Lausanne, Swiss Stroke Society, January 11th, 2018

Imaging selection criteria for late revascularisation or: when is thrombectomy still justified?

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The Impact of Recanalization on Ischemic Stroke Outcome

A Meta-Analysis

Joung-Ho Rha, MD; Jeffrey L. Saver, MD

- Recanalisation within 6 h after symptom onset improves the prognosis in most patients

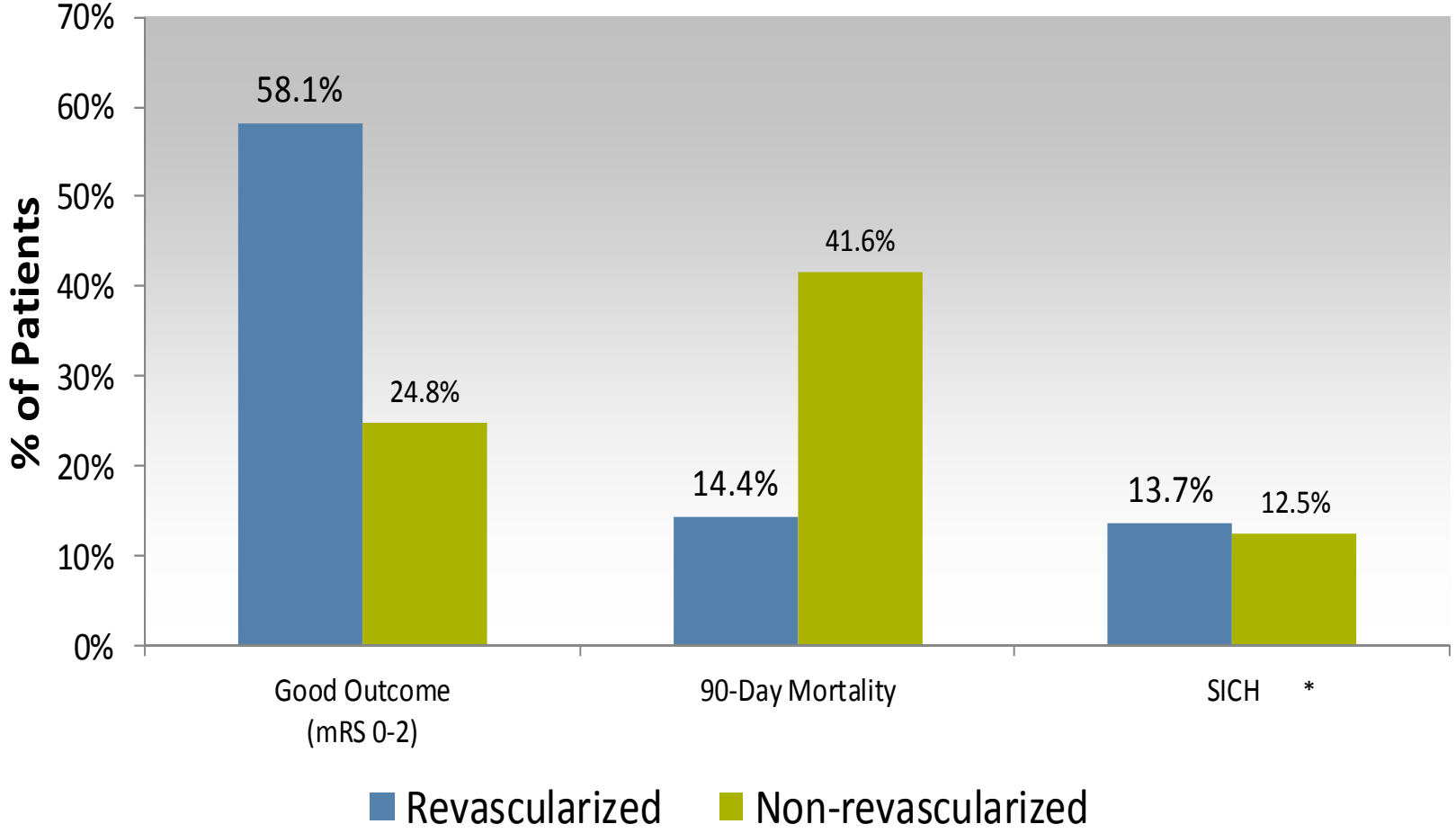
- Studies performed with multimodal magnetic resonance or computed tomography imaging indicating that selected patients still harboring substantial residual penumbra beyond 6 hours will benefit from reperfusion

Stroke 2007

Recanalisation rates

- spontaneous → 24.1%
- intravenous fibrinolytic → 46.2%
- intra-arterial fibrinolytic → 63.2%
- combined IV - intra-arterial → 67.5%
- Mechanical → 83.6%

Meta-Analysis showed strong correlation between vessel revascularisation and good clinical outcome



1985 -2002
998 pts.

*Differences in sICH were not statistically significant between the revascularized and non-revascularized groups

Rha JH, Saver JL. The impact of recanalization on ischemic stroke outcome: a meta-analysis. Stroke. 2007 Mar;38(3):967-73.

What is late?

DAWN study

- Should thrombectomy be performed between 6 and 24 hours after symptom onset rsp. in case of unkwown time window?
- Initially 500 patients were planned, study was stopped after enroling 206 pat. because of positive results demonstrated in thrombectomy group
- Median of treatment 13 hours after patient was last seen well
- Recanalisation rate (TICIIb/TICIIII) 84%

DAWN study

- Modified Rankin-scale (mRS) 0–2
  - 48,6% in thrombectomy group
  - 13,1% in control group

→ Absolute difference of 35,5% with relative risk reduction of 73%

→ Hemorrhage low (6 vers. 3%)

→ Mortality even

→ Number needed to treat: 2.8

(subgroup analysis of ESCAPE: 2,6)

DAWN Studie

- DAWN-Study was hugely successful in shifting the limits of stroke therapy in time
- → probably the number of eligible patients for thrombectomy will increase

Imaging selection criteria DAWN

Imaging Inclusion Criteria:

Occlusion of the intracranial ICA and/or MCA-M1
as evidenced by MRA or CTA

< 1/3 MCA territory involved, as evidenced by CT or MRI

Clinical Imaging Mismatch (CIM) defined as one of the following on MR-DWI or CTP-rCBF maps:

- 0-<21 cc core infarct and NIHSS ≥ 10 (and age ≥ 80 years old)
- 0-<31 cc core infarct and NIHSS ≥ 10 (and age < 80 years old)
- 31 cc to <51 cc core infarct and NIHSS ≥ 20 (and age < 80 years old)

What is late ?

Type of stroke onset — no. (%)‡		
On awakening	67 (63)	47 (47)
Unwitnessed stroke	29 (27)	38 (38)
Witnessed stroke	11 (10)	14 (14)

In all patients onset of symptoms was beyond 6 hours before thrombectomy was started

The median interval between the time the patient was last known to be well and reperfusion was 13.6 hours (interquartile range, 11.3 to 18.0) in thrombectomy group (84% TICI 2b/3)

What is late ?

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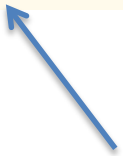


Small proportion, the real time interval is not given

5 randomised multicenter studies („big five“) showed superiority of thrombectomy compared to iv lysis (meanwhile „magnificent 7“)

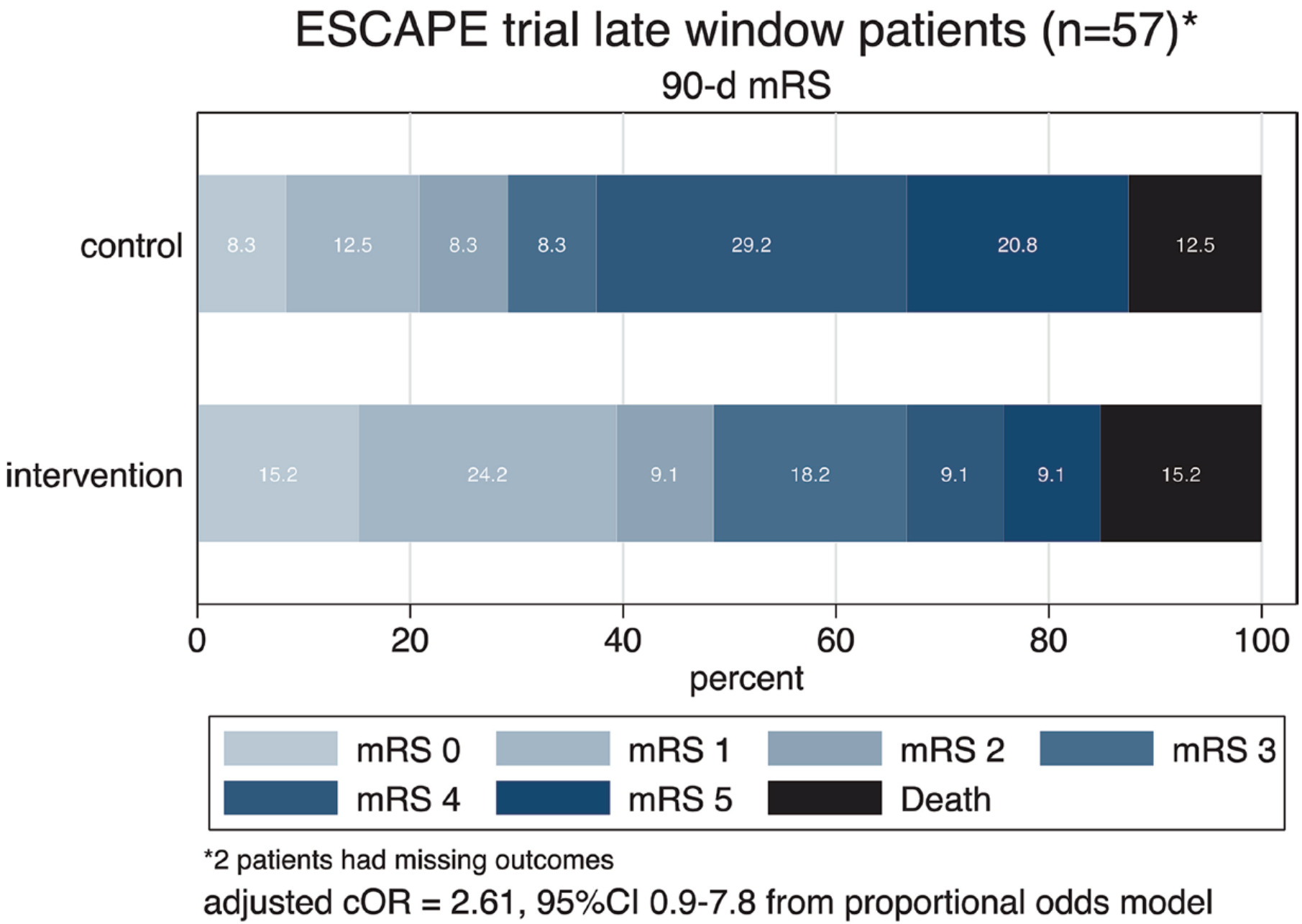
	MR CLEAN	ESCAPE	EXTEND-IA	SWIFT-PRIME	REVASCAT
time window	6 h	12 h	6 h (intervention ended after 8 h)	6 h	8 h
NIHSS	> 2	> 5	no data	> = 8 and < 30	> = 6
imaging	NCCT + CTA / MRI + MRA / DSA	NCCT + CTA (multiphasic)	NCCT + CTA + CTP	NCCT + CTA / MRI + MRA (perfusion in the first 71 patients)	NCCT + CTA / MRI + MRA (perfusion optional)
occlusion	carotid-T, M1 – 2, A1; ACI stent+PTA no exclusion	carotid-T, M1 or M1 equivalent (2 or more M2 branches); ACI stent +PTA no exclusion	carotid-T, M1 – 2; ACI stent+PTA no exclusion	carotid-T, M1; only PTA of ACI allowed	carotid-T, M1; ACI stent+PTA no exclusion
functional imaging	–	moderate to good collateralization	penumbra: tmax > 6s; infarct core: < 70 ml + rCBF < 30 %; mismatch: > 1.2 + > 10 ml	for the first 71 patients: Mismatch > 1.8 + > 15 ml + infarct core < 50 ml	–

