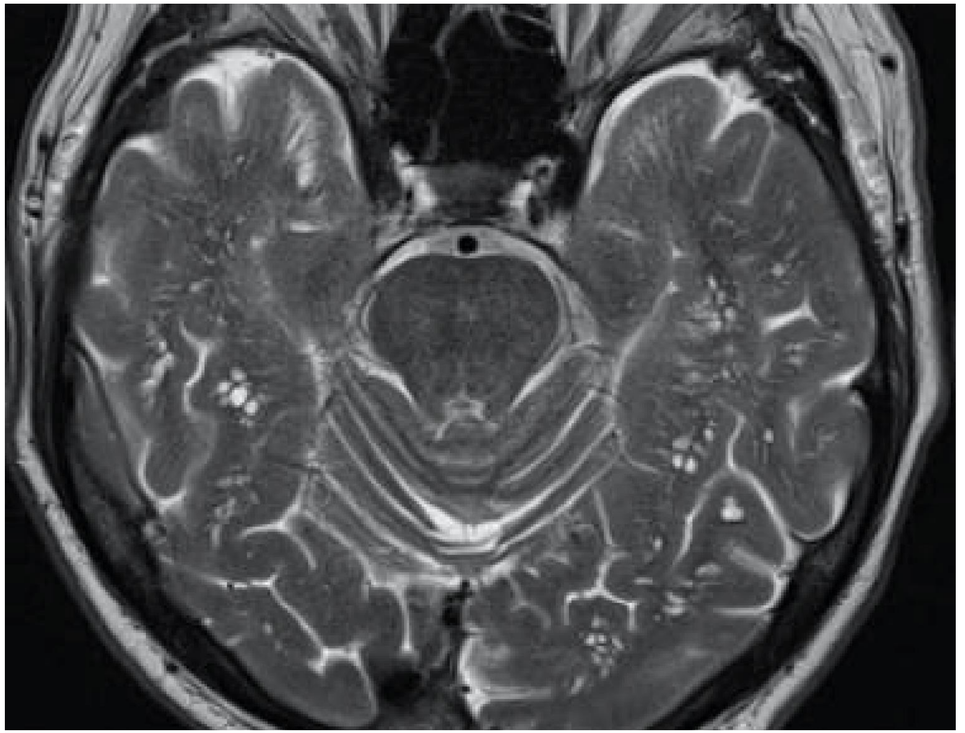


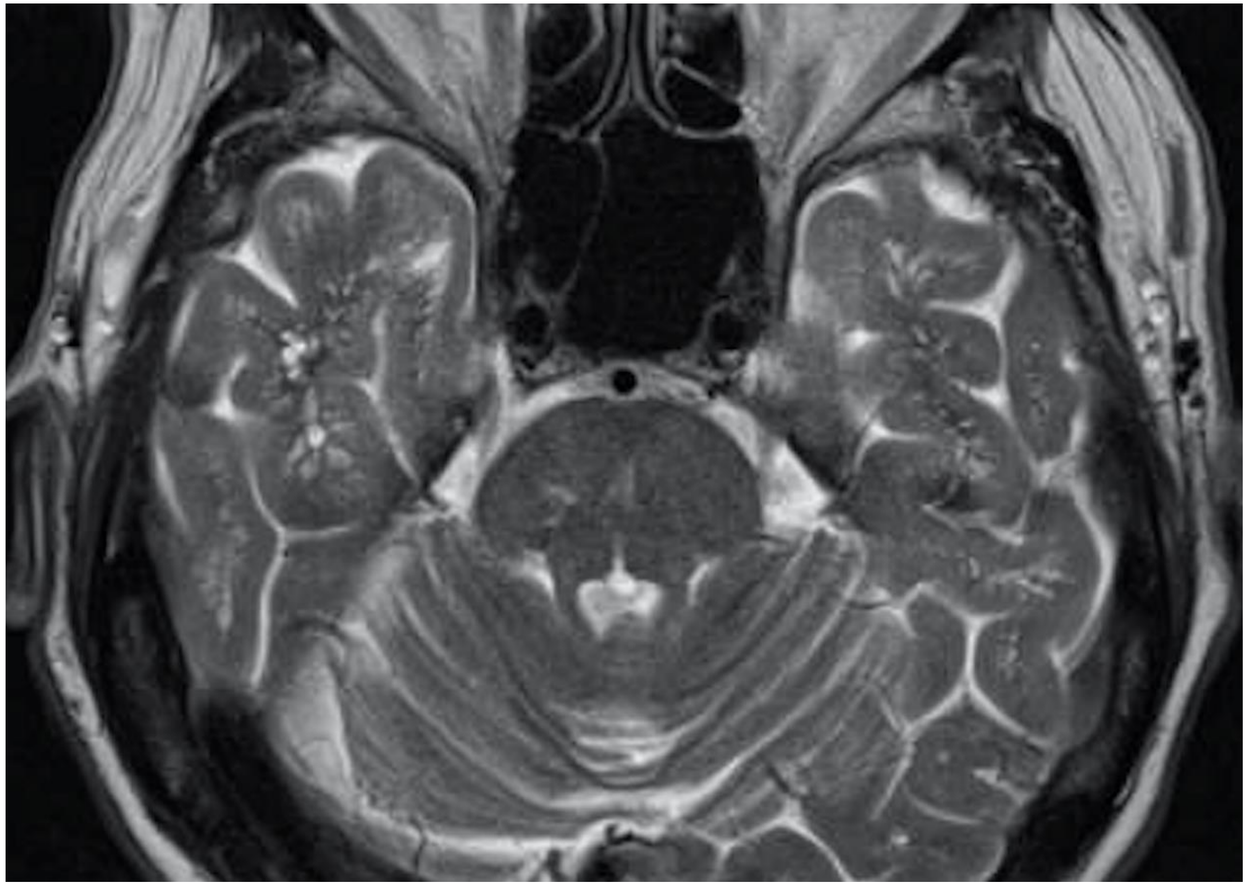
Linear prominent PVS

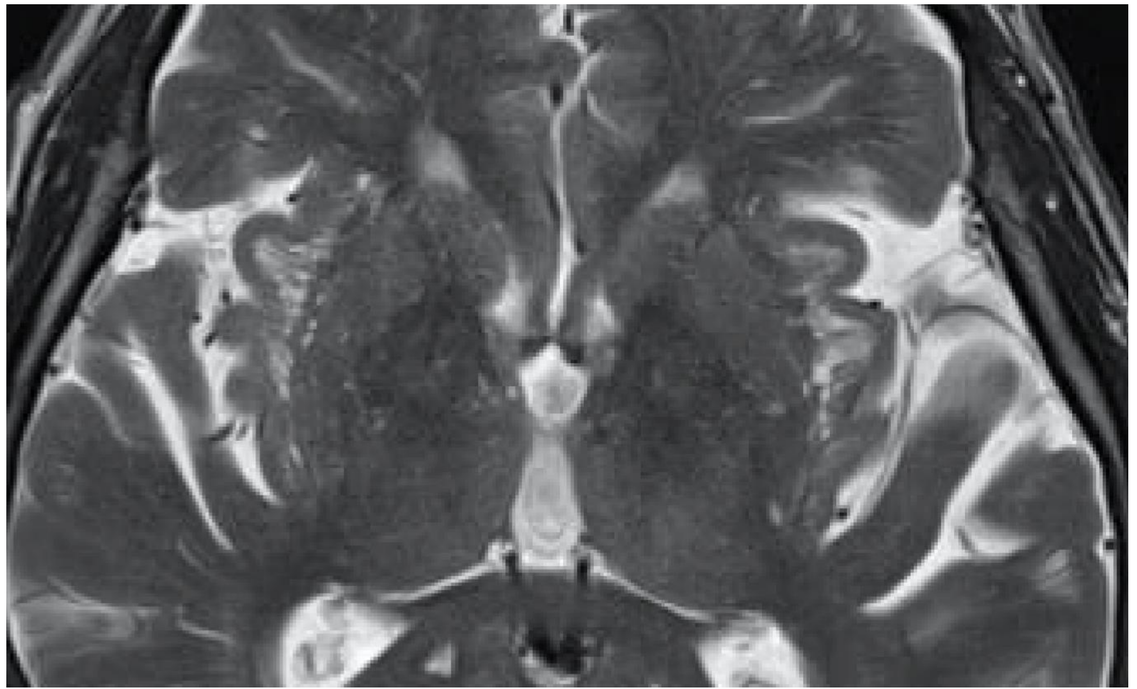


PVS with a different shape

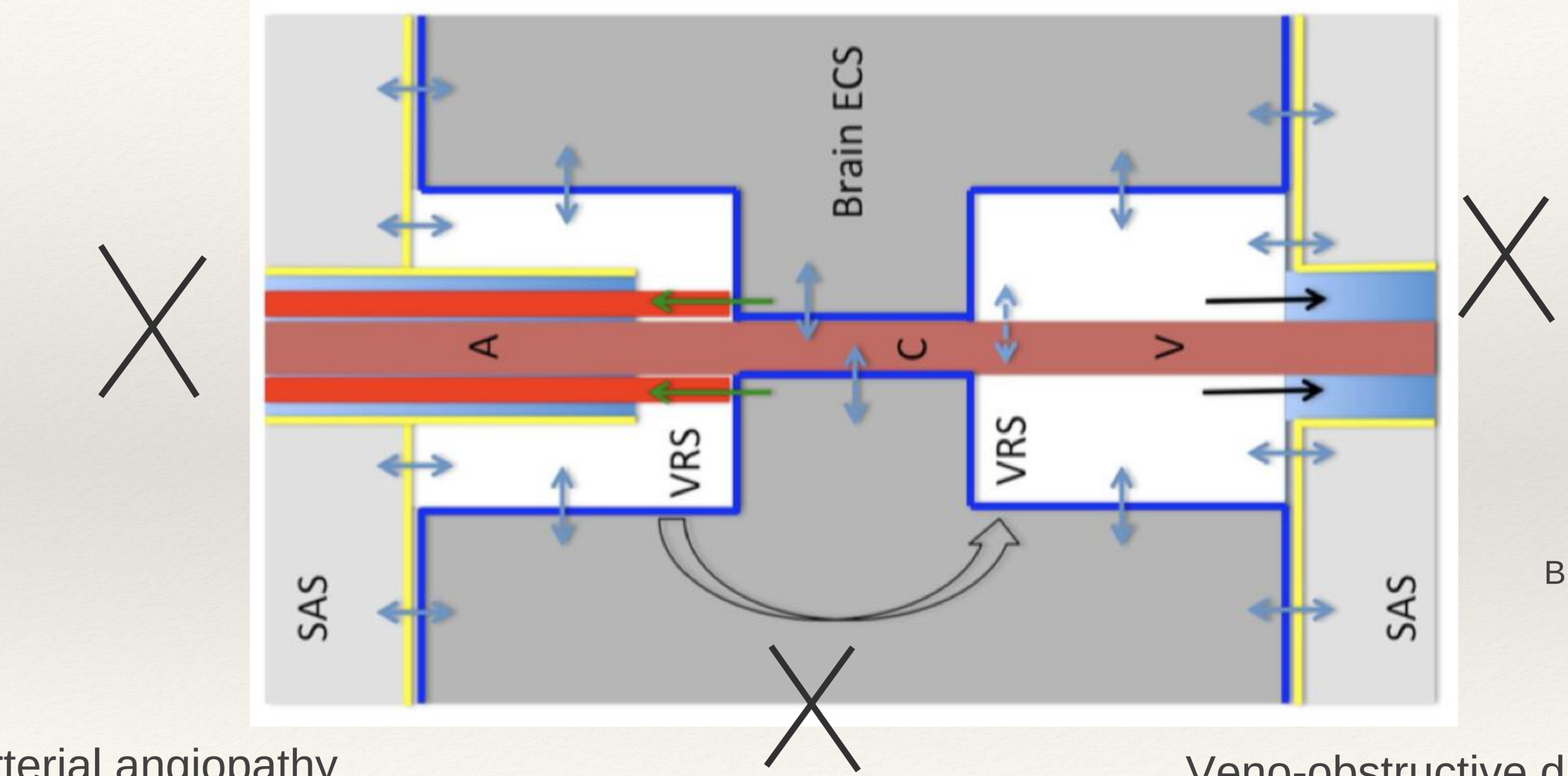
EPVS - SIZE AND SHAPE







Impeded flow : arteries/CSF/veins



Brinker et al 2014

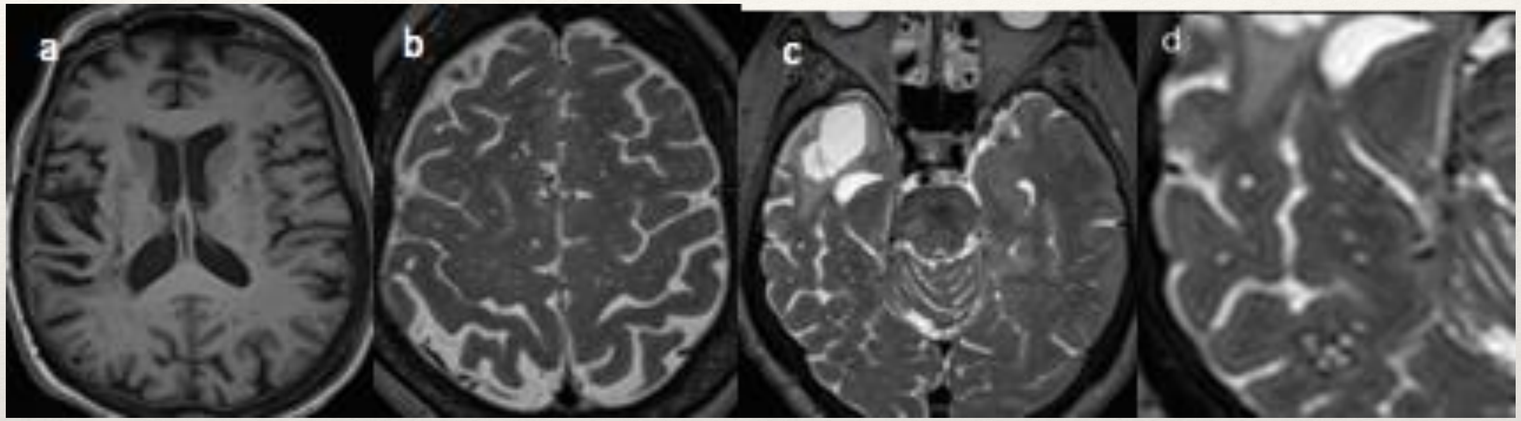
