ECMINT
European Course of
Minimally Invasive Neurological Therapy

Endovascular Treatment of Paediatric Stroke

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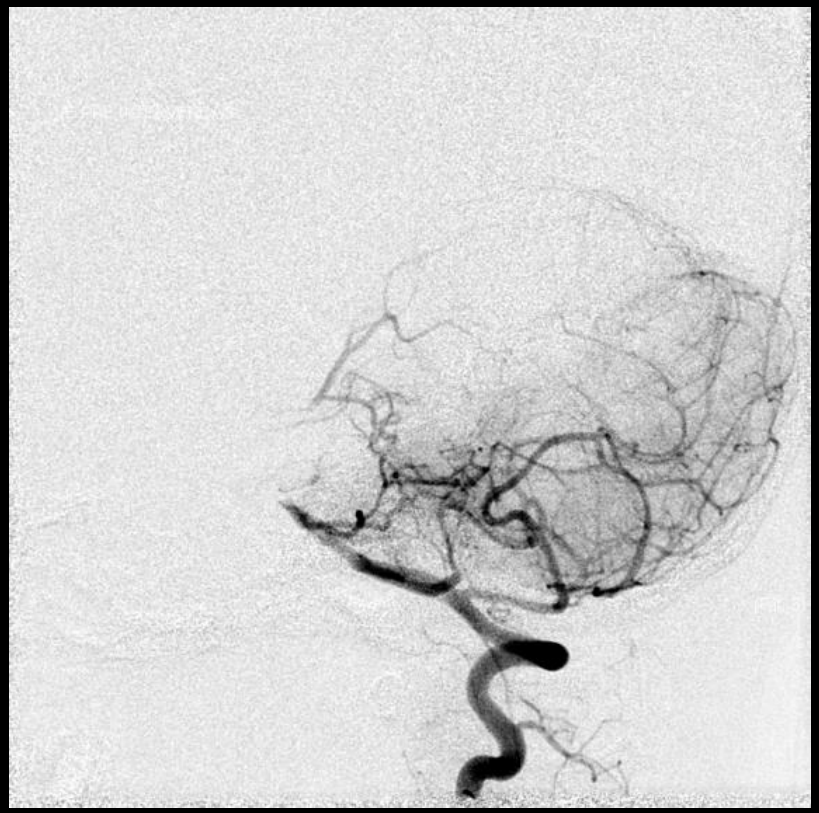
A paediatric case.....

2 year old boy acute L hemiparesis, stuttering onset, 2 days

Normal CT Head (No Contrast / CTA) ➢ MRI/A

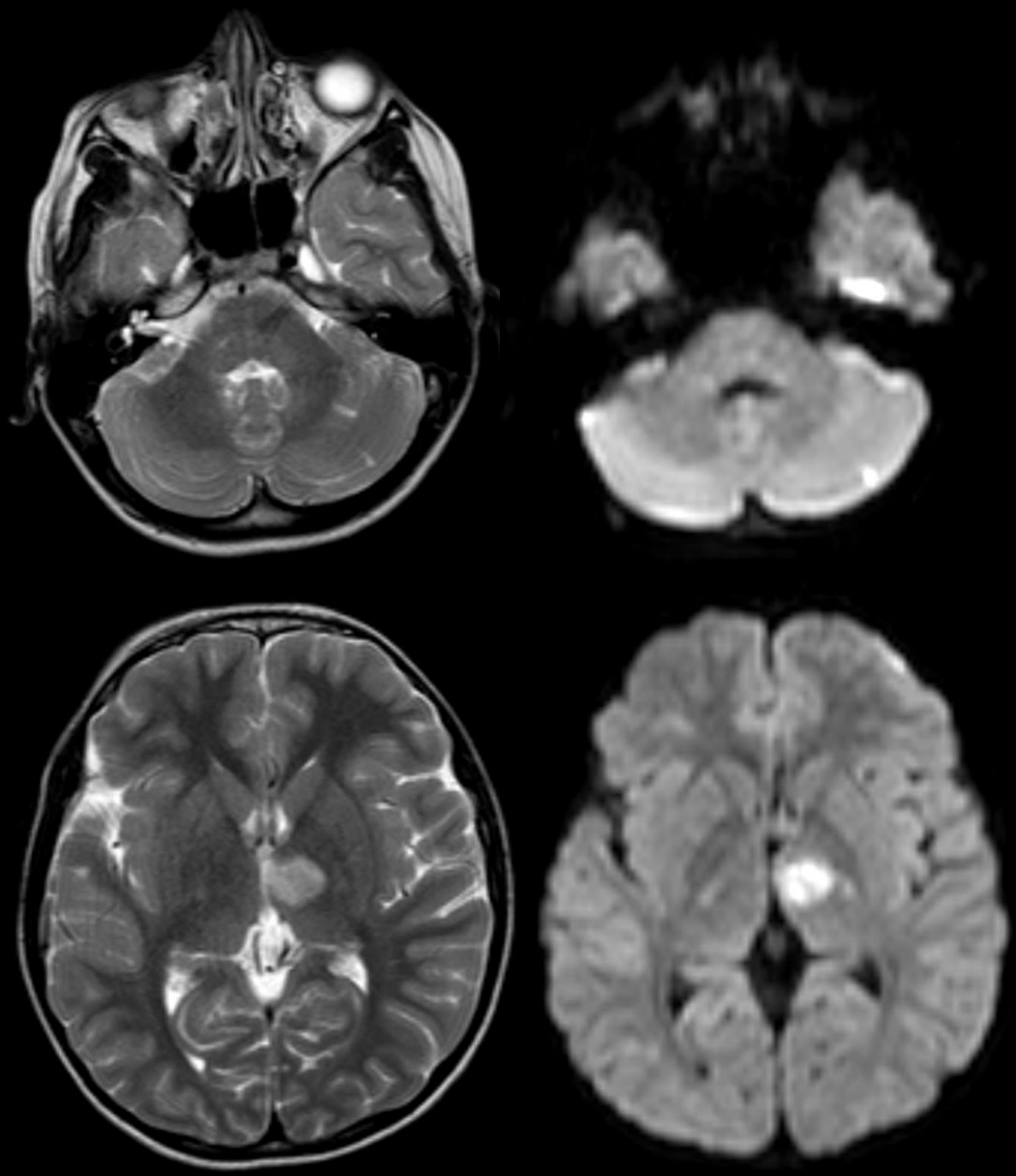
Case courtesy of Dr Isabel Fragata, Lisbon, Portugal

Aspiration & TREVO thrombectomy, multiple passes – TICI 0

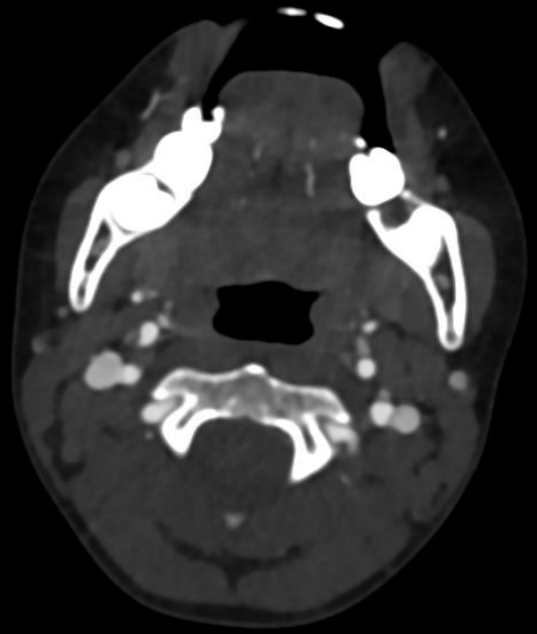


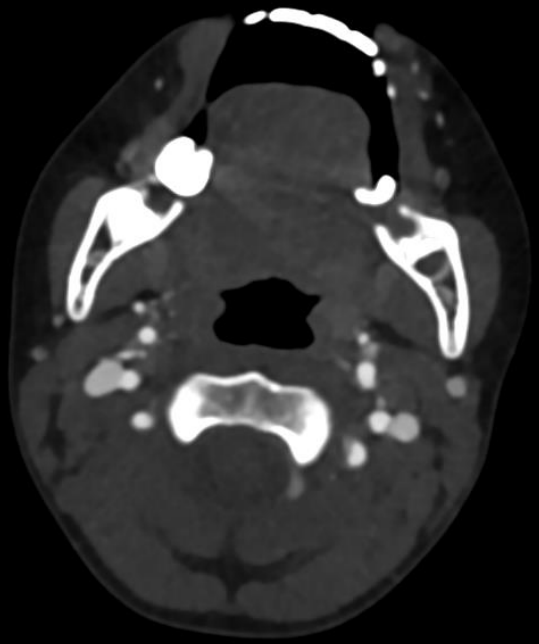
Leucocytosis, LP 12 mononuclear cells CSF VZV PCR +ve
(fever 38C, unwell 1 week)