HERMES collaboration to pool patient-level data from five studies
(Goyal JAMA 2016)

Time for a Time Window Extension: Insights from Late Presenters in the ESCAPE Trial

J.W. Evans, B.R. Graham, P. Pordeli, F.S. Al-Ajlan, R. Willinsky, W.J. Montanera, J.L. Rempel, A. Shuaib, P. Brennan, D. Williams, D. Roy, A.Y. Poppe, T.G. Jovin, T. Devlin, B.W. Baxter, T. Krings, F.L. Silver, D.F. Frei, C. Fanale, D. Tampieri, J. Teitelbaum, D. Iancu, J. Shankar, P.A. Barber, A.M. Demchuk, M. Goyal, M.D. Hill, and B.K. Menon; for the ESCAPE Trial Investigators

- Patients with an extended time window could potentially benefit from endovascular treatment
- Ongoing randomized controlled trials using imaging to identify late presenters with favorable brain physiology will help cement the paradigm of using ~~time windows~~ to select the population for acute imaging and **imaging to select** individual patients for therapy.



*2 patients had missing outcomes

adjusted cOR = 2.61, 95%CI 0.9-7.8 from proportional odds model

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Table 2: Clinical outcomes and treatment effect in subjects in the ESCAPE trial with last seen healthy to randomization ti[illegible] of >5.5 hours

Outcome	Intervention (n = 33)	Control (n = 26)	Risk Difference (Absolute)	P Value	Risk Ratio Unadjusted (95% CI)
mRS at 90 days, (median) (IQR)	3 (3)	4 (3)	–	.029[a]	–
mRS 0–2 at 90 days	48.5% (16/33)	29.2% (7/24)	19.3%	.178	1.7 (0.8–3.4)
mRS 0–1 at 90 days	39.3% (13/33)	20.1% (5/24)	18.6%	.161	1.89 (0.8–4.6)
NIHSS score 0–2 at 90 days	45.5 (15/33)	13.6 (3/22)	31.8%	.019	3.33 (1.1–10.2)
ICH any (all types)	48.5% (16/33)	11.5% (3/26)	[illegible]	.004	4.2 (1.4–12.9)
ICH symptomatic	0%	0%	[illegible]	1.000	–
mTICI 2b-3 (EVT group) or mAOL 2–3 (control group)[b]	87.5% (28/32)	13.0% (3/23)	74.5%	–	–

Collaterals Predict Outcome Regardless of Time Last Known Normal

Richa Sharma, MD, MPH, Rafael H. Llinas, MD, Victor Urrutia, MD, and Elisabeth B. Marsh, MD

- There was no difference in outcome for patients outside the window (> 6h) with known (39.1%) versus unknown (60.9%) time of onset
- When imaging is favorable, the mRS score at follow-up is comparable regardless of time LKN

Functional outcomes appear to be driven most significantly by the presence of collaterals

Journal of Stroke and Cerebrovascular Diseases, 2017

Collaterals play major role

The extent of collateral flow is highly variable between individuals

As a consequence, the speeds of infarct growth are highly variable, resulting in varying individual treatment time windows until the whole salvageable tissue has become infarcted

Jung S, Swiss Med Wkly. 2017

Collaterals play major role

The extent of collateral flow is highly variable between individuals

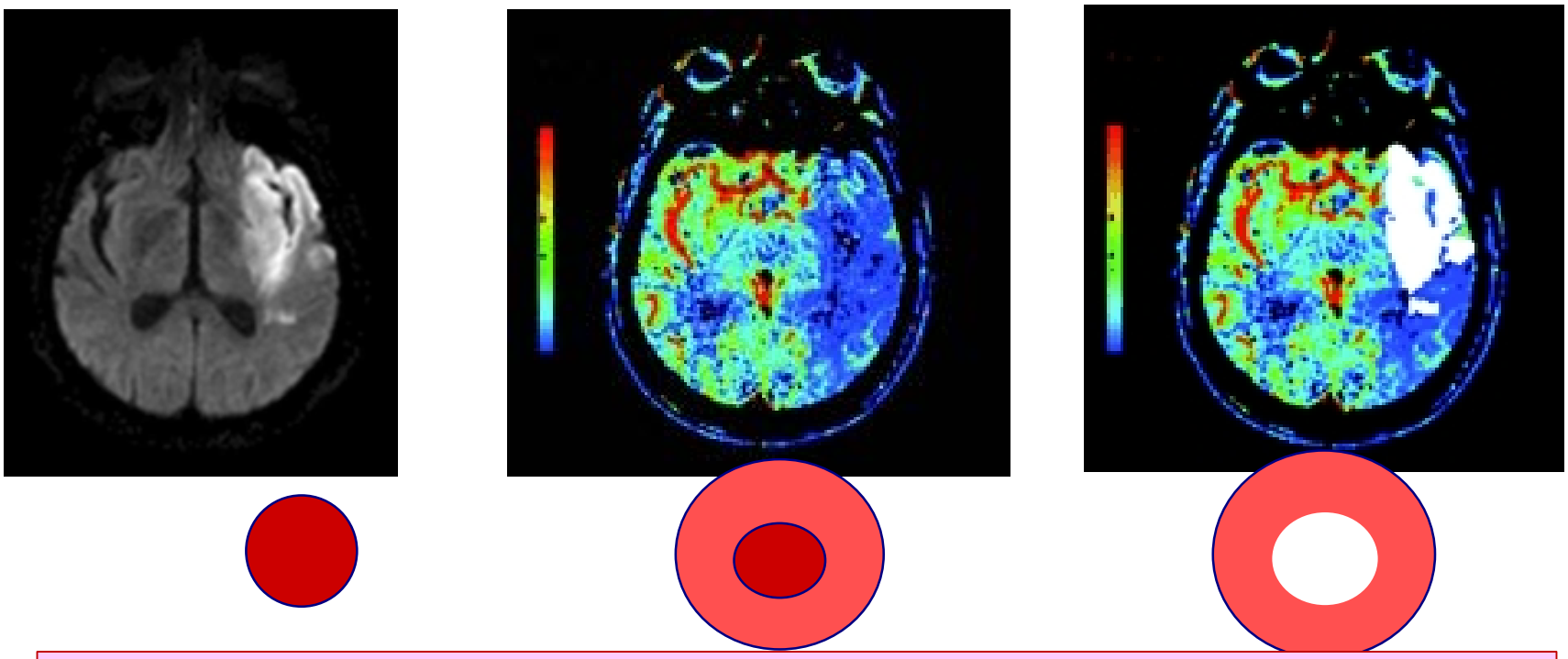
As a consequence, the speeds of infarct growth are highly variable, resulting in varying individual treatment time windows until the whole salvageable tissue has become infarcted

→ Blood pressure: until recanalisation, systolic RR not below <160 mmHg, without iv lysis even higher, unless contraindications exists