Arterial angiopathy

CSF block

Veno-obstructive disease

Obstruction/impairment to flow
Arterial system

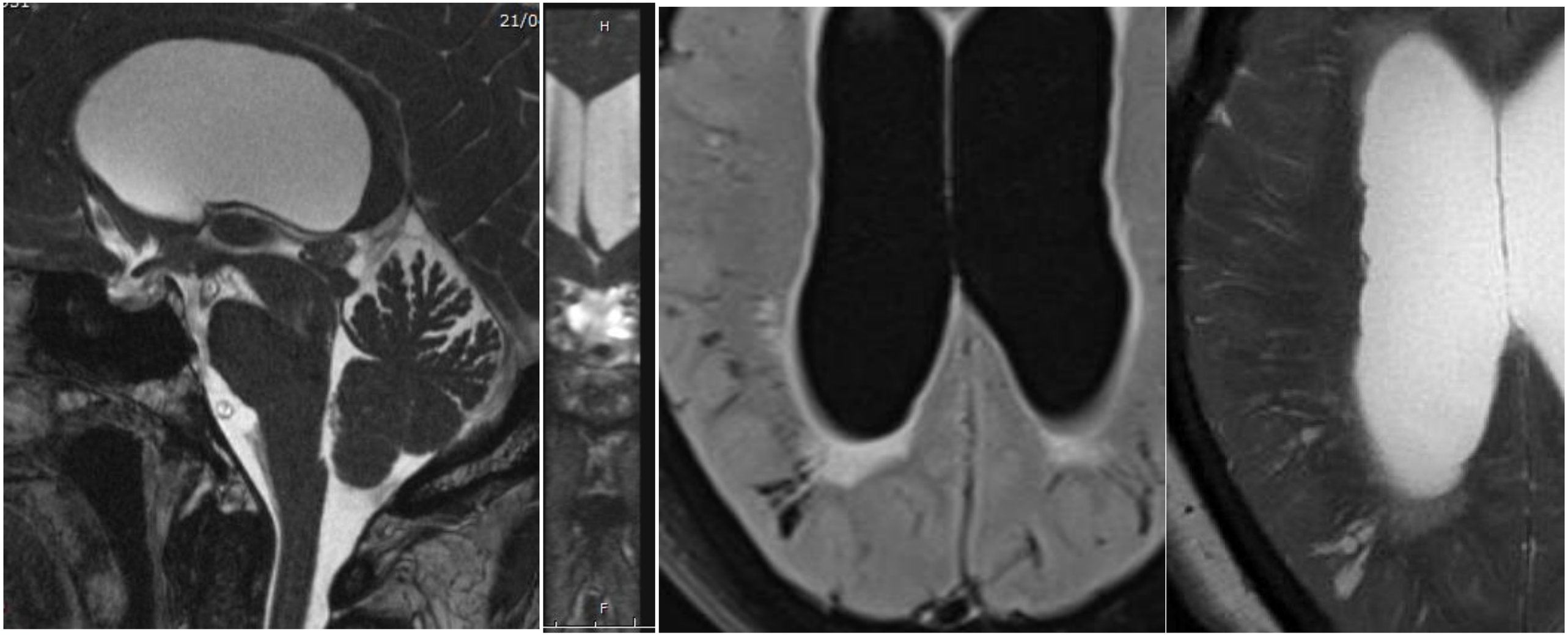
Cerebral amyloid angiopathy



Subarachnoid hemorrhage

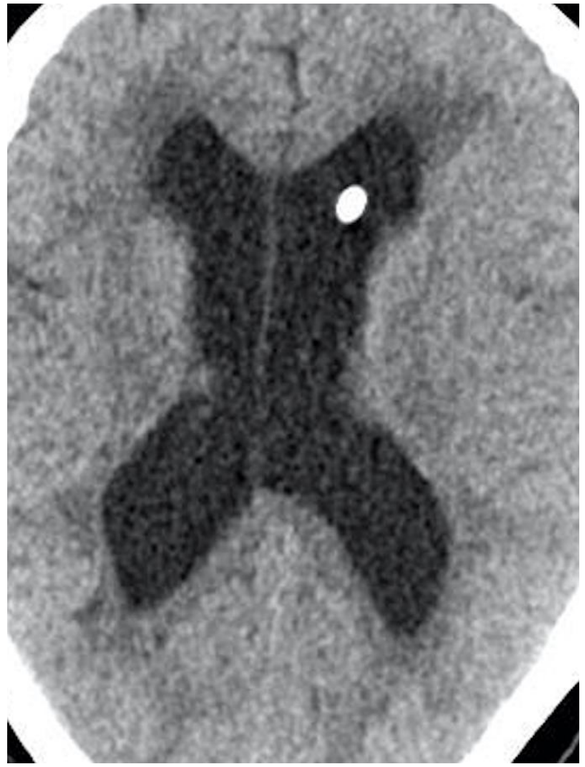
Increased arterial pulsatility
Blockage of periarterial spaces
Risk factors determining SVD

Obstructive hydrocephalus: bilateral stenosis of the foramen of Monro



CT images

Before VS



After VS

after two months of VS

Obstruction/impariment to venous flow

Intraparenchymal venous obstruction

Extracranial venous vessel obstruction

Intraparenchymal venous obstruction

Periventricular venous collagenosis: association with leukoaraiosis.