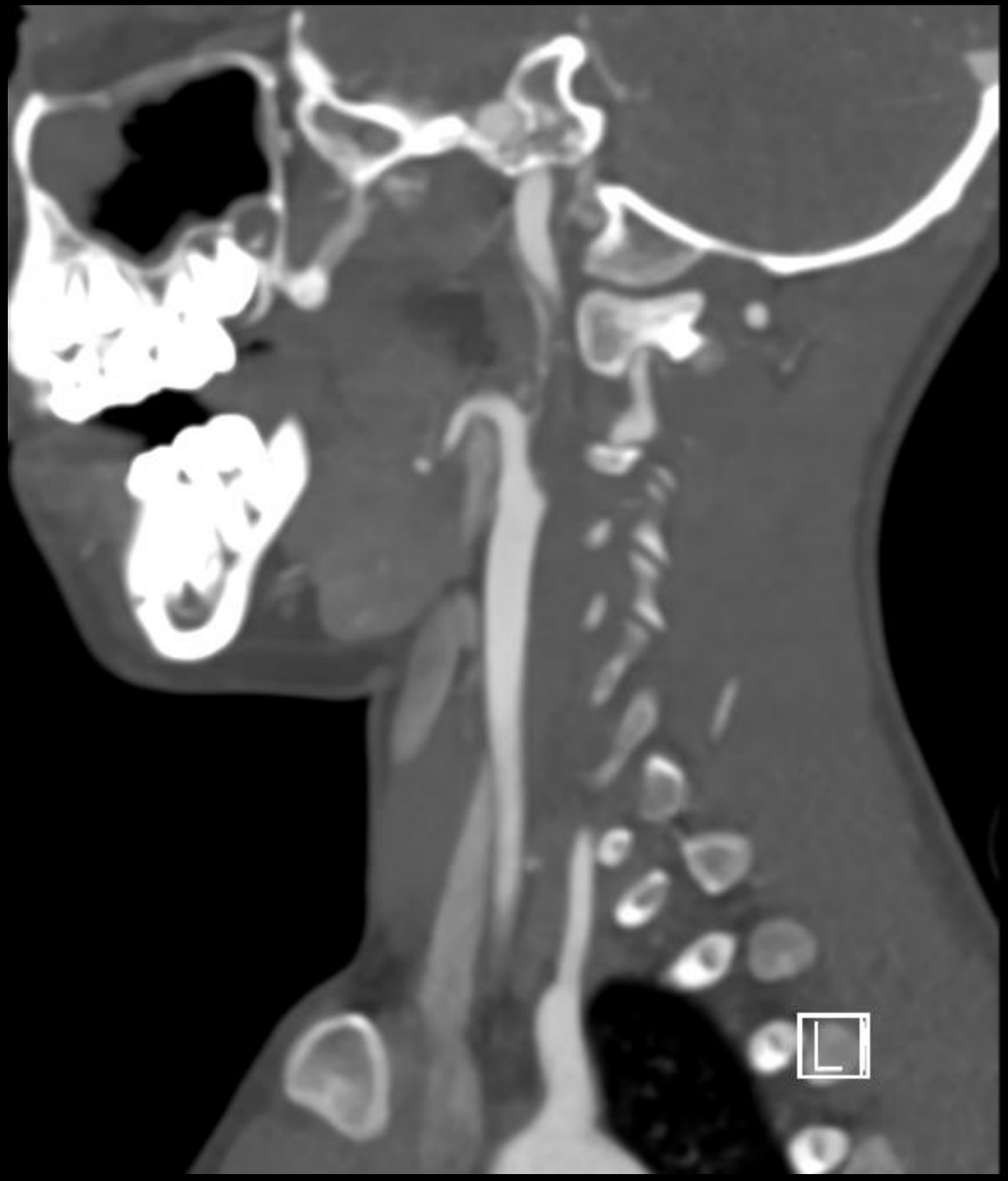
Case courtesy of Dr Isabel Fragata, Lisbon, Portugal



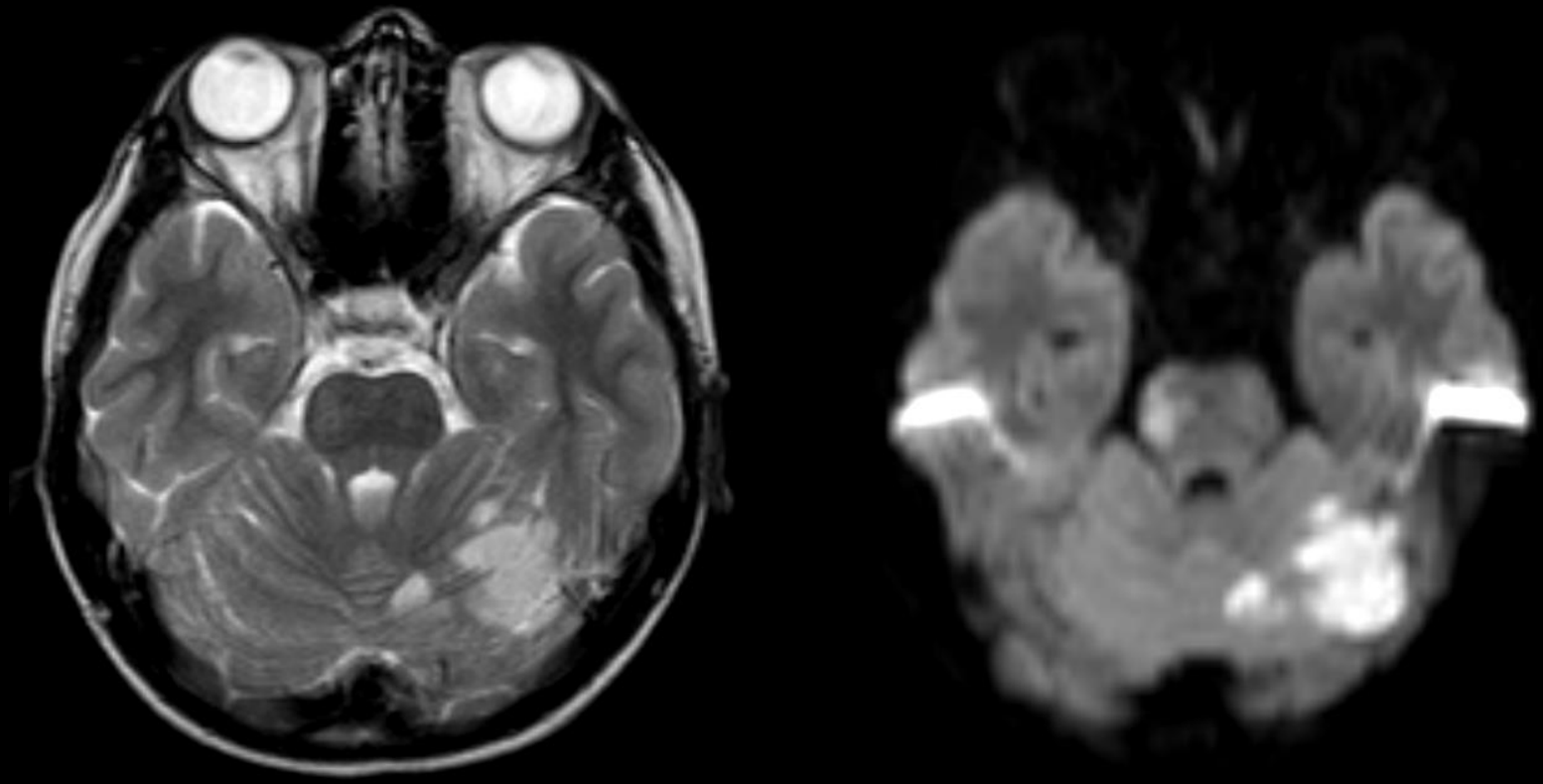
9 yr old boy
3 weeks of daily headache
2 days blurred peripheral vision
Symptoms now resolved
Examination normal