→ Mainains collaterals

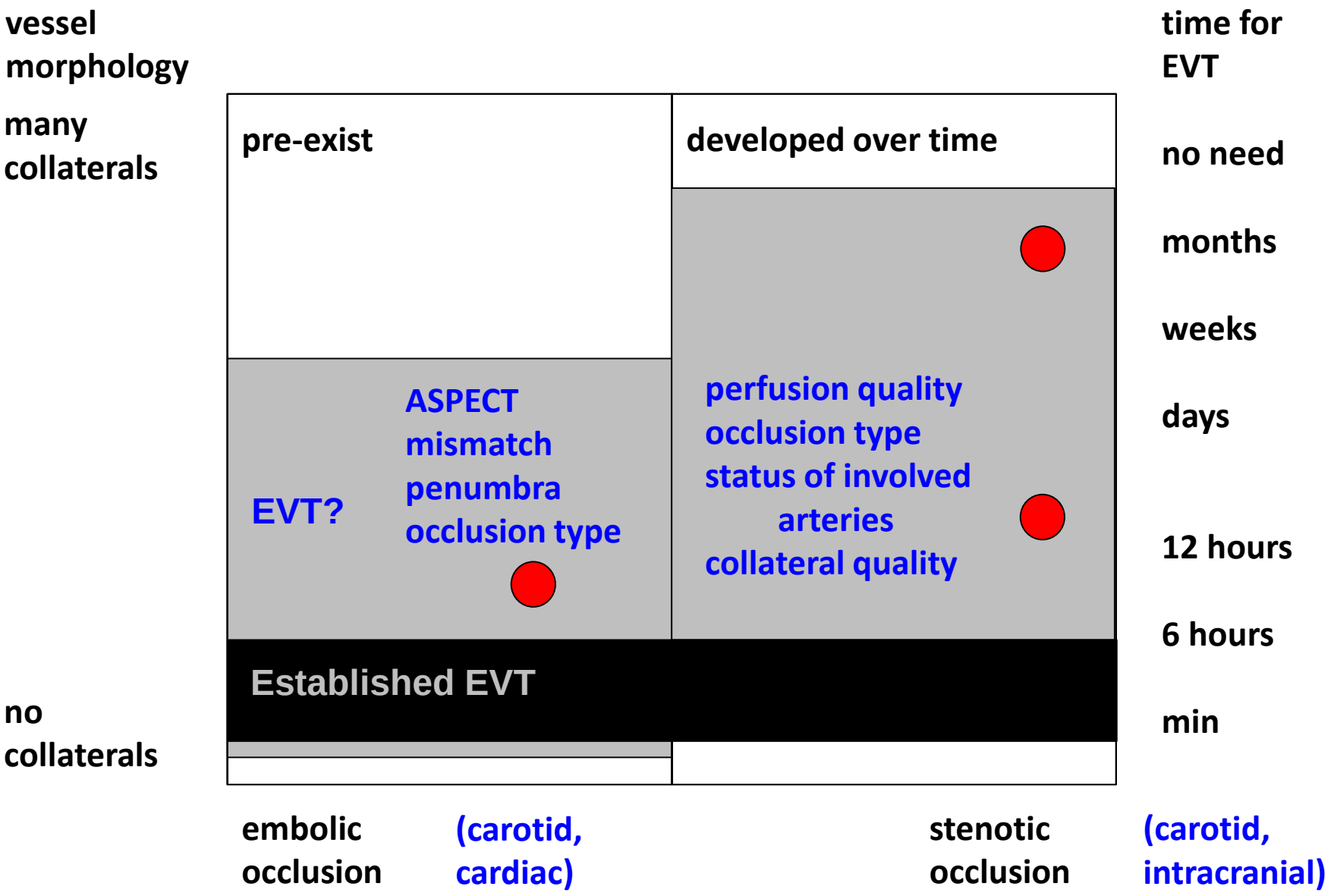
Individual decision

Small ischemic core and a persisting large artery occlusion



→ Patient may benefit from thrombectomy

Assessing the chance for good success



Case 1: 53 y, m
Acute hemiplegia on left side since 7 hours

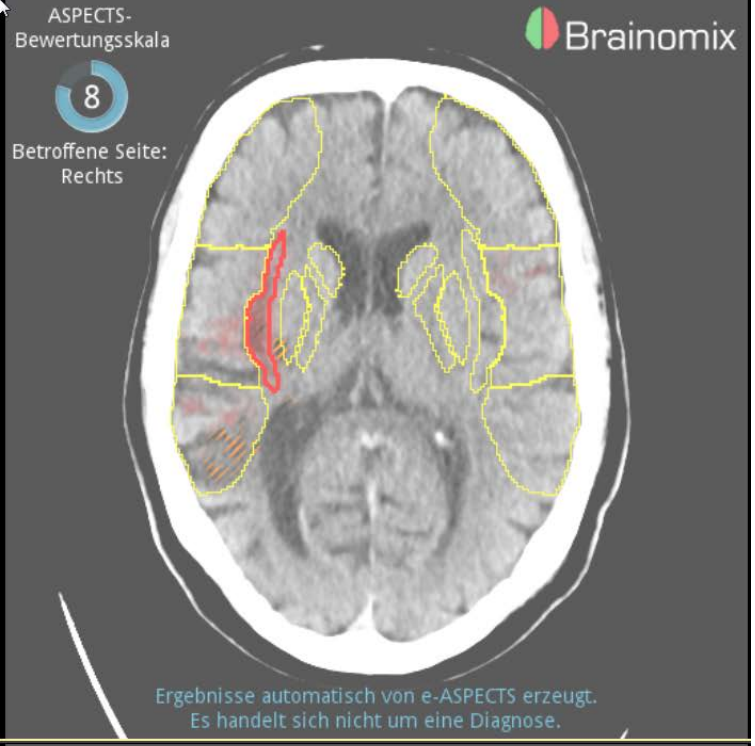
Preexisting partial infarction right MCA territorium (temporal and parietal)

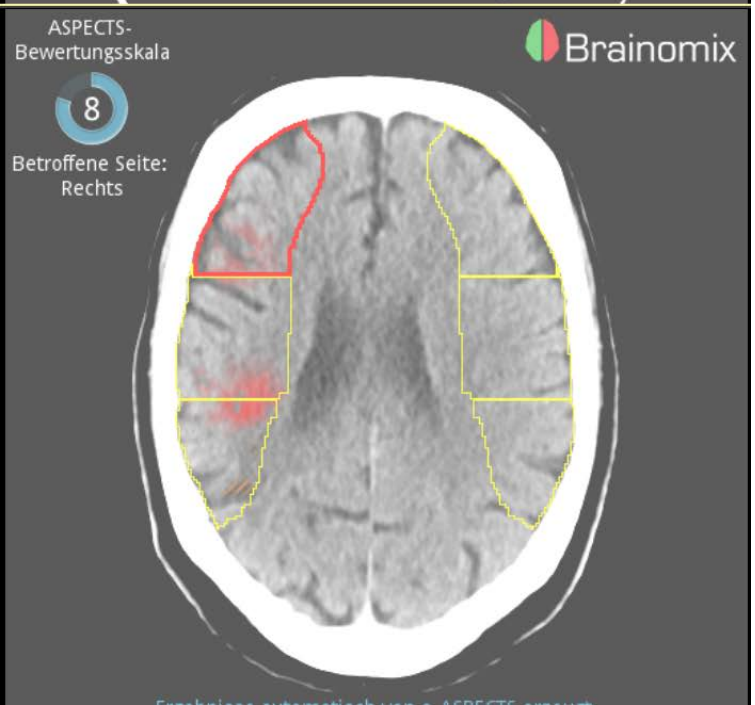
No acute signs of ischemia

MCA-occlusion right on CT-angiography

No CT- or MR perfusion, no FLAIR

→ Send to thrombectomy


ASPECTS-
Bewertungsskala
Brainomix
8
Betroffene Seite:
Rechts
Ergebnisse automatisch von e-ASPECTS erzeugt.
Es handelt sich nicht um eine Diagnose.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Bewertungsskala
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8
Betroffene Seite:
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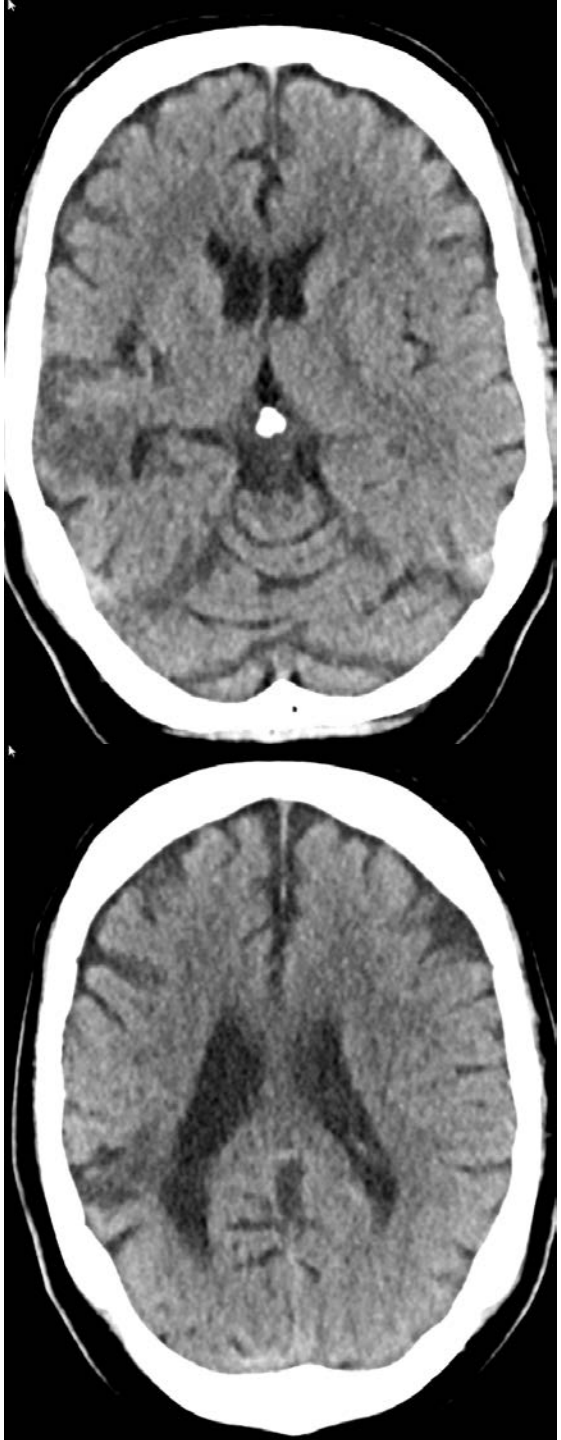
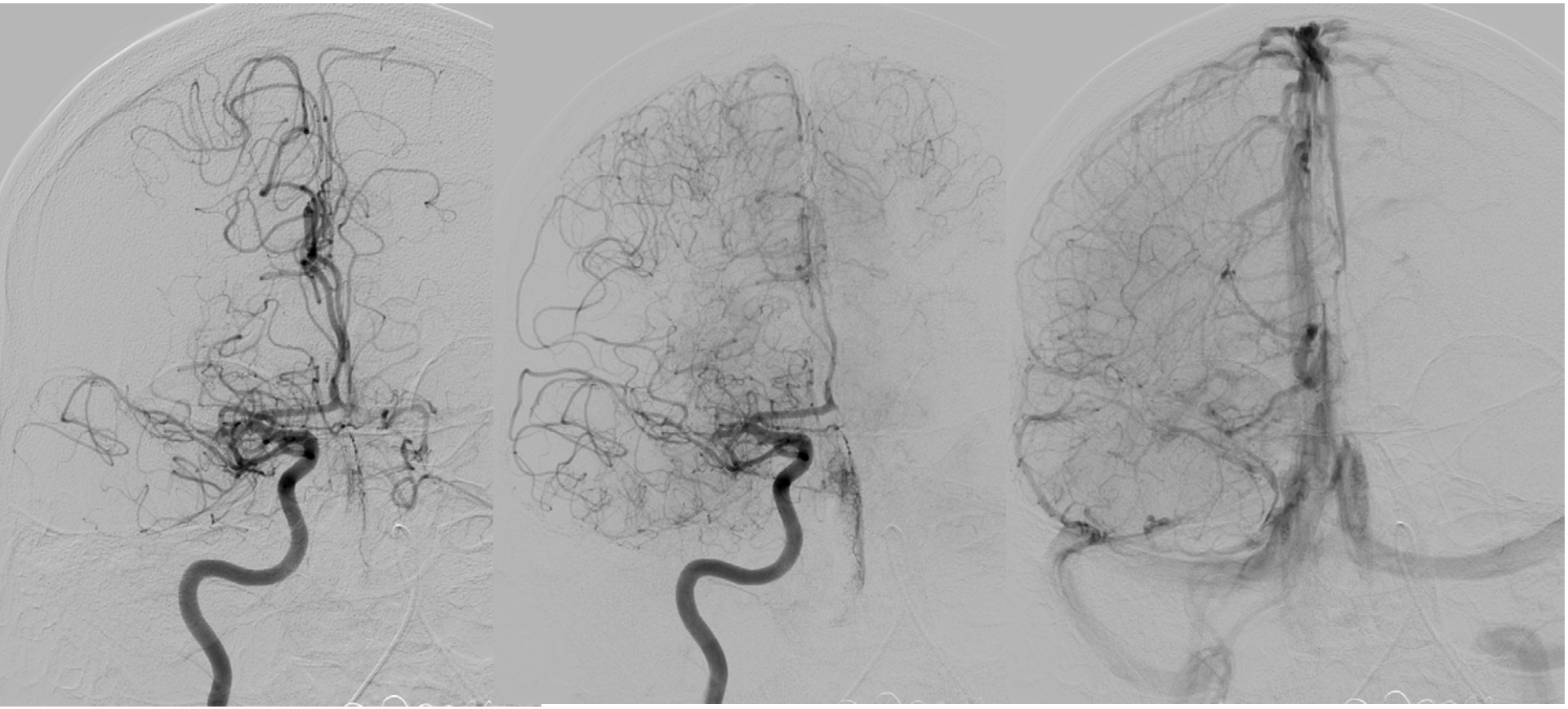
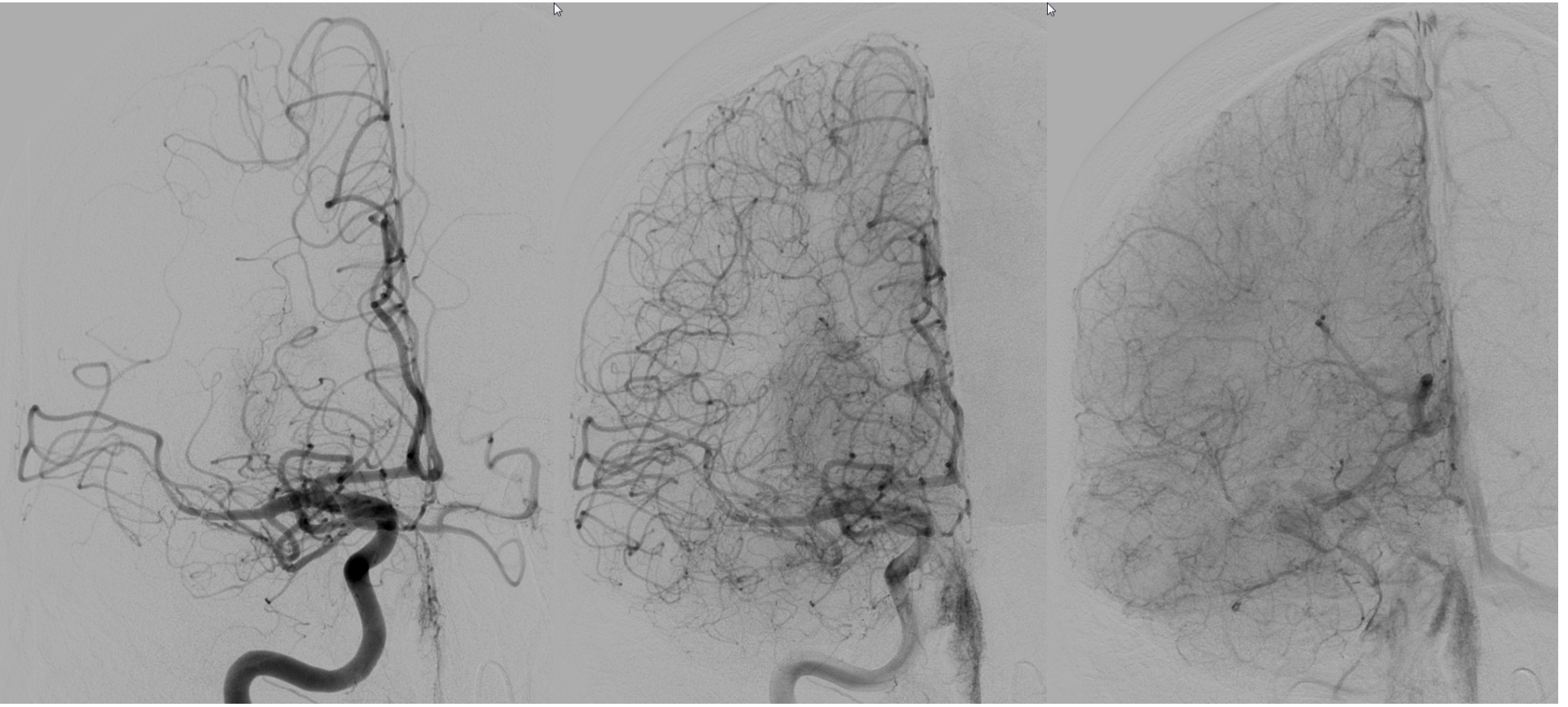