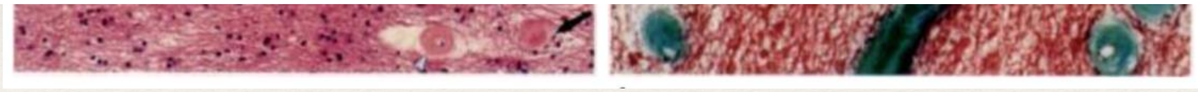
D M Moody, W R Brown, V R Challa, R L Anderson

Venous collagenosis and arteriolar tortuosity in leukoaraiosis

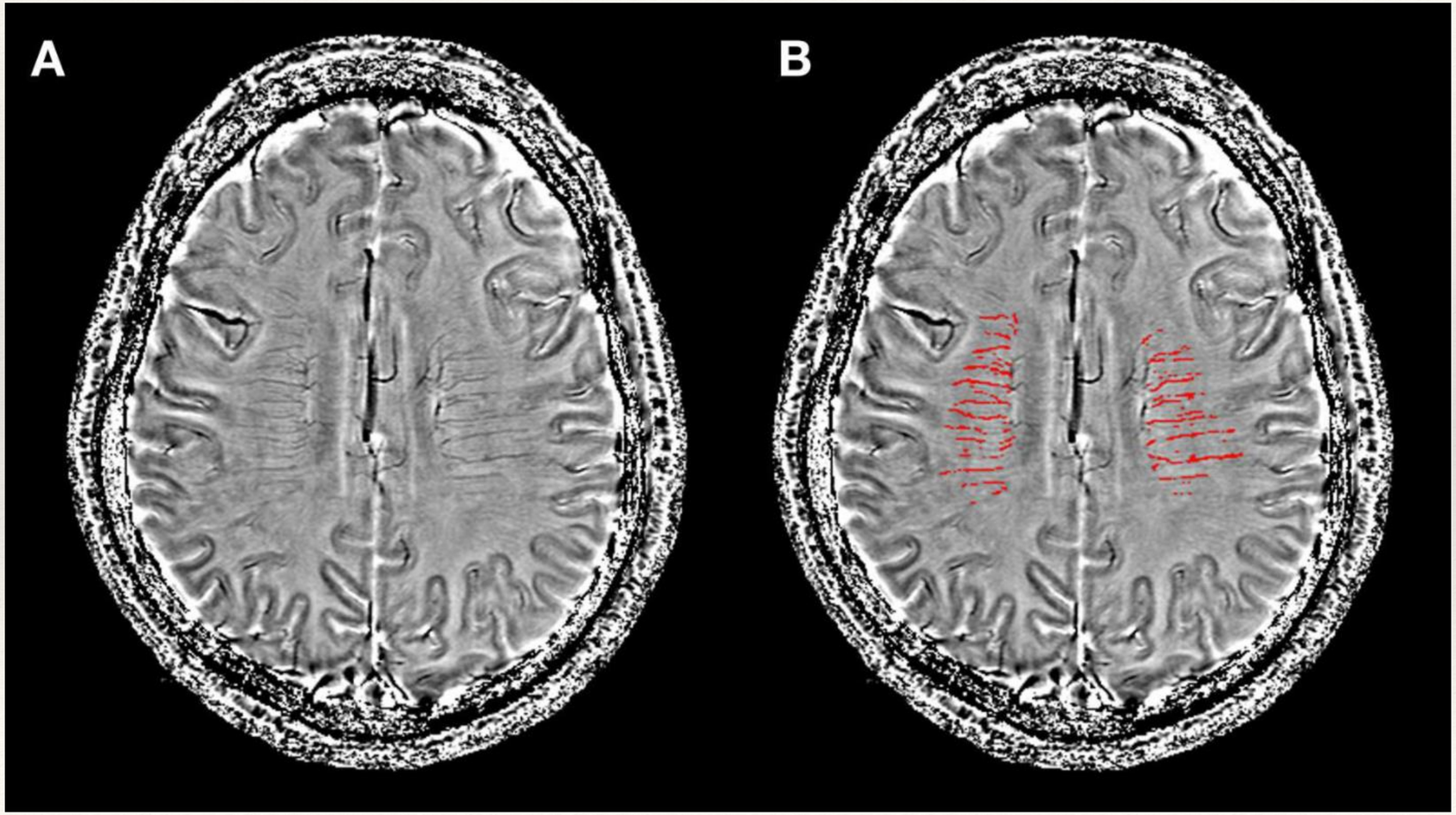
William R Brown*, [a], Dixon M Moody[a], Venkata R Challa[b], Clara R Thore[a], John A Anstrom[a]

PlumX Metrics

DOI: https://doi.org/10.1016/S0022-510X(02)00283-6



Yan et al. FNS 2014

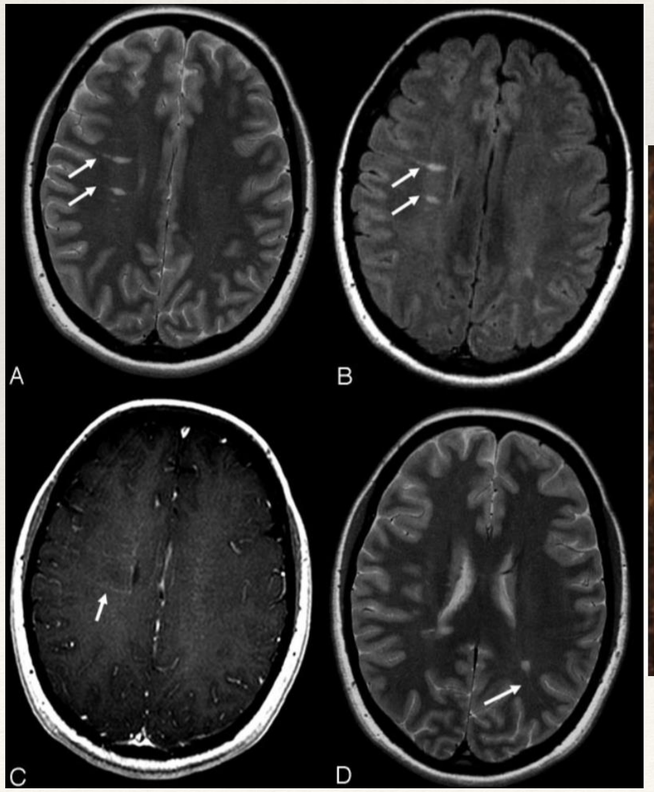


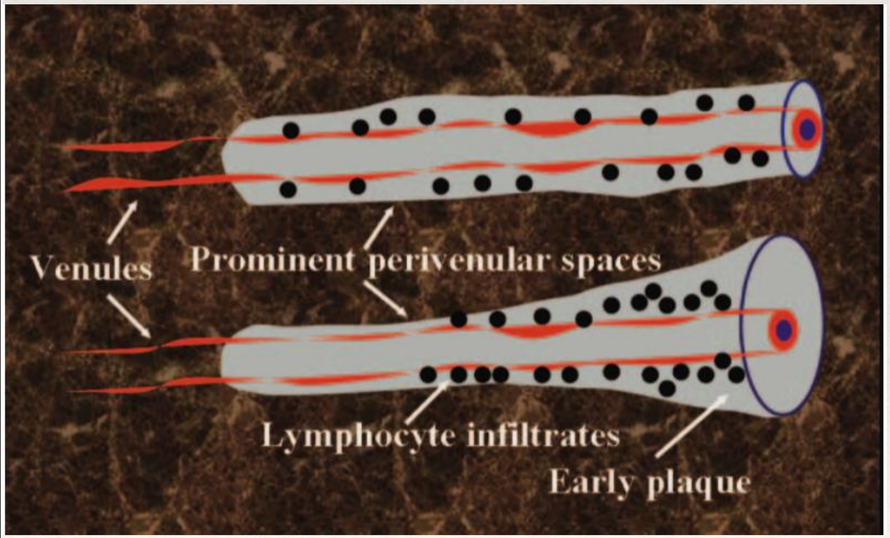
WMH load is directly proportional to the volume of deep medullary veins on SWI

Enlarged perivenular space? Any evidence?