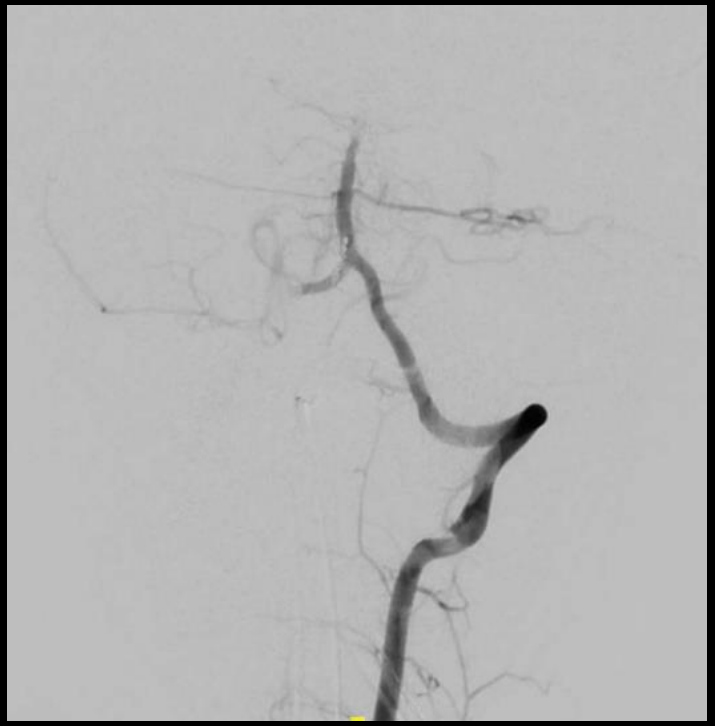


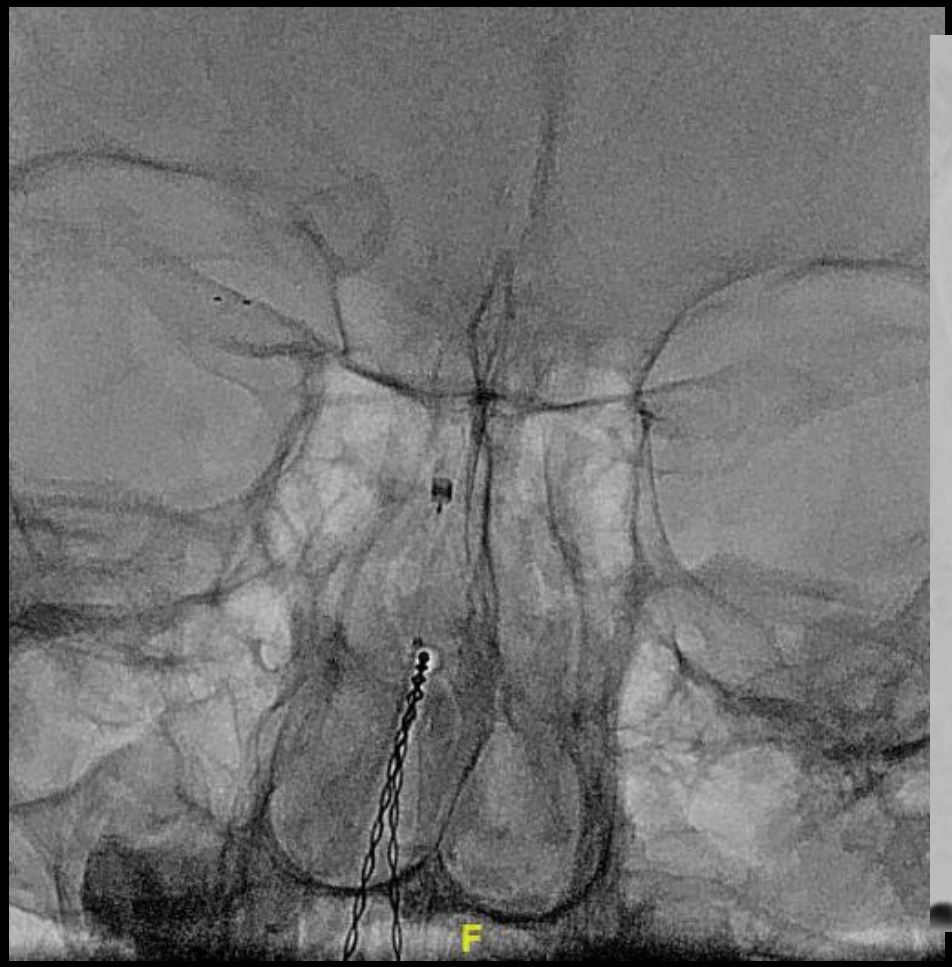


2 weeks later…
Represented with significant headache
Repeat MRI



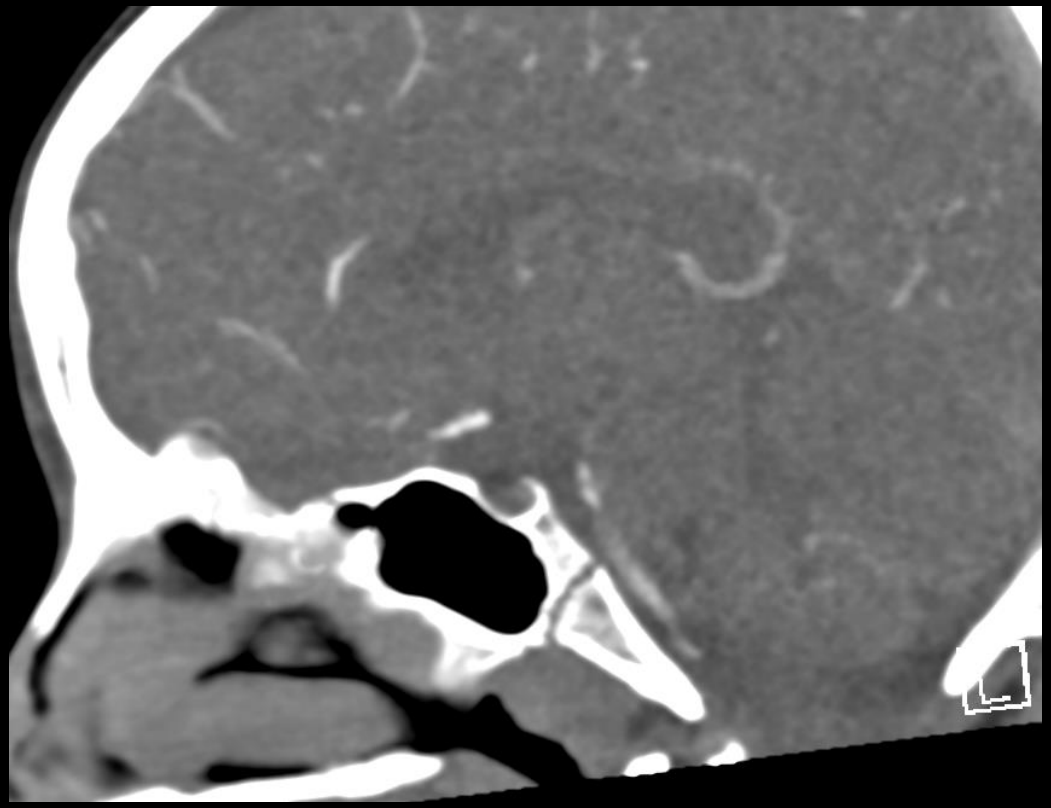
Angio
several days later



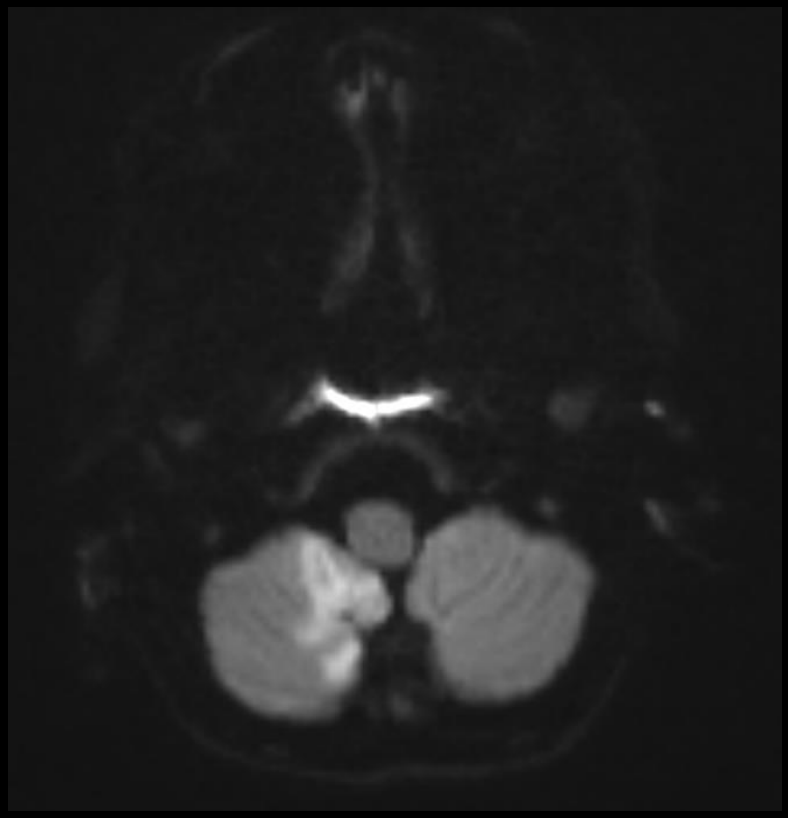


pRESET 3mm, ACE 60 with Neuronmax 8F access

10 days later
New episodic vertical diplopia, headache and left cerebellar signs

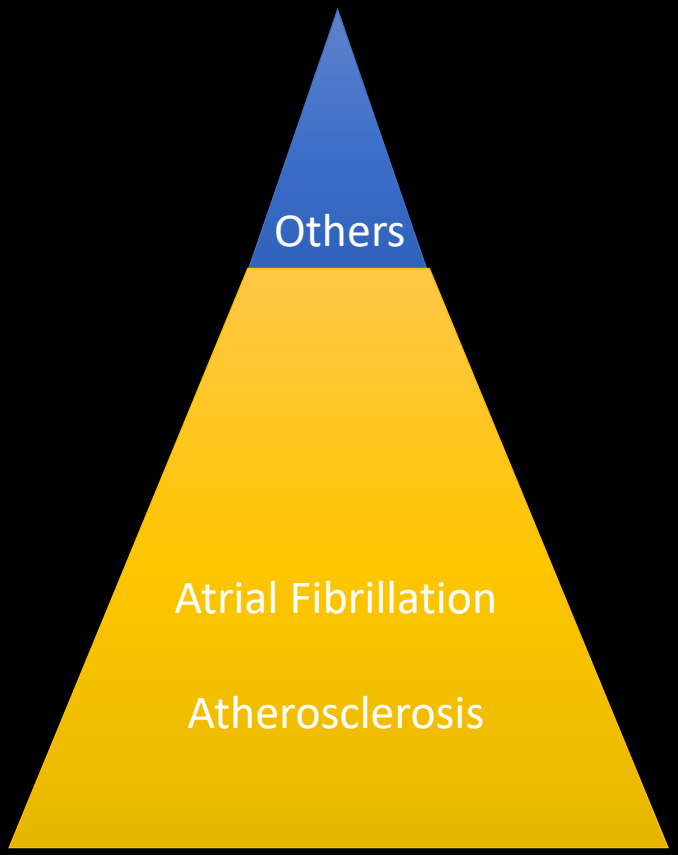


8 days later…
Yet further symptoms
Right PICA infarct on 3rd MRI



Causes of AIS

Adults



Children

Arteriopathy:

Focal cerebral arteriopathy,

Dissection,

Moya Moya

Vasculitis

Cardioembolic:

Congenital / acquired cardiac Dx

Cardiac surgery

Thrombophilia:

Inherited: FVLeiden, Pr C&S, homocysteine /α1-antitrypsin etc

Sickle Cell Disease

Chronic disease

Leukaemia

Difficulties of Paed MT

- Delayed presentation
- Large number of mimics
- Poor network infrastructure to support urgent transfers to experienced centres
- Better collateral vessels
- Unknown benefit of perfusion imaging
- High incidence of vasculopathy – ? Increased risk of MT in context of diseased vessel

- Children under 5 have smaller intracranial vessels (device selection)
  - 4F systems, intermediate catheter access, smaller suction devices, smaller stent devices (pRESET 3mm, Tigertriever 13, Trevo 3mm)

Access

- Femoral/iliac artery size is the greatest restriction to access
- By age 5 the cervicocranial vessels have reached approx. 90% of their adult diameter

Table IV: Percentage of the Adult Diameter Attained at Different Age Groups for Internal Carotid Artery, Iliac Artery, Anterior and Middle Cerebral Artery

Group	ICA-petrous	ICA-cavernous	ICA-supraclinoid	ICA-choroidal	MCA	ACA	Iliac artery
1 (0-6 mo)	60	67	76	79	87	74	36