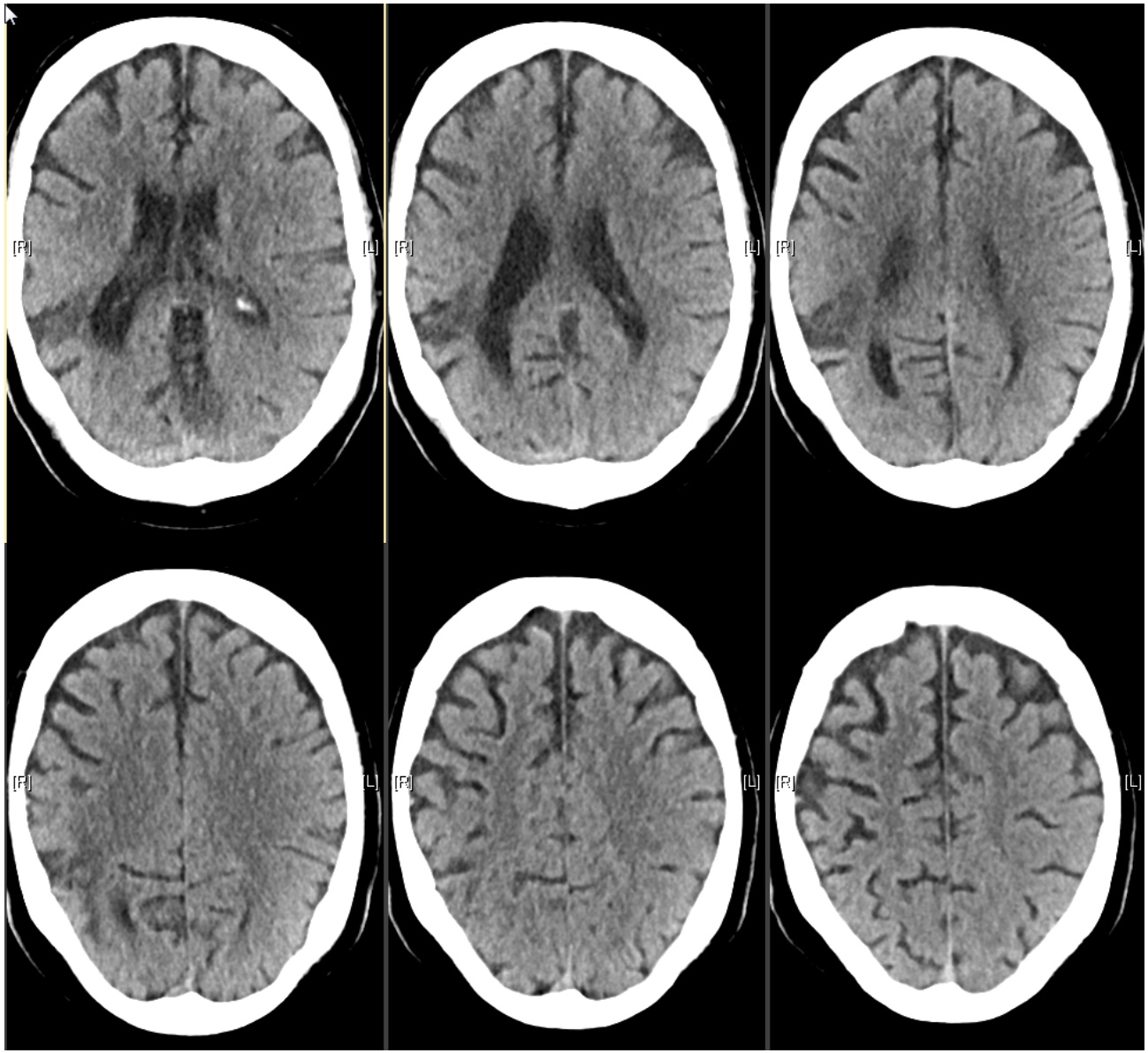
53 y, m
Acute hemiplegia on left side since 7 hours

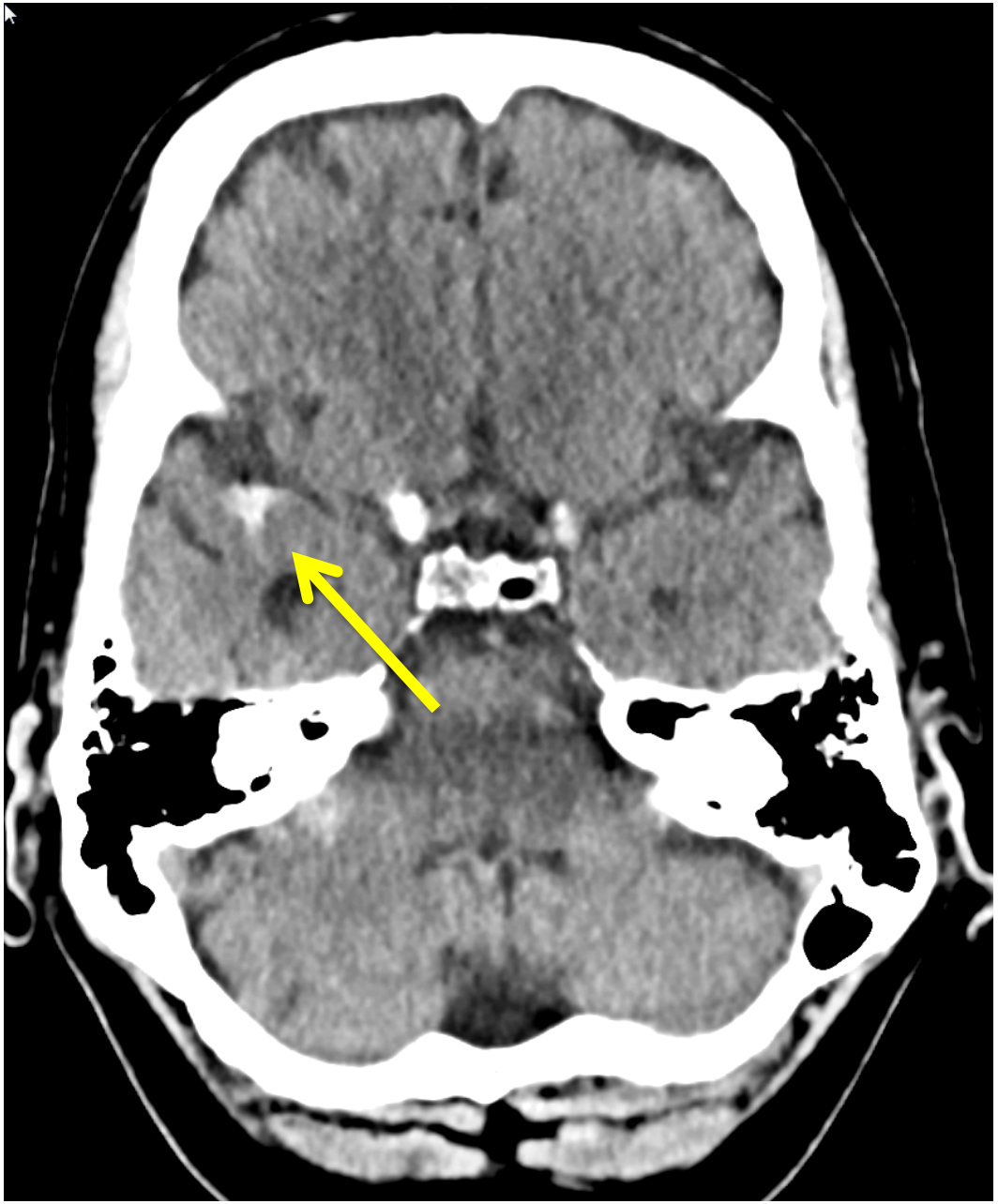


53 y, m
After thrombectomy



Thrombectomy 7 hours after onset, control CT next day
No new infarction, clinical recovery