Prominent Perivenular Spaces in Multiple Sclerosis as a Sign of Perivascular Inflammation in Primary Demyelination

Yulin Ge, Meng Law, Joseph Herbert, and Robert I. Grossman

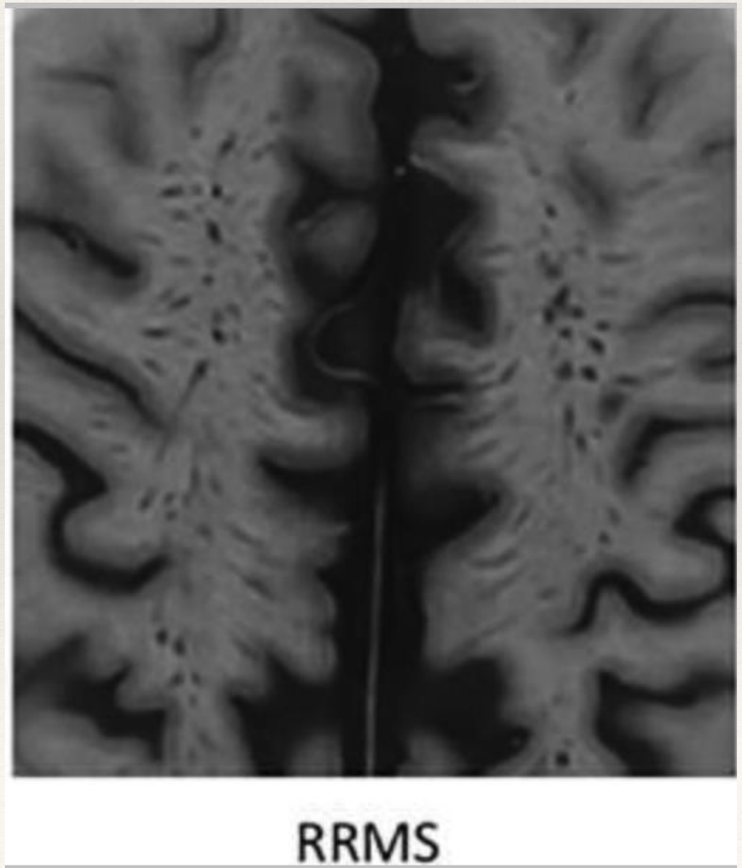




RESEARCH ARTICLE

Enlarged Virchow Robin spaces associate with cognitive decline in multiple sclerosis

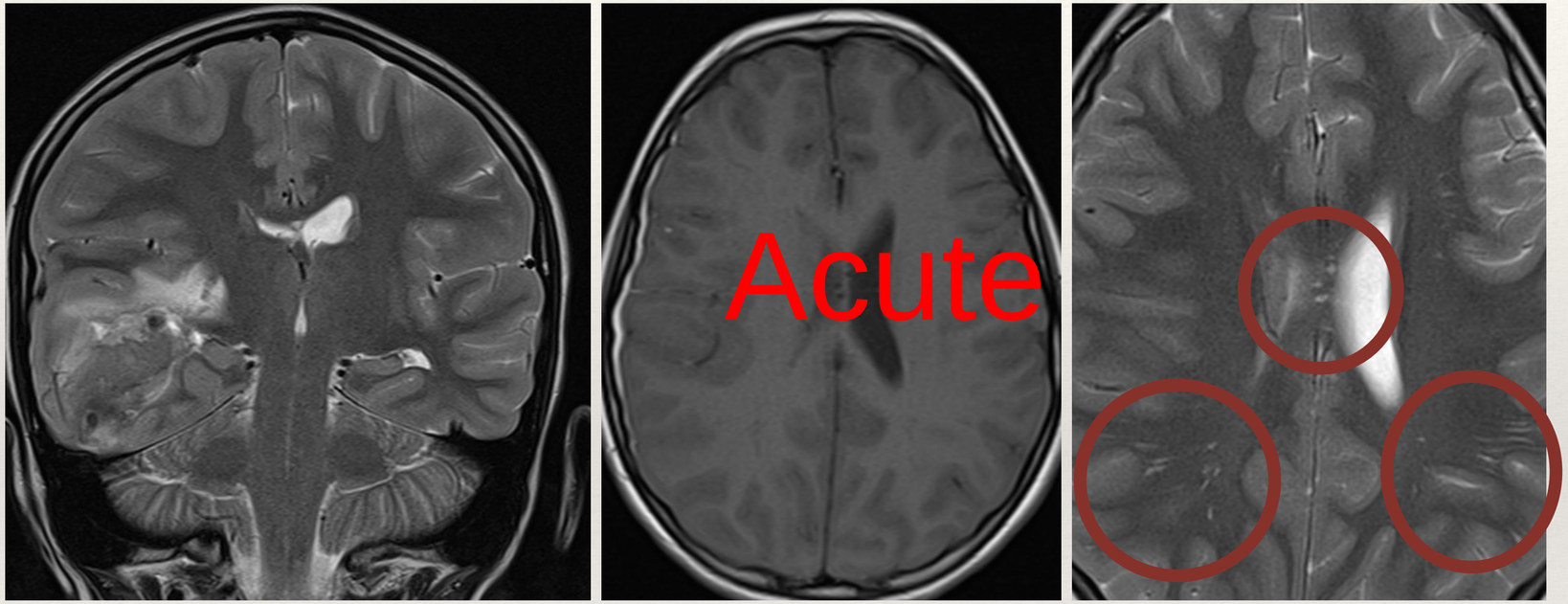
Alice Favaretto[1☯], Andrea Lazzarotto[1☯], Alice Riccardi[1], Stefano Pravato[1], Monica Margoni[1], Francesco Causin[2], Maria Giulia Anglani[2], Dario Seppi[1¤], Davide Poggiali[1‡], Paolo Gallo[1‡*]