2 (6-12 mo)	73	75	83	85	92	85	40
3 (12-24 mo)	76	79	86	90	96	91	47
4 (24-48 mo)	81	86	90	94	99	93	59
5 (48-72 mo)	81	83	88	92	100	94	63
6 (72 mo&up)	93	97	99	100	100	93	77

Angiographic Morphometry of Internal Carotid Artery Circulation in Turkish Children

Yonca Ozkan ARAT[1,2], Anil ARAT[3], Kubilay AYDIN[4]

Turk Neurosurg 2015, Vol: 25, No: 4, 608-616

Paediatric MT evidence

Endovascular Therapies for Acute Ischemic Stroke in Children

Mary In-Ping Huang Cobb, MD; Avra S. Laarakker, MD; L. Fernando Gonzalez, MD; Tony P. Smith, MD; Erik F. Hauck, MD; Ali R. Zomorodi, MD

(*Stroke*. 2017;48:2026-2030.

- Pooled analysis of published 68 individual cases
- 24 papers

- Bias…

Table 2. Clinical and Radiographic Outcomes

	All	Intra-Arterial Fibrinolysis	Mechanical Thrombectomy	*P* Value
Vessels occluded, n (%)	68 (100)	24 (35.3)	44 (64.7)	
Anterior	35 (51.5)	13 (19.1)	22 (32.4)	0.74
Posterior	31 (45.6)	11 (16.2)	20 (29.4)	0.98
Both	2 (2.9)	0 (0)	2 (2.9)	0.23
Time to treatment, average hours (range)*	65	24 (36.9)	41 (63.1)	
	13.7 (1.5–72.0)	13.7 (2.2–72.0)	13.6 (1.5–72.0)	0.98
Recanalization,* n (%)	61	18 (29.5)	43 (70.5)	
Complete	41 (67.2)	7 (11.5)	34 (55.7)	0.002
Incomplete	17 (27.9)	9 (14.8)	8 (13.1)	
None	3 (4.9%)	2 (3.2)	1 (1.6)	
Good clinical outcome,† n (%)	67	23 (34.3)	44 (65.7)	
Yes	44 (65.7)	9 (13.4)	35 (52.2)	0.001
Complications, n (%)	64	20 (31.3)	44 (68.7)	
Any	15 (23.4)	9 (14.1)	6 (9.4)	0.006
Any symptomatic	4 (6.3)	3 (4.7)	1 (1.6)	
Hemorrhage	11 (17.2)	7 (10.9)	4 (6.3)	0.01
Symptomatic hemorrhage	1 (1.6)	1 (1.6)	0 (0)	

Paediatric MT evidence

J Neurosurg Pediatr. 2019 Aug 9:1-14. doi: 10.3171/2019.5.PEDS19126. [Epub ahead of print]

Mechanical thrombectomy in pediatric stroke: systematic review, individual patient data meta-analysis, and case series.