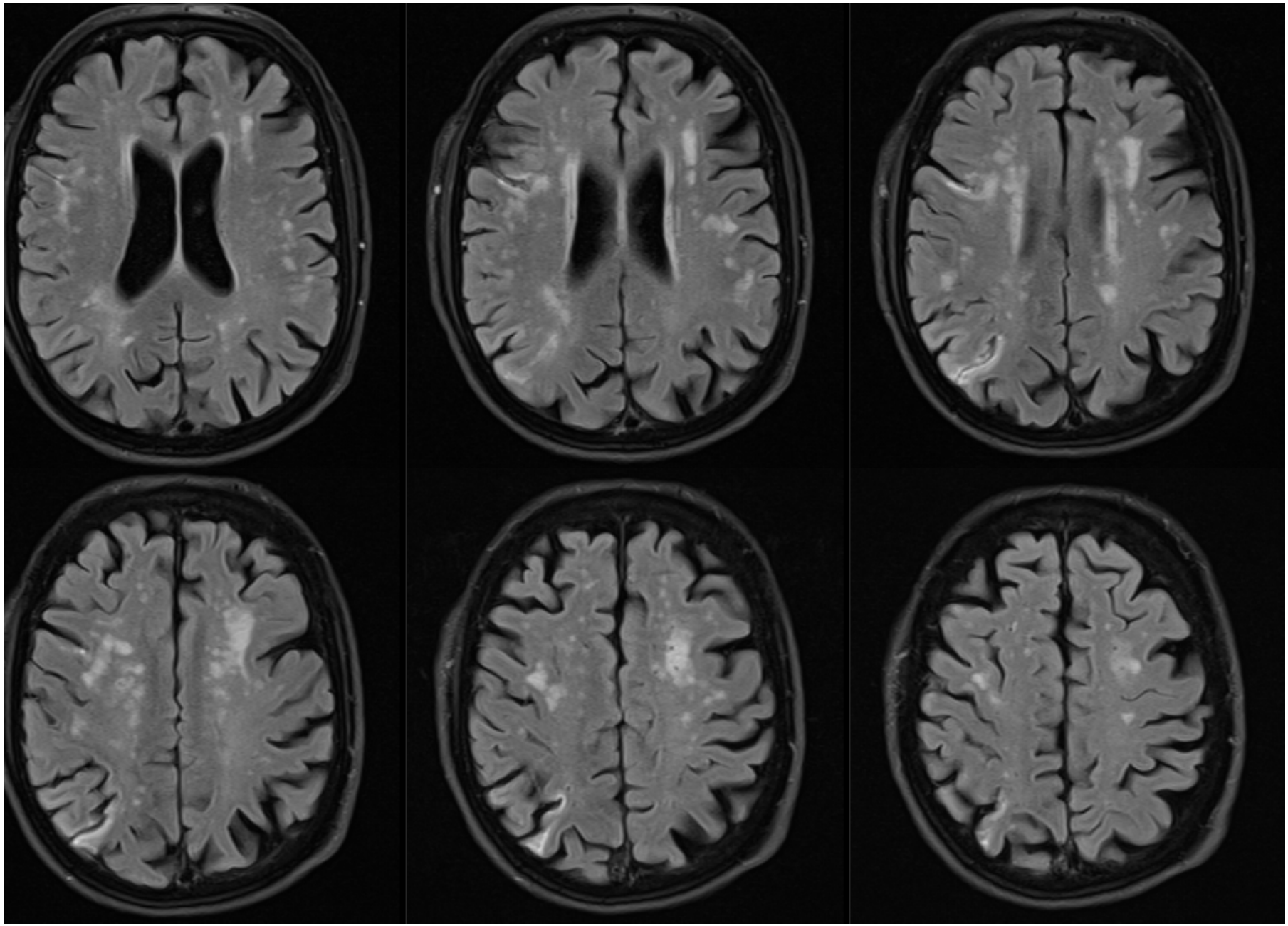
Symptomatic hemorrhage rate very low in DAWN and ESCAPE and meta-analysis

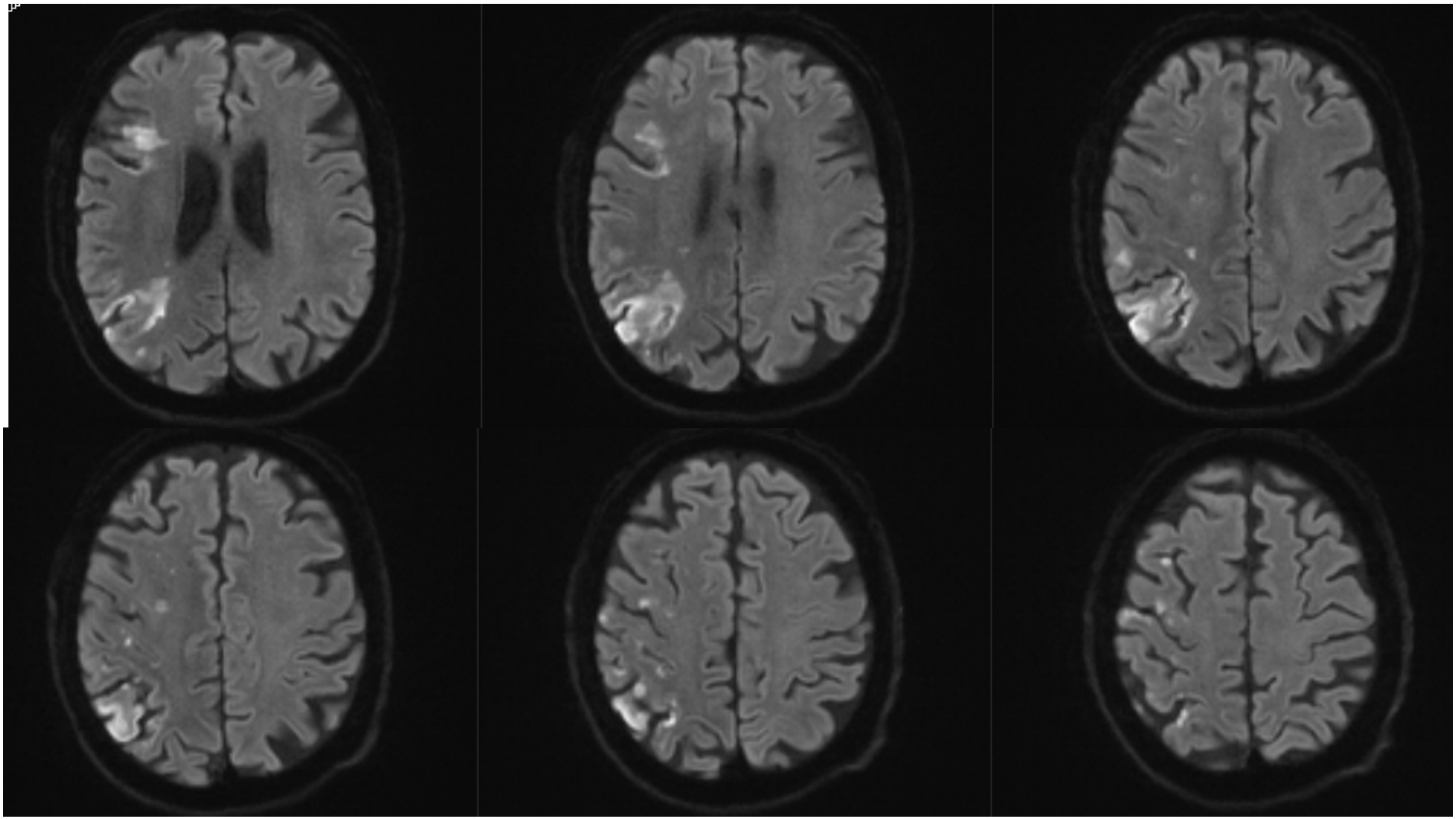
Case 2: 75 y, m

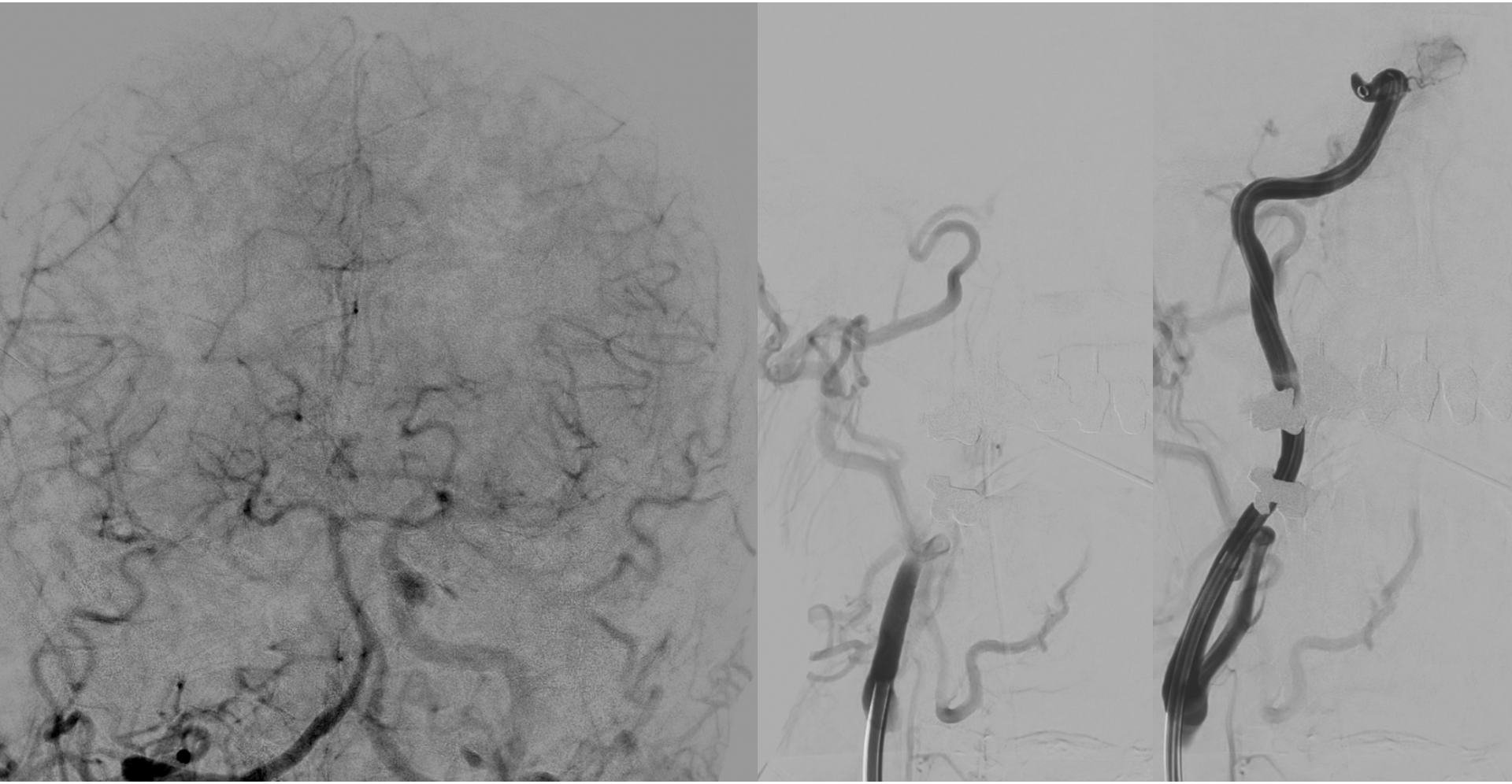
Acute headache and hemiparesis left on October 28, 2017. On MRI hemodynamic infarct and right ICA occlusion. Same day almost complete resolution of symptoms.