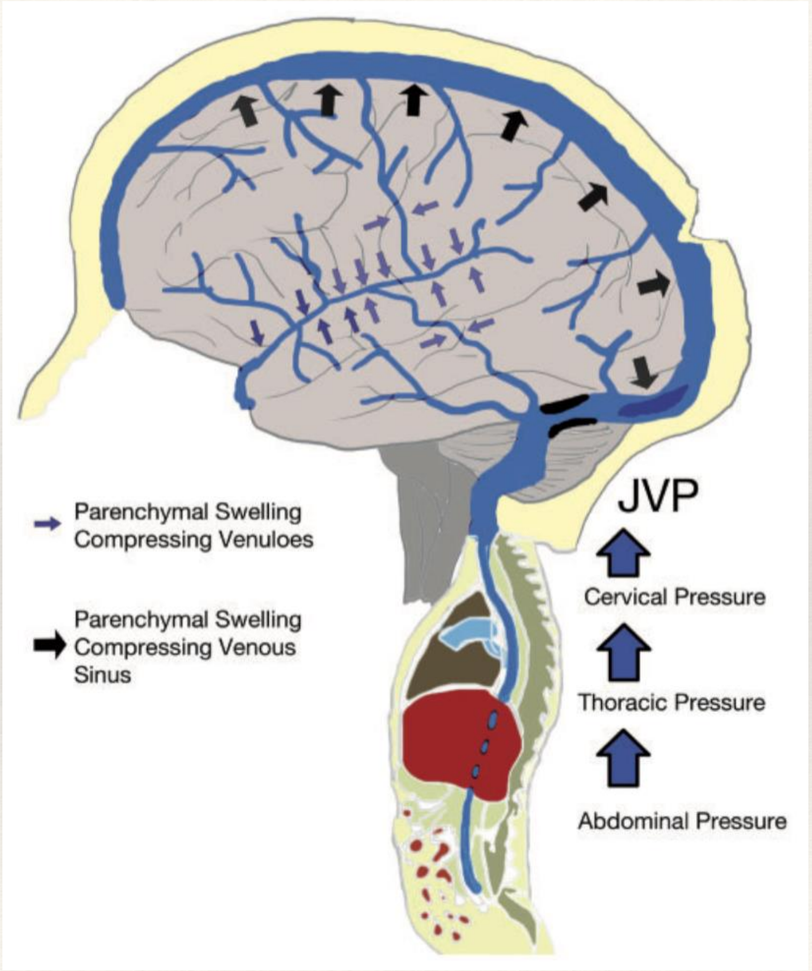
RRMS

Venous hypertension

9 yr old child!