Bhatia K[1,2], Kortman H[1], Blair C[3], Parker G[2], Brunacci D[2], Ang T[2,3], Worthington J[3], Muthusami P[4], Shoirah H[5], Mocco J[6], Krings T[1].

Author information

Meta-analysis of 113 cases of MT
Incomplete follow-up
90% (87 of 96) good long-term neurological outcomes
88% recanalisation TICI 2b/3

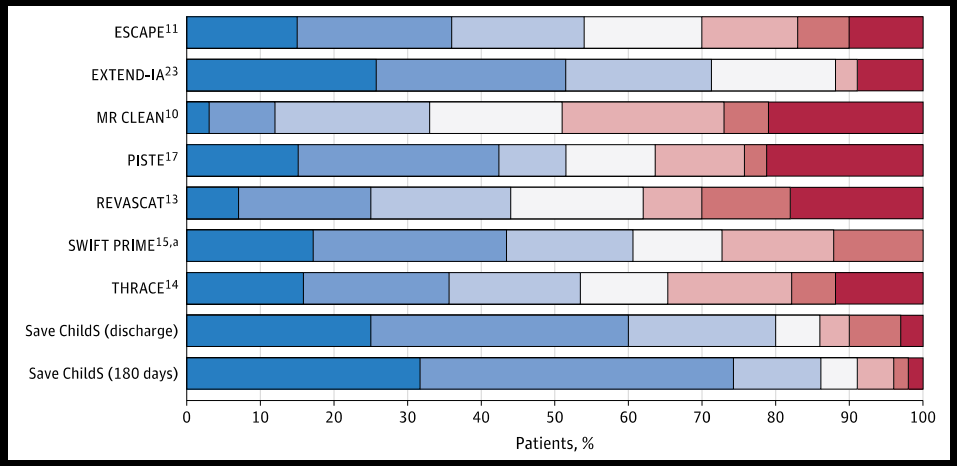
“MT may be considered for AIS due to large vessel occlusion in children” (II b evidence)

JAMA Neurology | Original Investigation

Feasibility, Safety, and Outcome of Endovascular Recanalization in Childhood Stroke

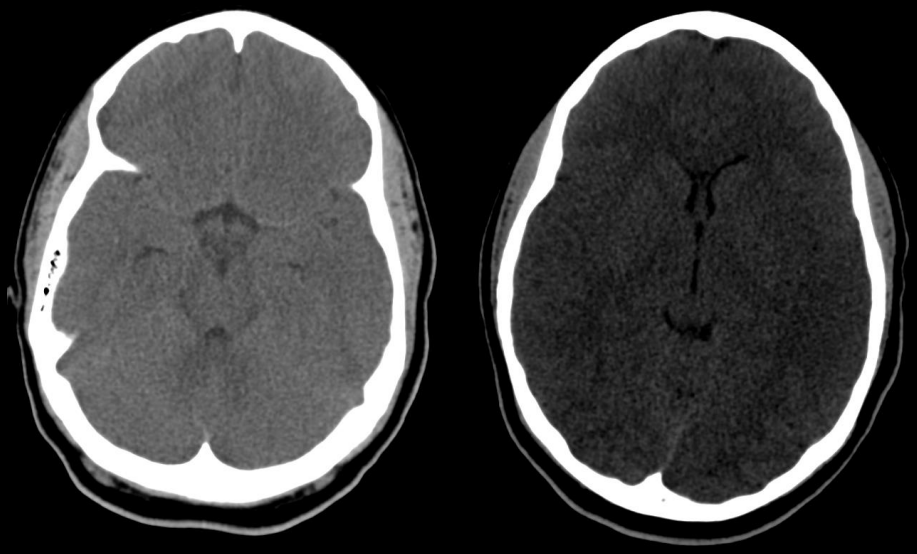
The Save ChildS Study

- Retrospective multicentre
- 73 children (av. Age 11.3)
- Median: 3 hours onset to admission
- CASCADE
  - FCA 6
  - Bilateral arteriopathy 1
  - Cervical arteriopathy 7
  - Cardioembolic 32
  - Other 27

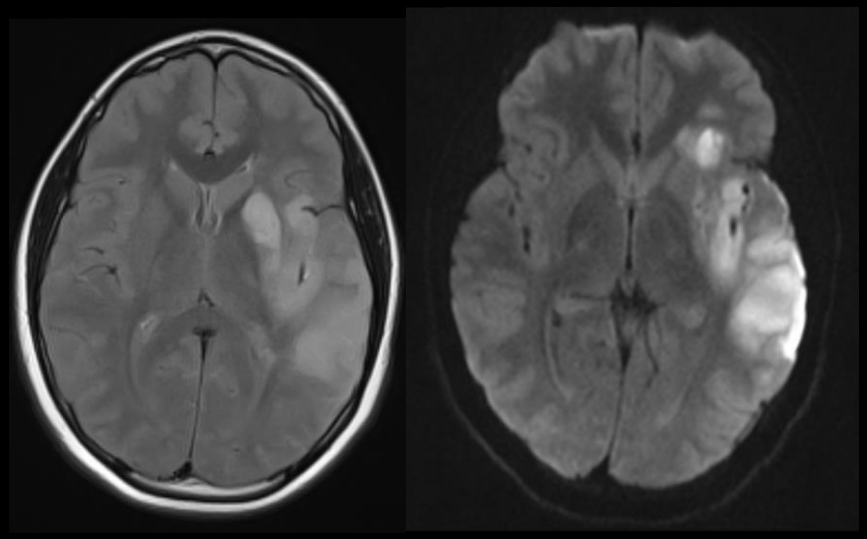


- Low complication rate (1 haemorrhage)
- Median mRS 1, PSOM 0.5 at 6 months

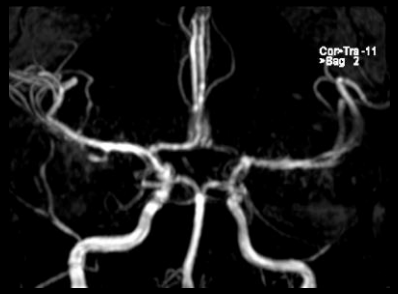
JAMA Neurol. doi:10.1001/jamaneurol.2019.3403
Published online October 14, 2019.