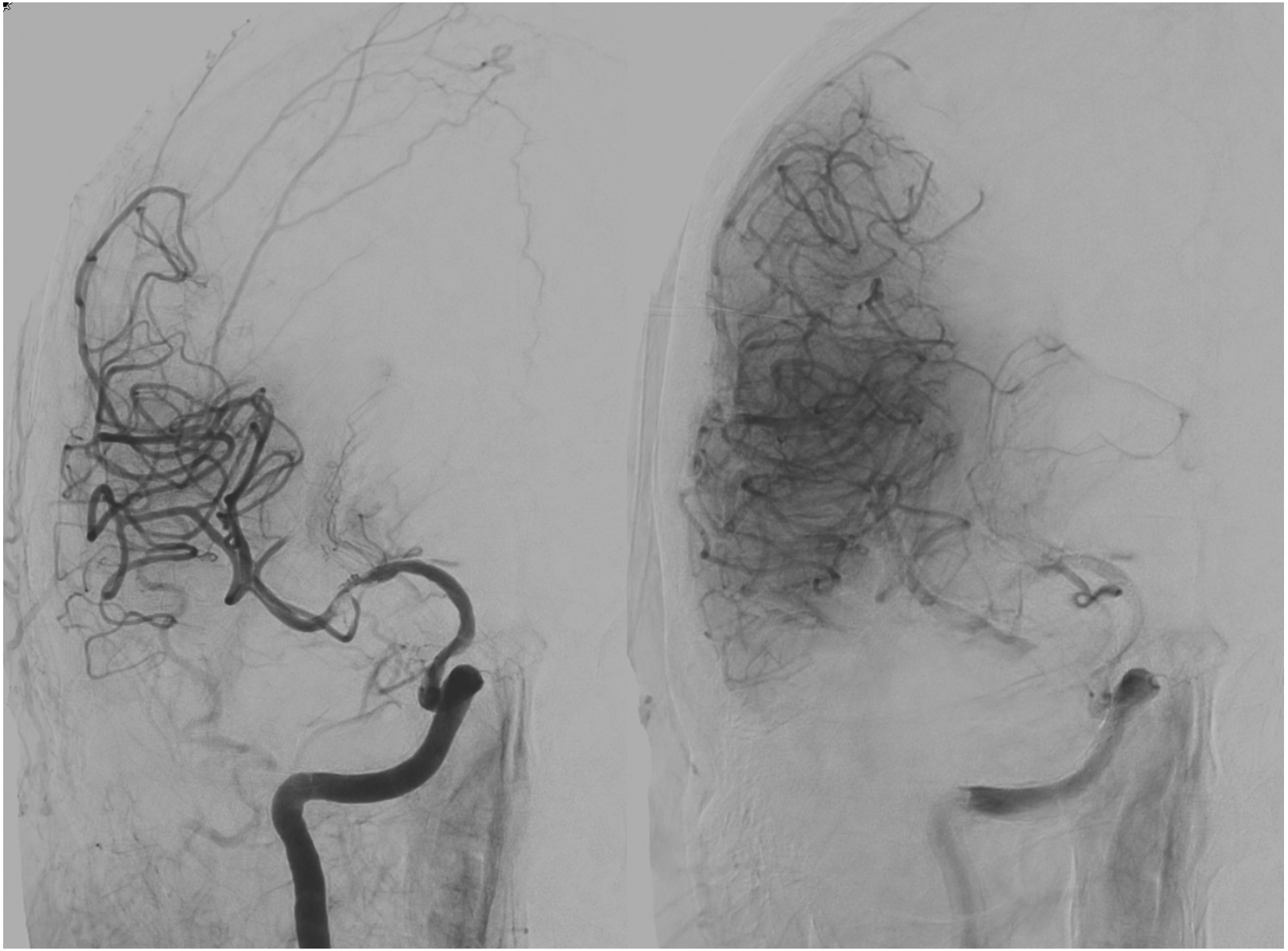
29th: echography, afterwards left high grade hemiparesis, probably due to art. hypotension due to sedation