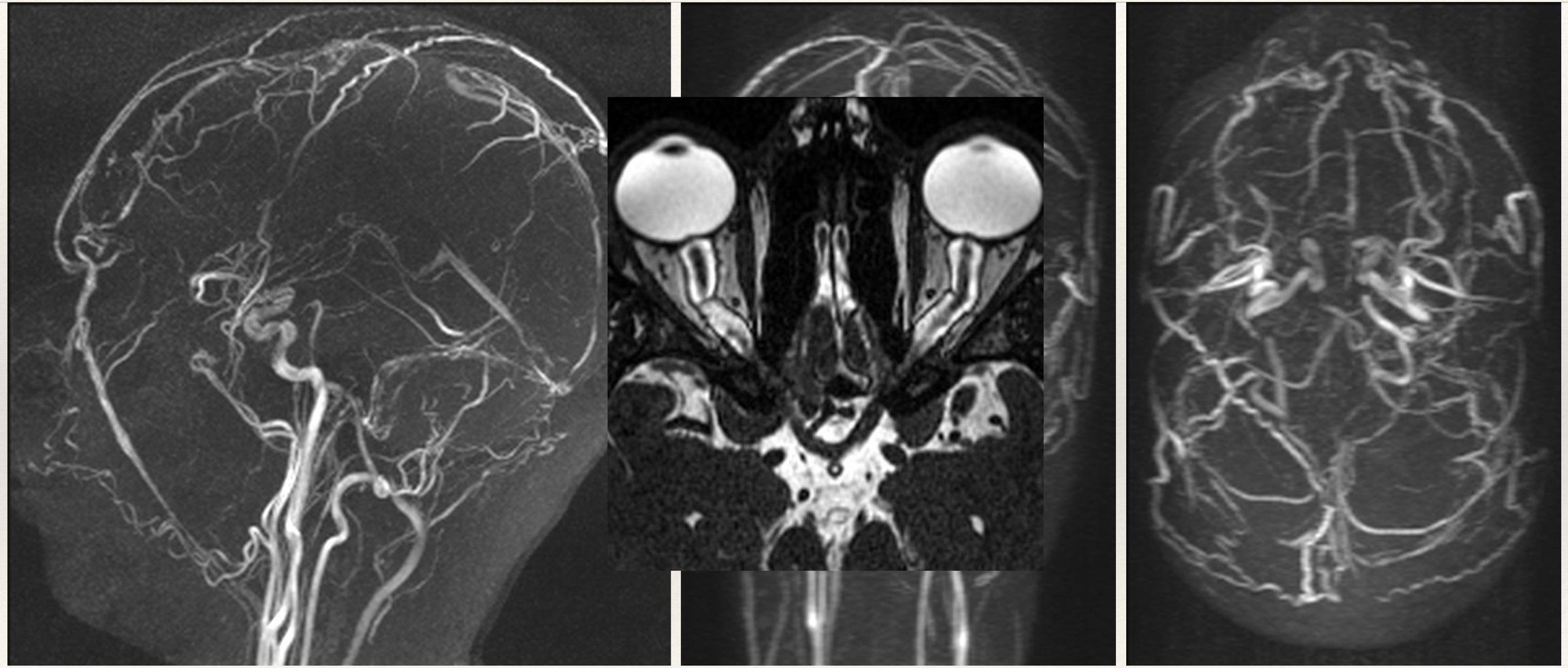


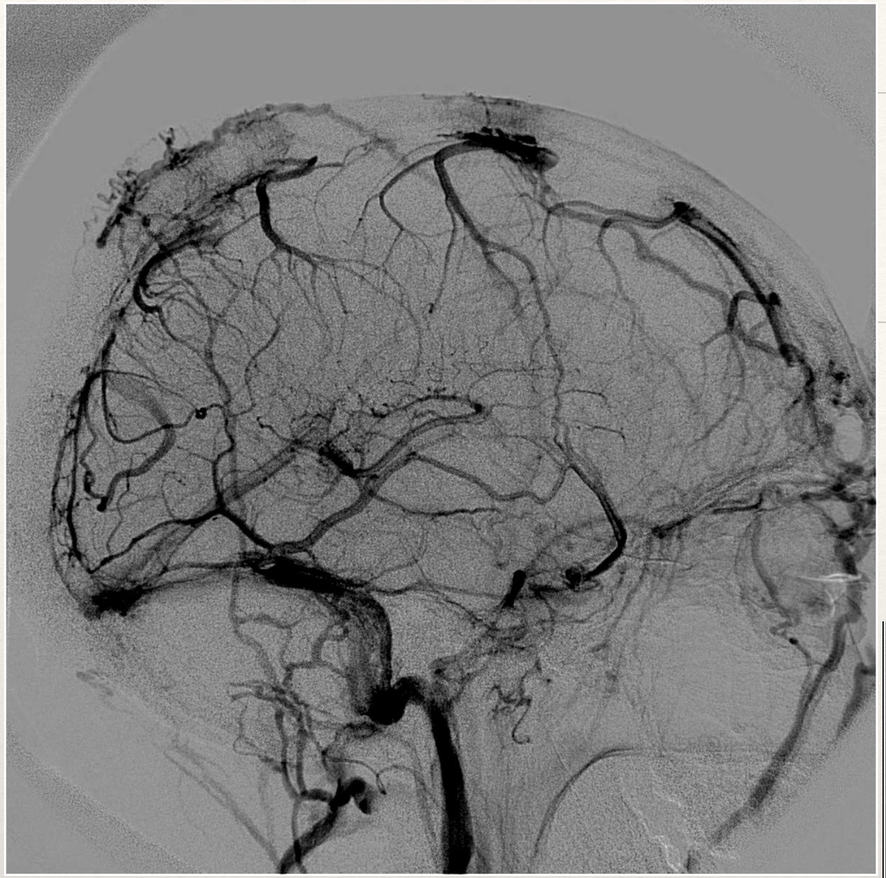
Dural venous fistula



M. Wilson , JCBFM 2016

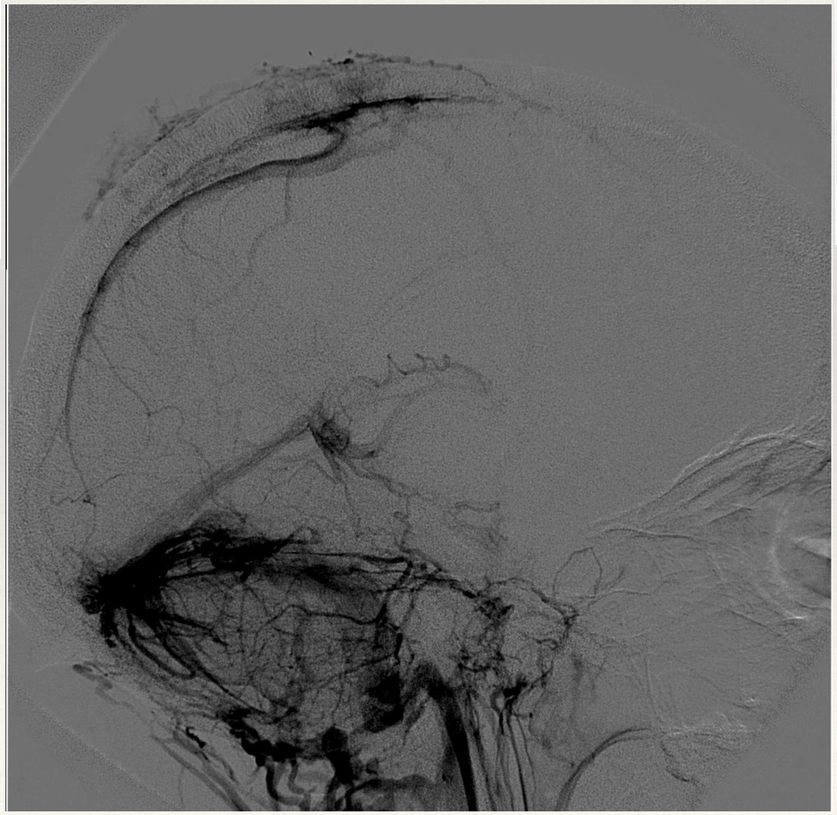
Chronic veno-obstructive disease

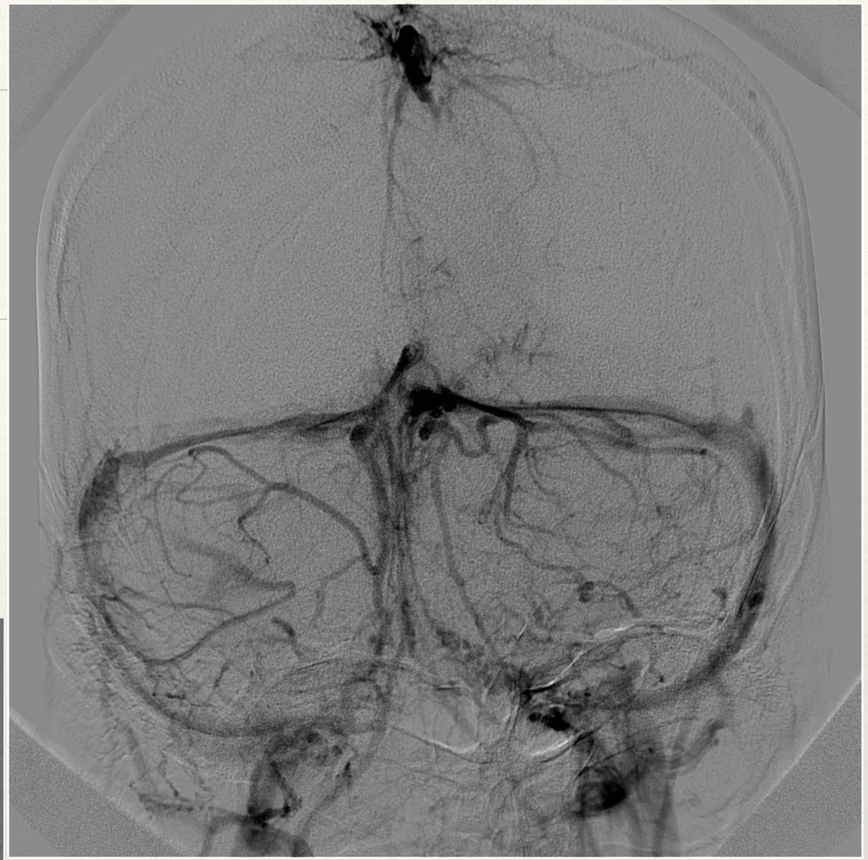




Carotid artery injection

Vertebral artery injection

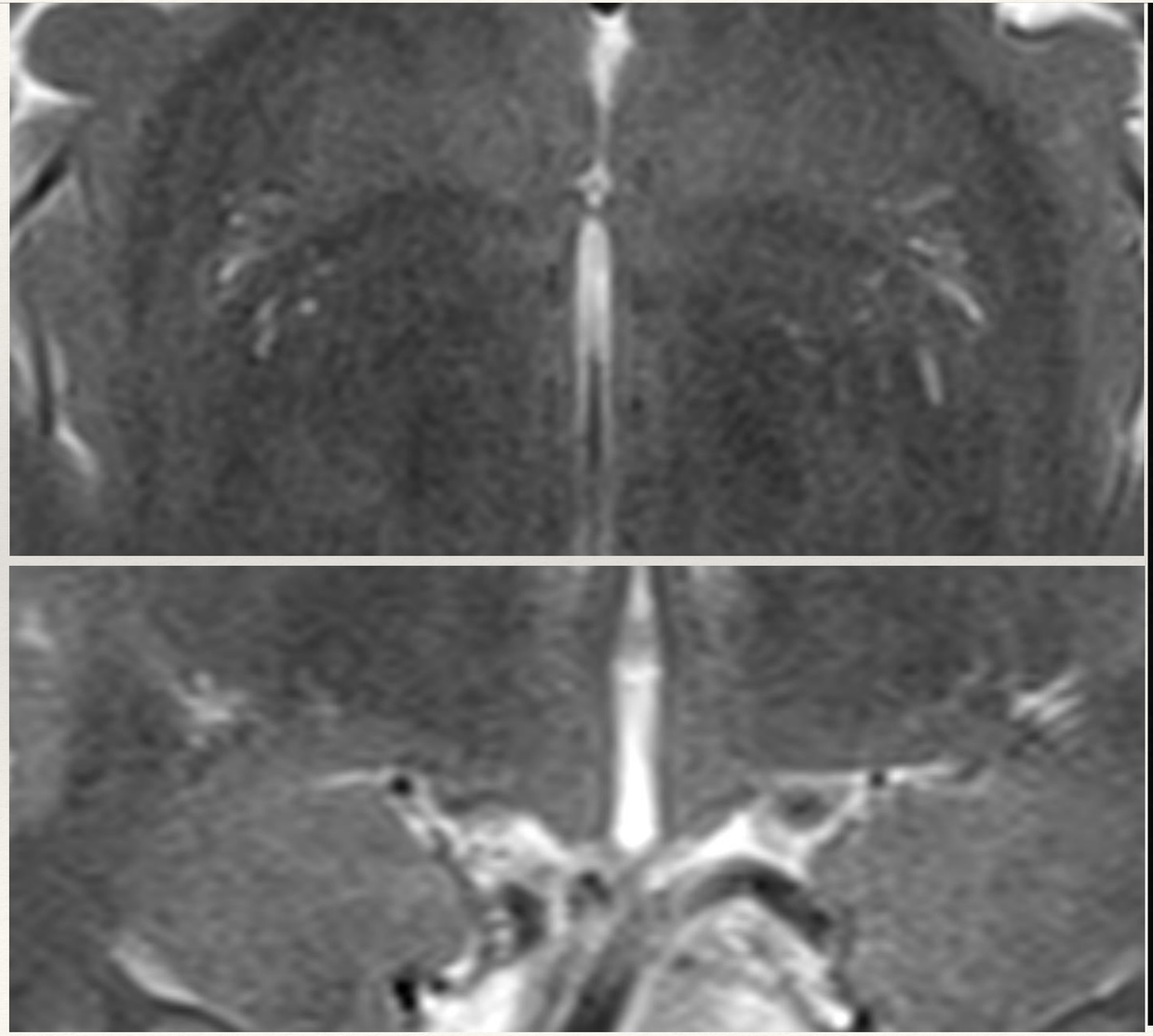


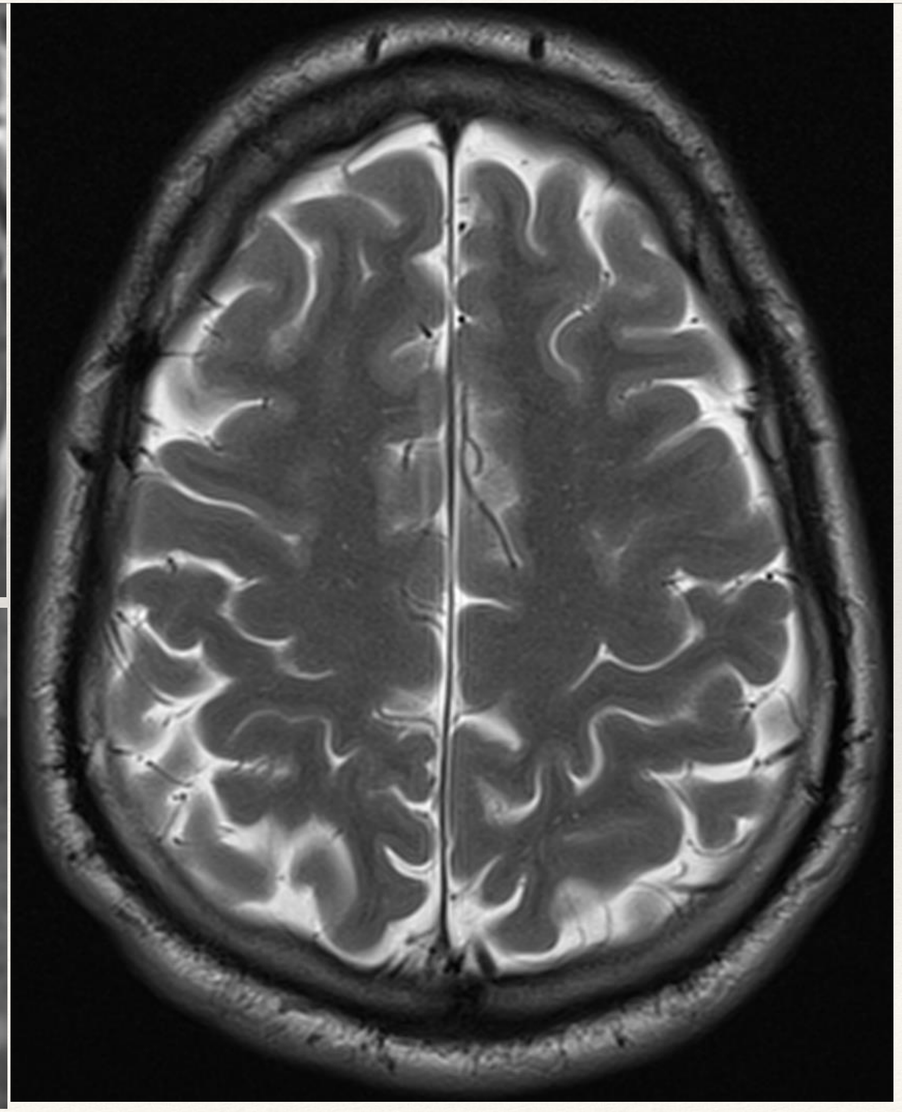


Posterior fossa, coronal view

Left high IJV stenosis

Secondary intracranial hypertension





Idiopathic intracranial hypertension

Summary

- Venous hypertension and PVS - not much MR literature to support an association
- Differentiate periarterial (VRS) from perivenous spaces
- Perivenous spaces would likely not dilate in veno-obstructive disease
- Acute venous hypertension may show EPVS with respect to chronic venous hypertension – much to be scientifically demonstrated.

Thank you!