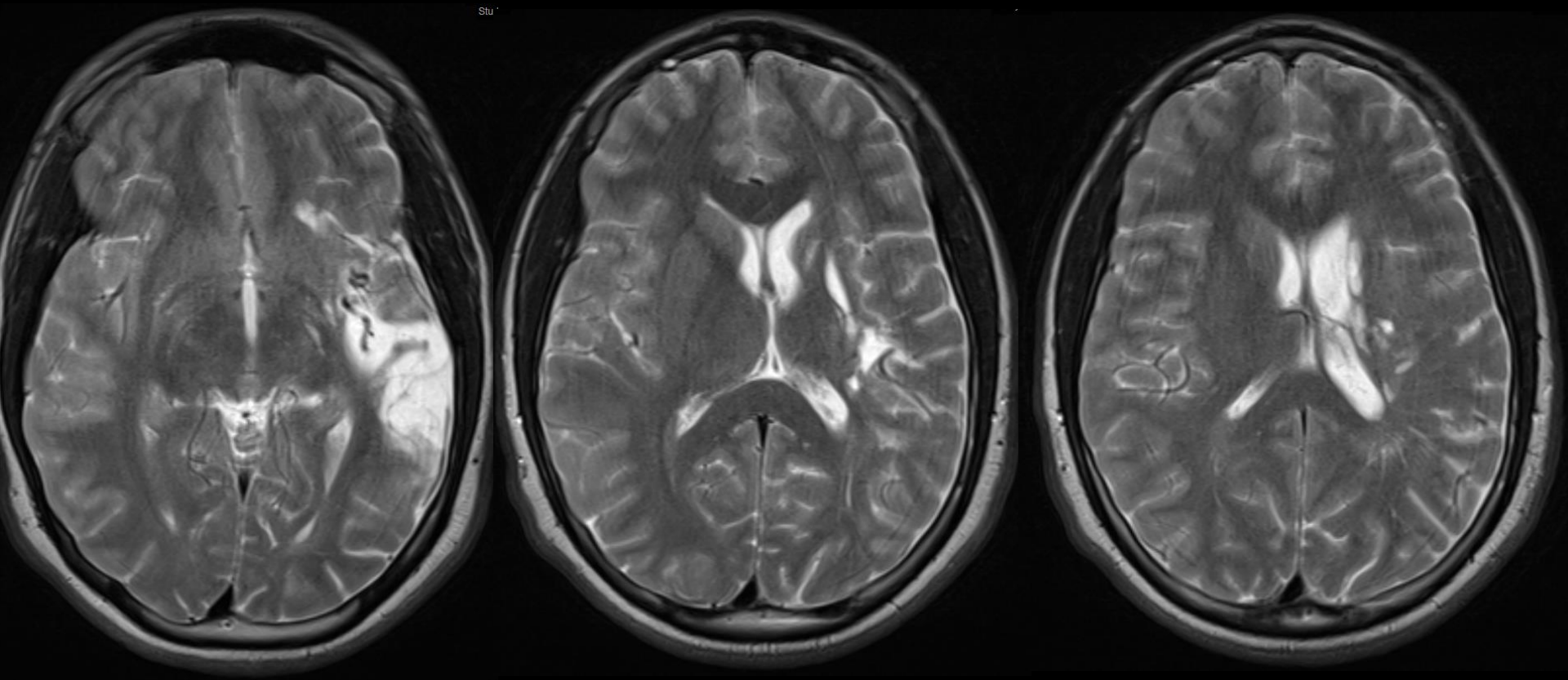
2 hours



26 hours

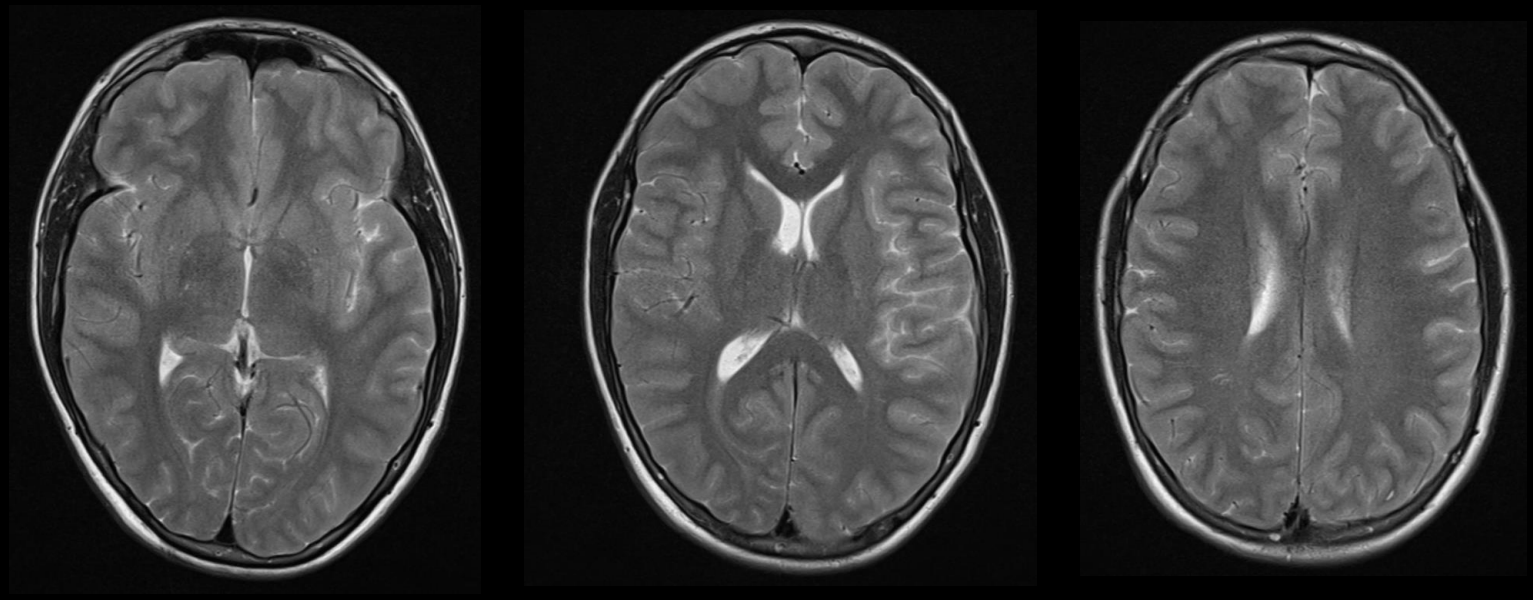


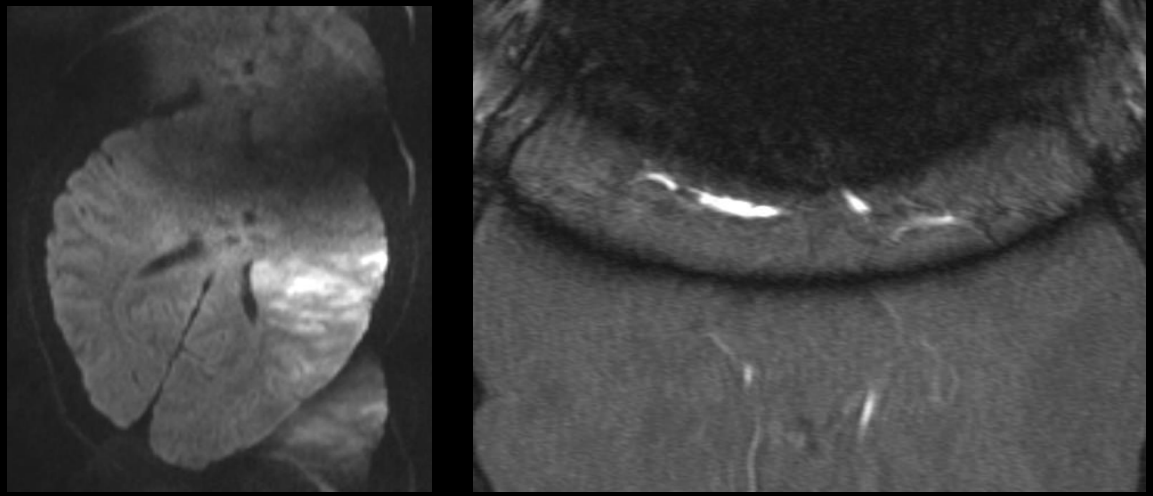
14y M, sudden collapse during cross-country run
Dense R hemiparesis & aphasia