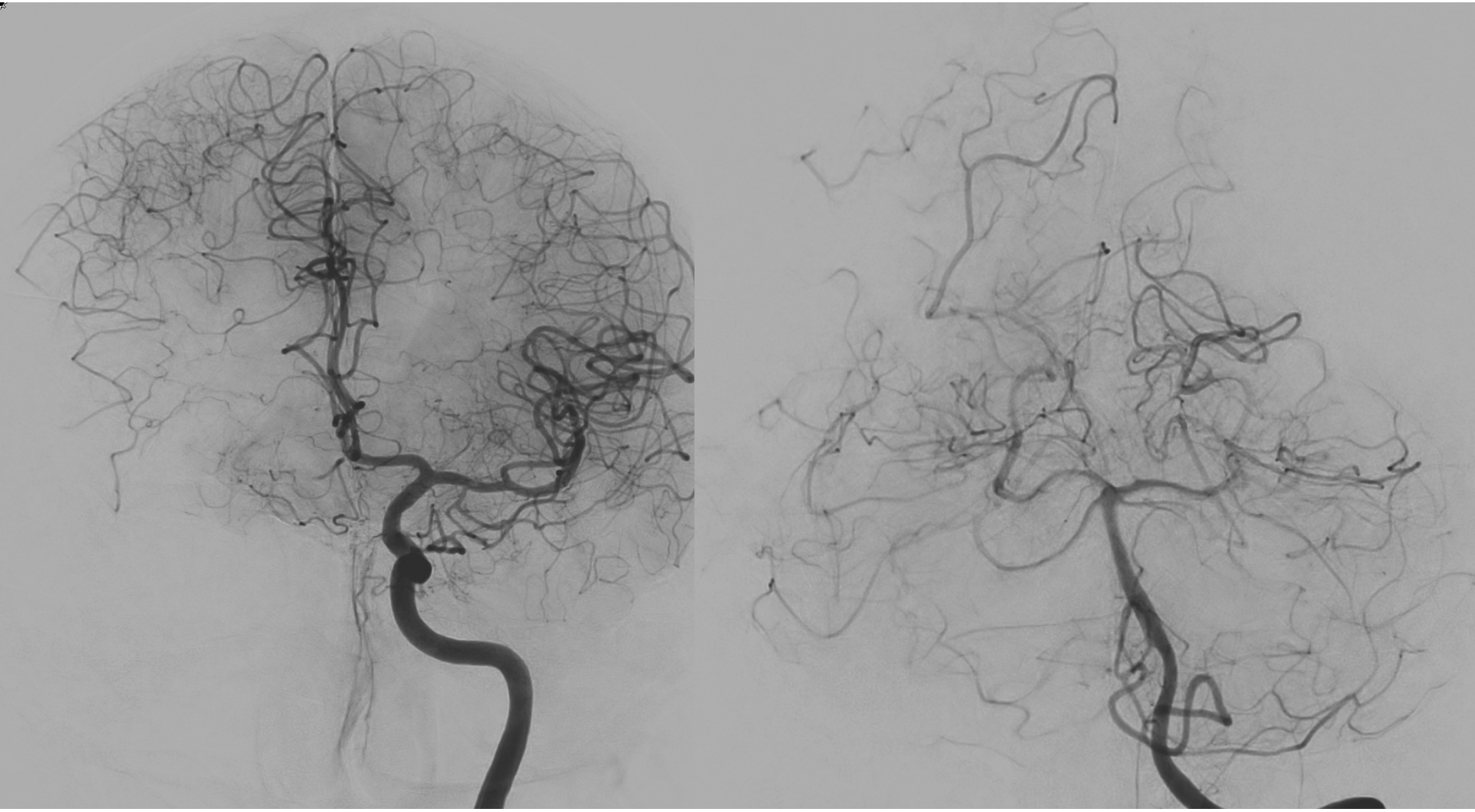
→ Send to recanalisation of ICA

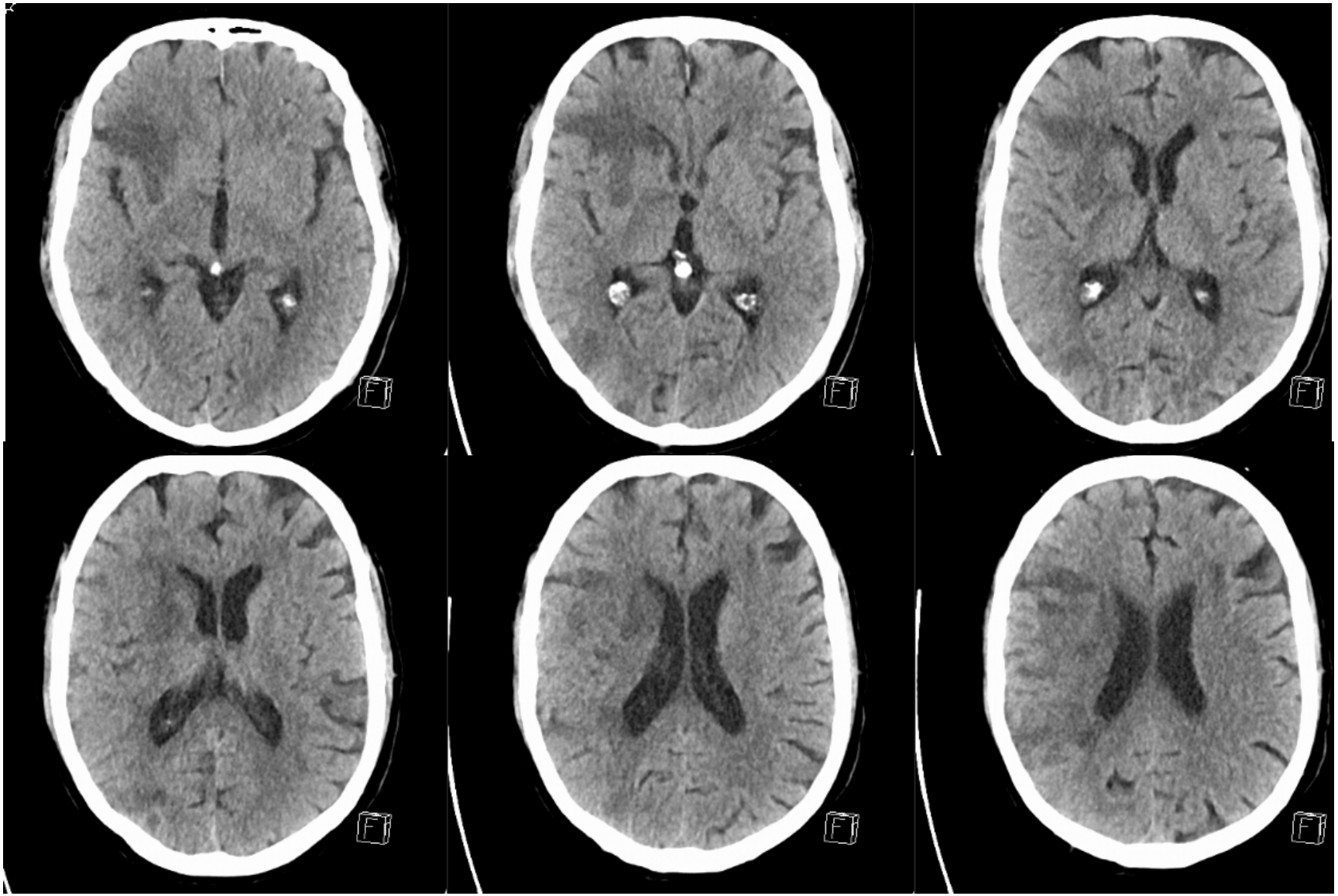








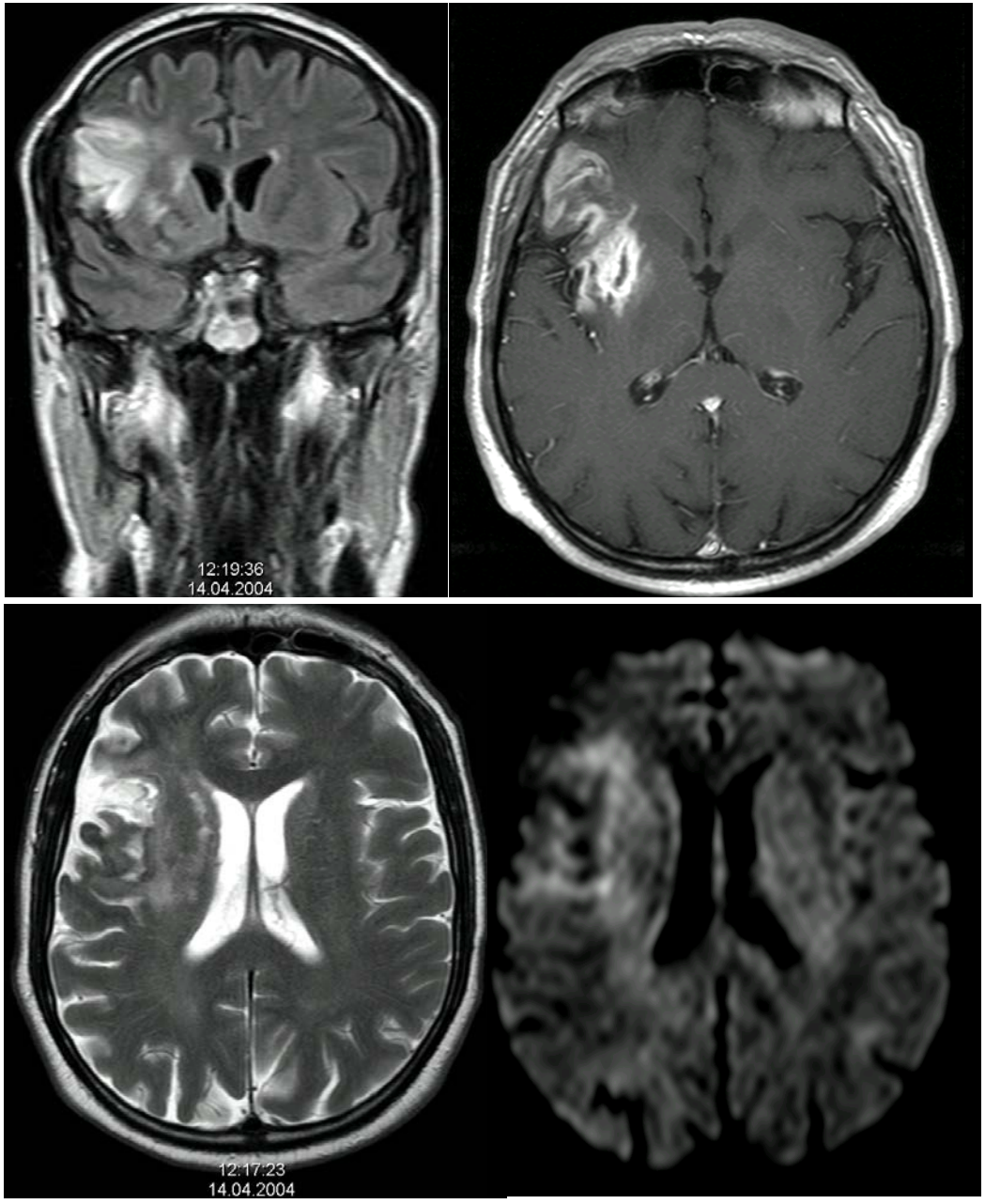




Case 3 : 56 y, m

First stroke 8 months ago

Continous upright mobilisation not possible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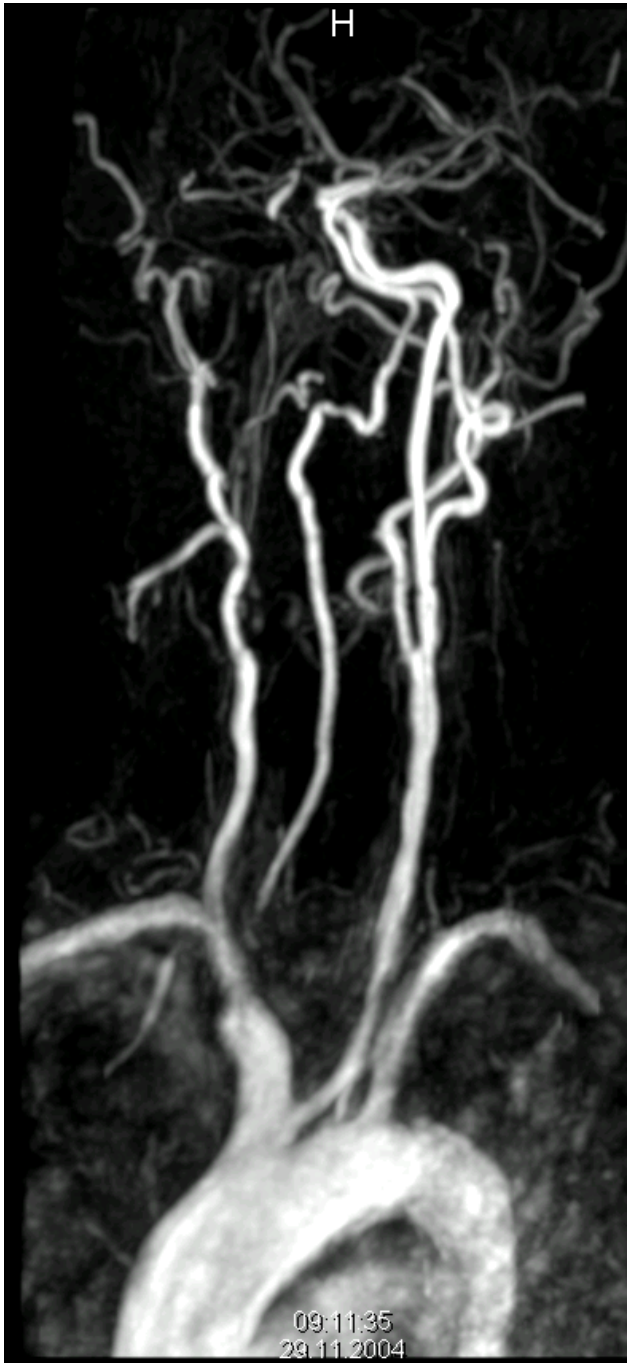
14.04.2004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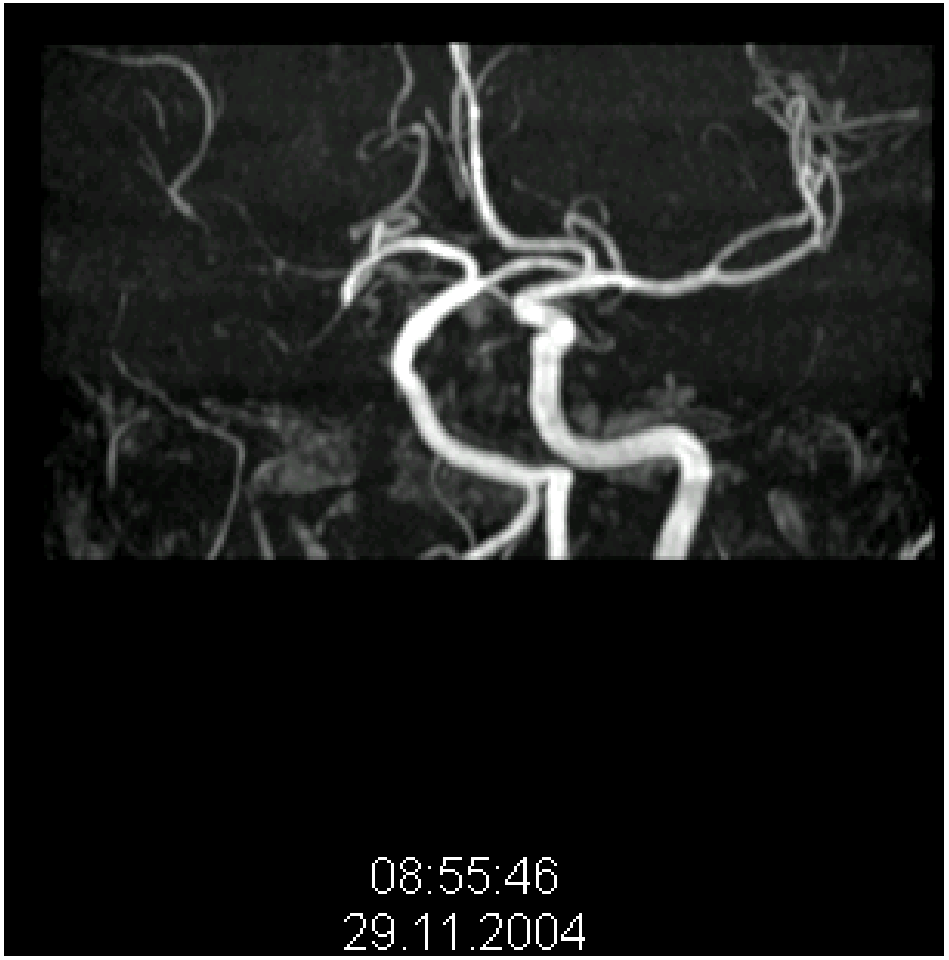
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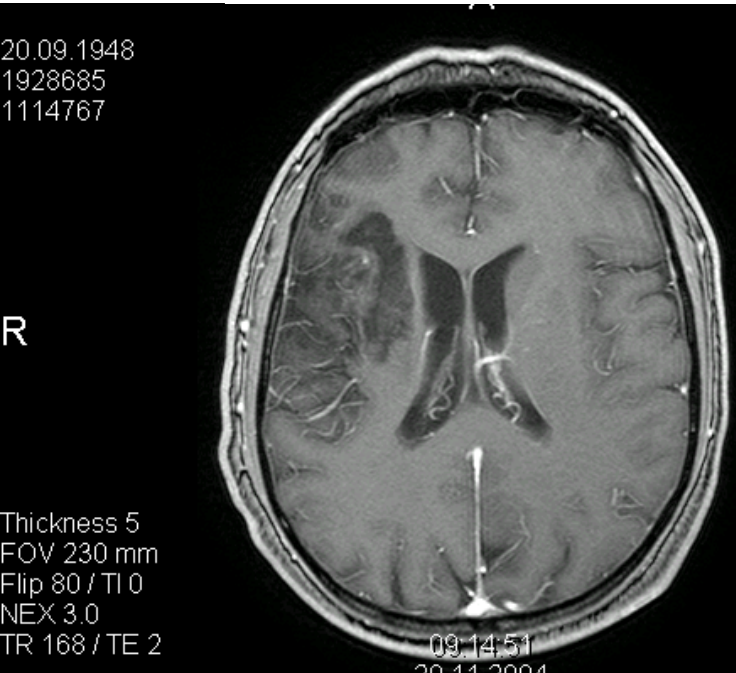
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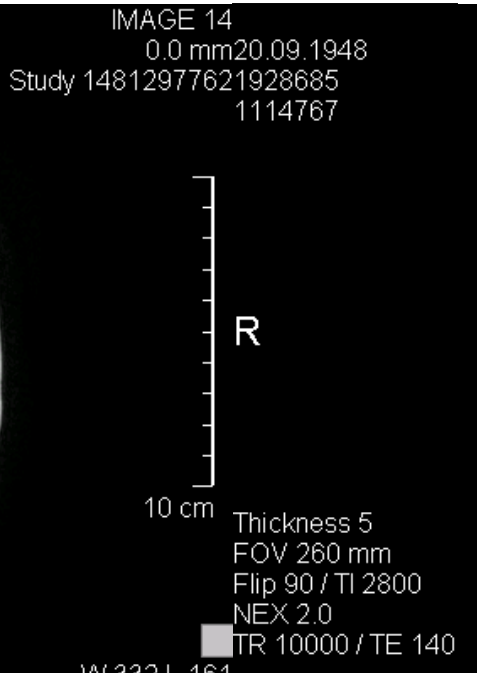
29.11.2004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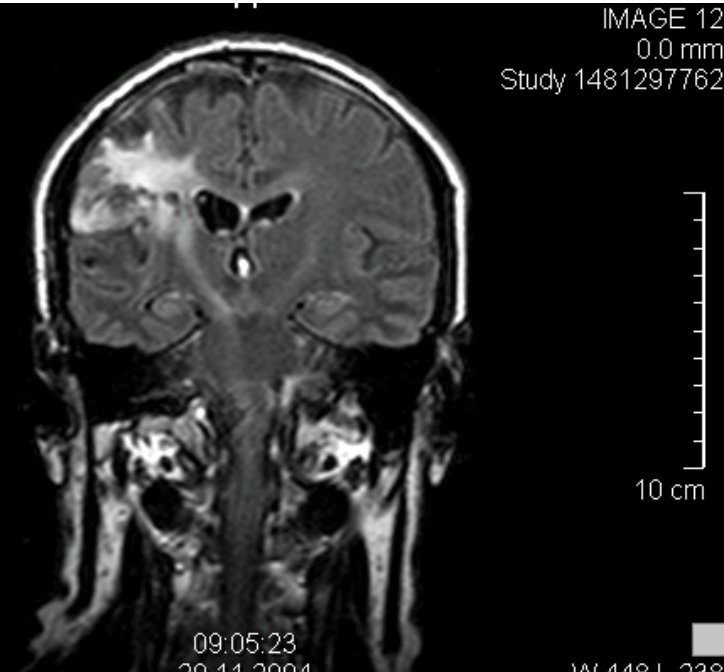
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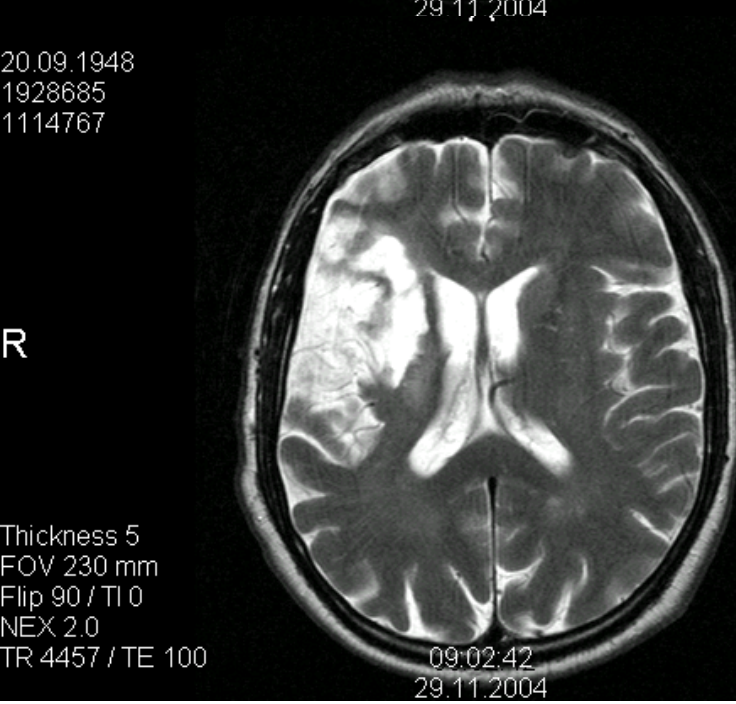
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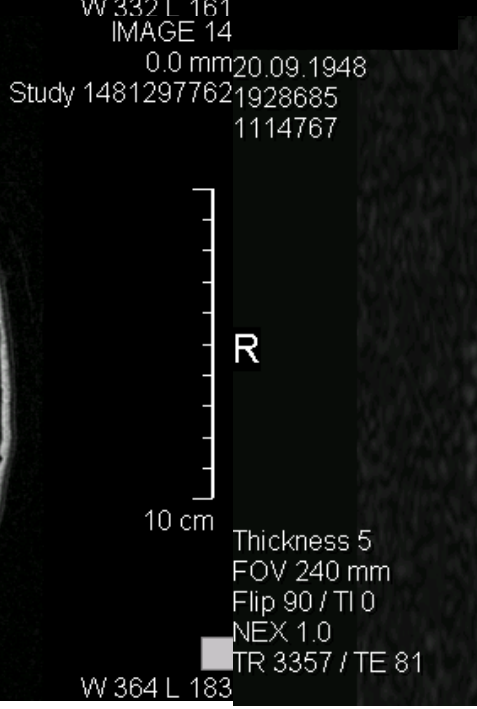
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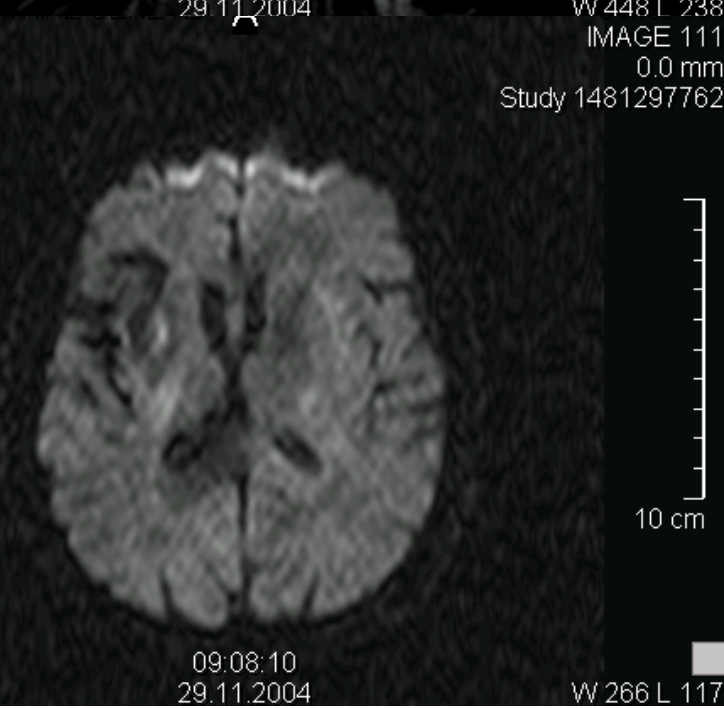
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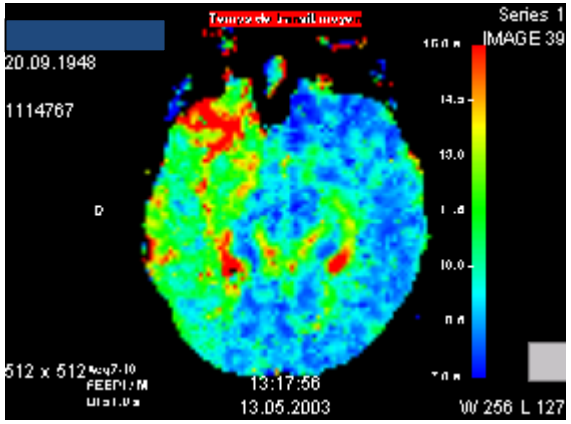