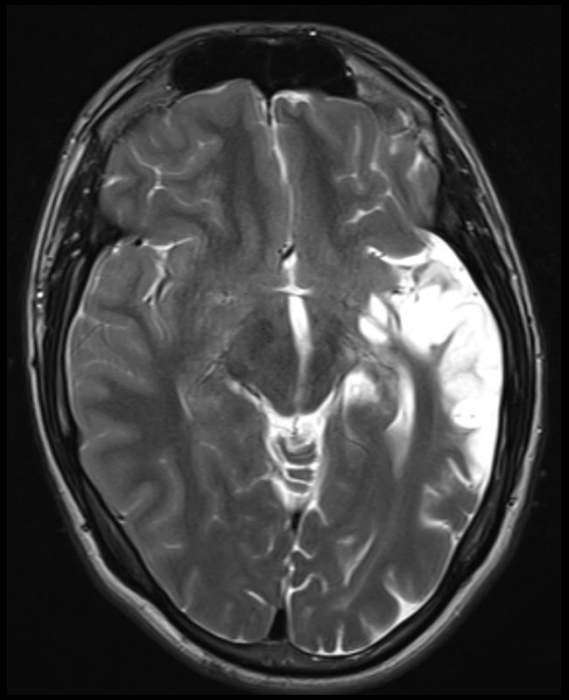
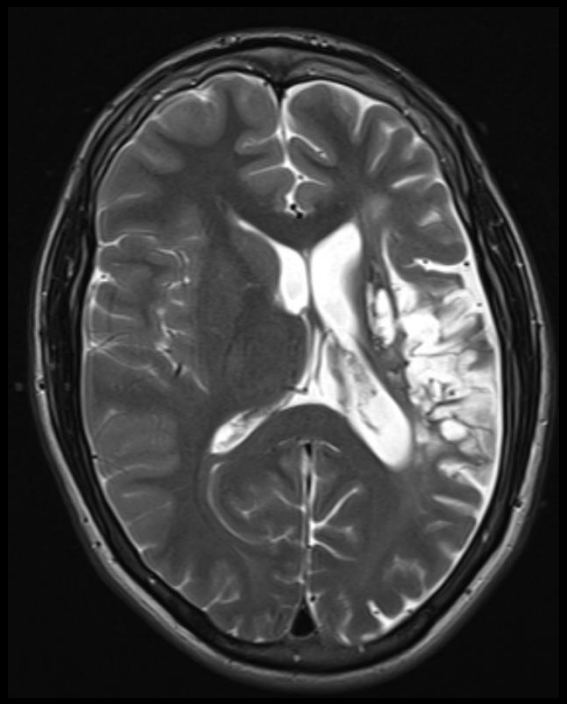
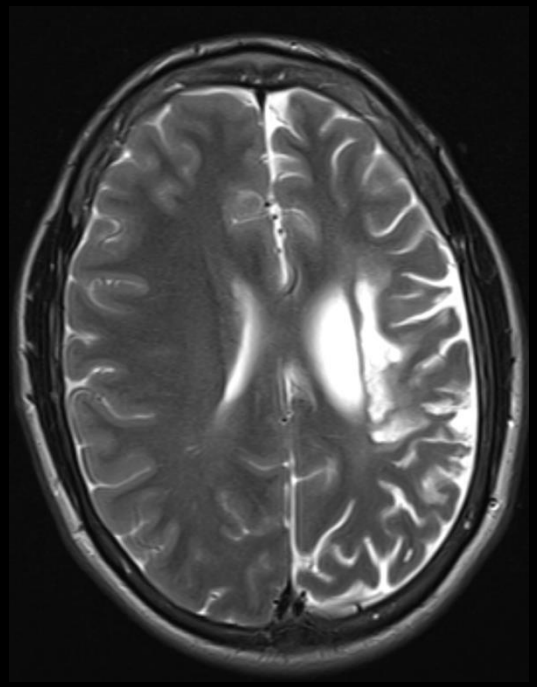
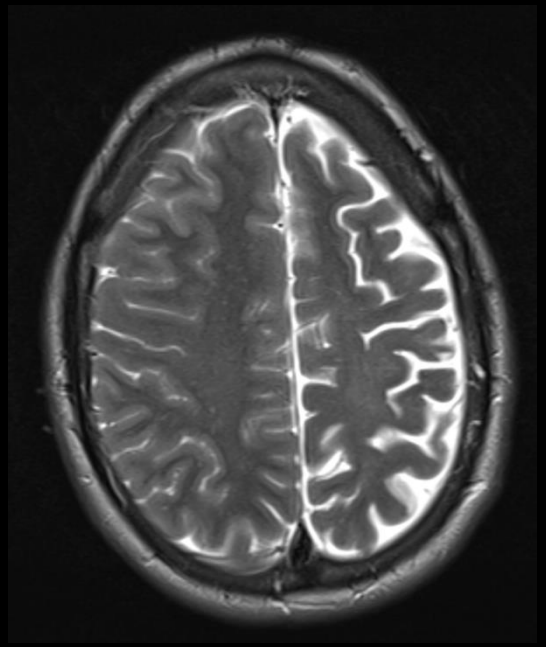


2 years later:
no motor deficit, speech normal
Returned to normal school 11 GCSE

14 yr boy, right sided dense hemiparesis, dense MCA on CT 10 hrs

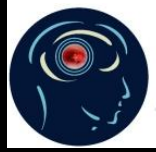




PETITE:
Pediatric Endovascular Therapy after Imaging in acuTE stroke

PIs: Gregory W Albers, MD, Sarah Lee, MD
Stanford Stroke Center / Stanford Children's Health
StrokeNet Steering Committee 6/12/19



STANFORD STROKE CENTER
Stanford University Medical Center

Stanford Children's Health | Lucile Packard Children's Hospital Stanford

Primary aim

To determine if children who meet target mismatch criteria are more likely to benefit from MT

MRI/MRA/MR Perfusion or CT/CTA/CT Perfusion*:

Core*: < 50 mL (age 5-10)
< 70 mL (age 11-17)

AND

Mismatch ratio** ≥ 1.8

AND

Mismatch volume ≥ 15 ml

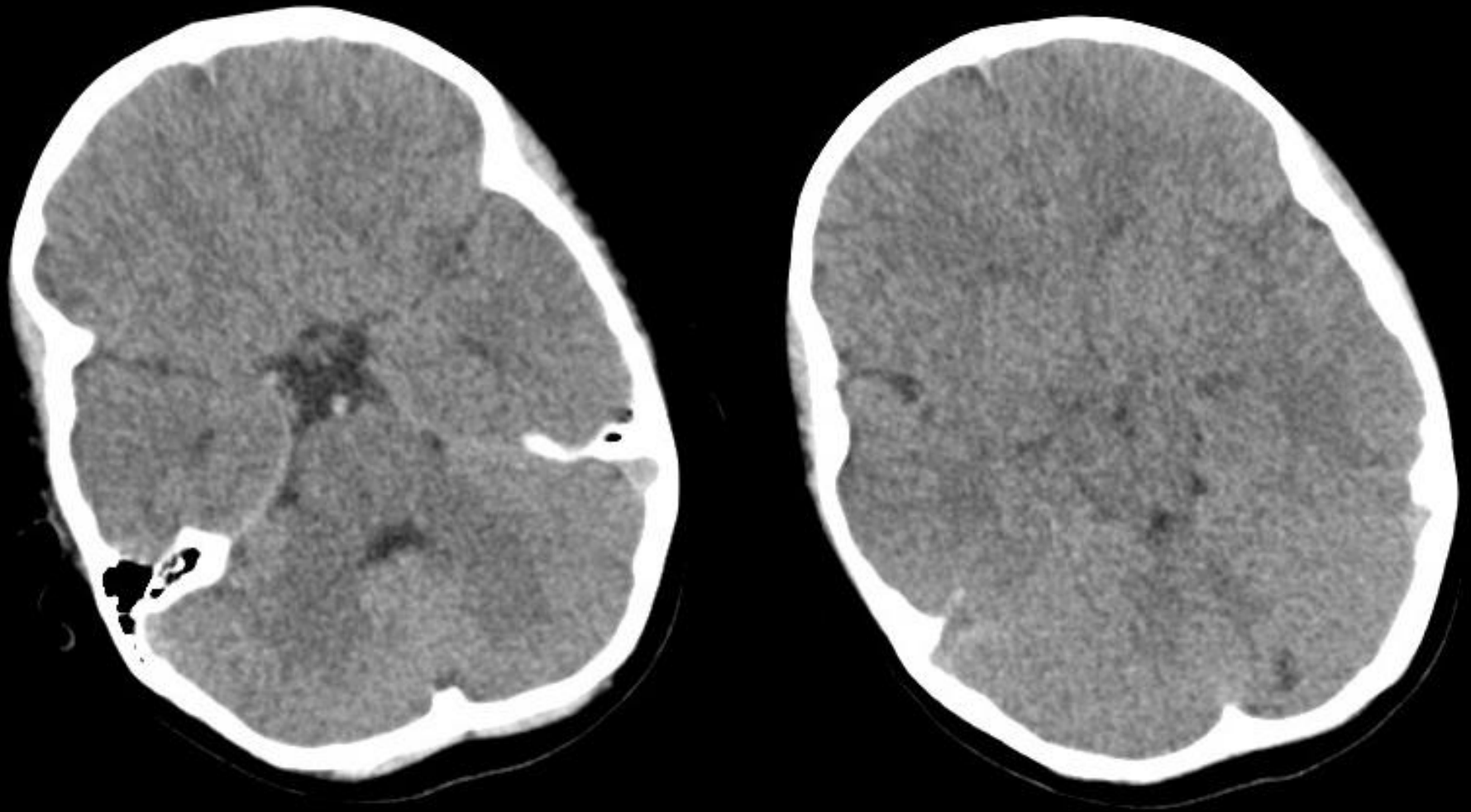
MRI/MRA without perfusion:

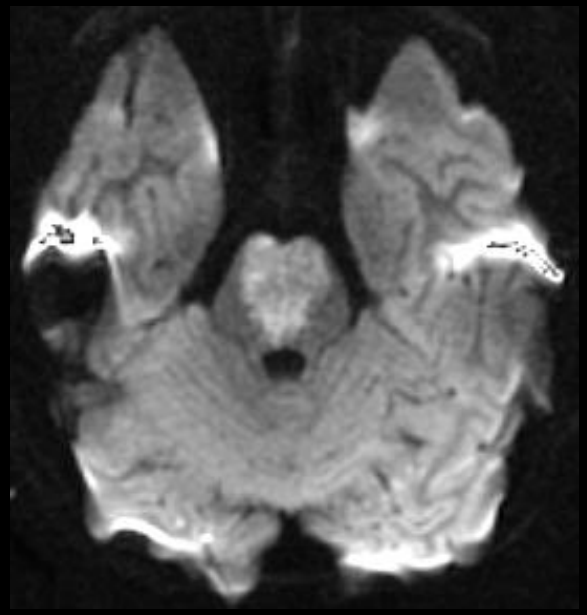
DWI lesion volume < 25 mL

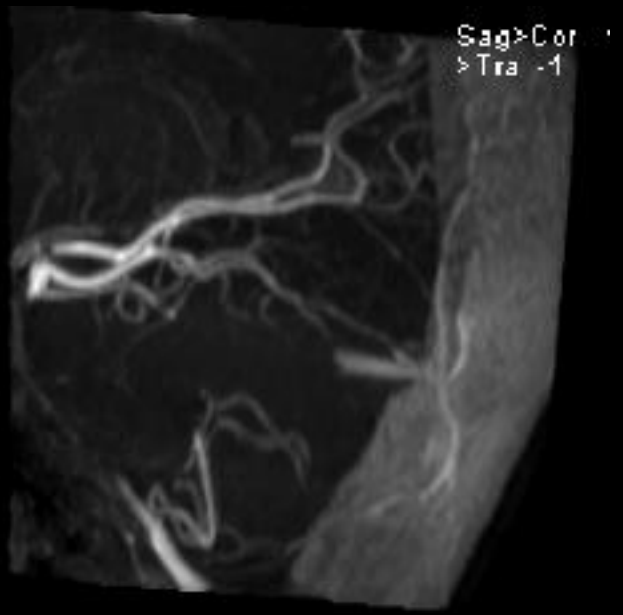
CT/CTA:

ICA, M1 or proximal M2 occlusion AND ASPECTS ≥ 8

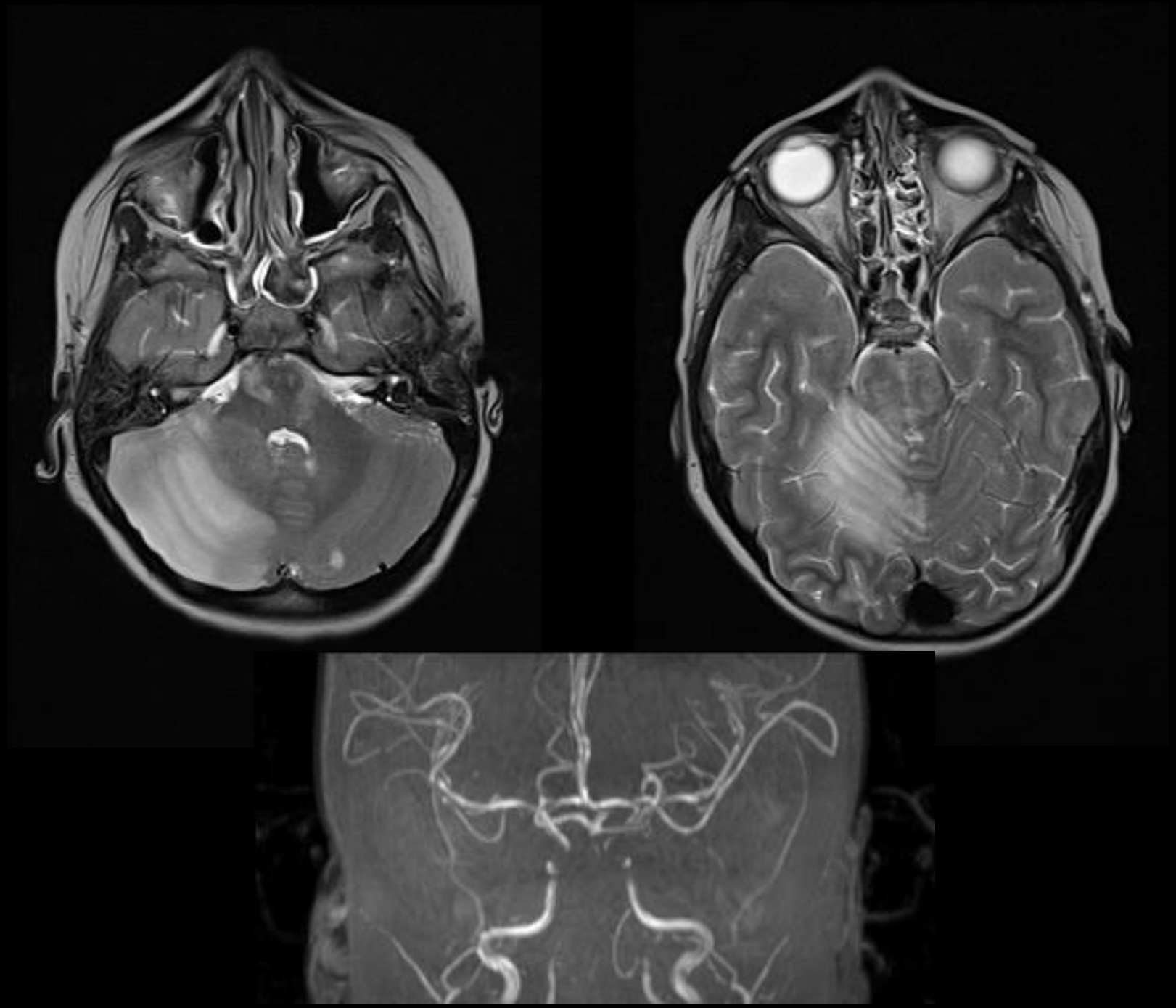
8 yrs F, 6 hr history, drowsy, difficulty walking
CT “normal”







At 12h became acutely unconscious
MRI done at 36h



Role of endovascular therapy in children…?

- Paed NIHSS >4
- Within 5 hours of stroke onset
- Large cerebral artery occlusion (basilar, ICA, M1)
- Favourable profile of salvageable brain on imaging
  - Extend to 24 hours
- Experienced centre for paediatric arterial (cerebral) procedures
- Mechanical thrombectomy (rather than IA tPA)

Summary

- Paediatric stroke has radically different aetiologies
- Image early, preferably MRI/A
  - Perfusion imaging??
- Consider all differentials
- Involve neurology and haematology (and others) in decision making and therapy