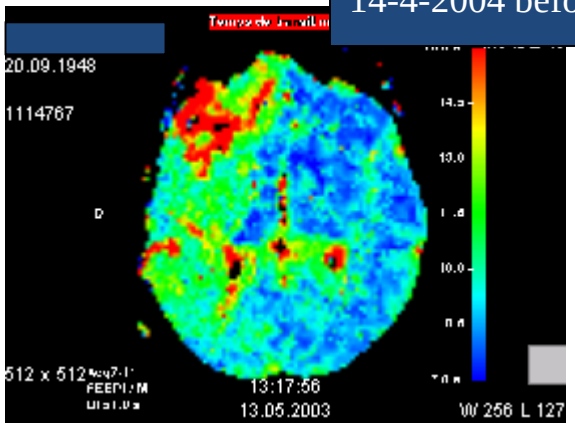

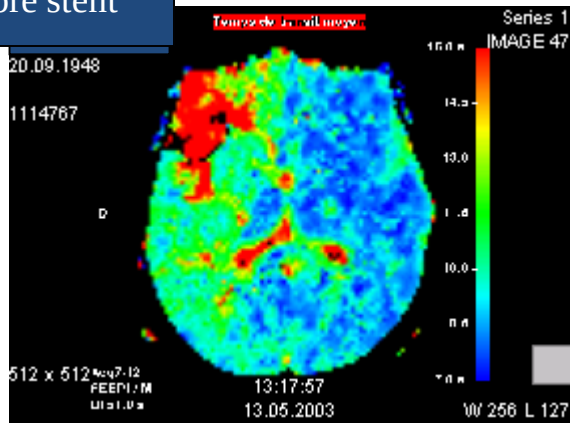

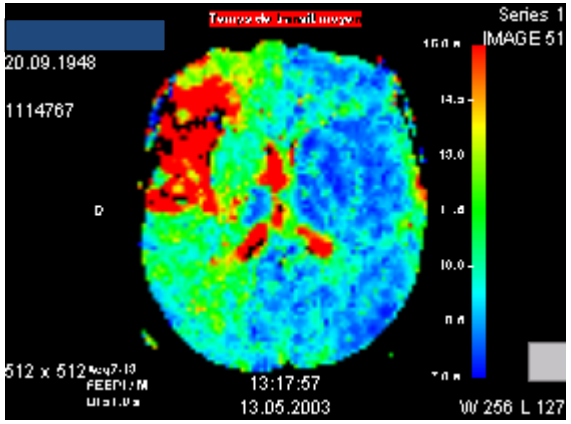

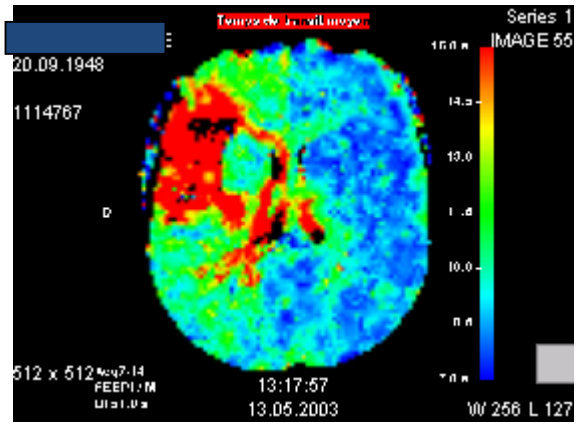

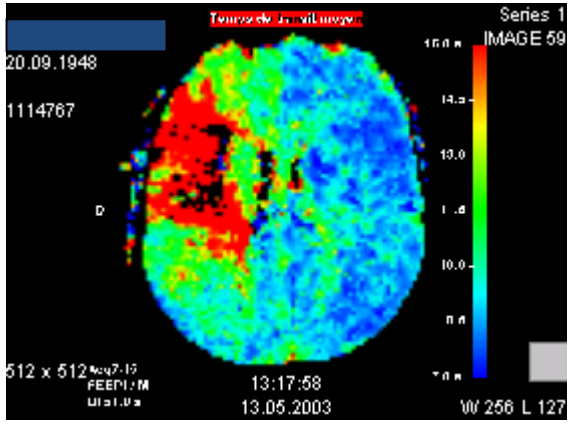

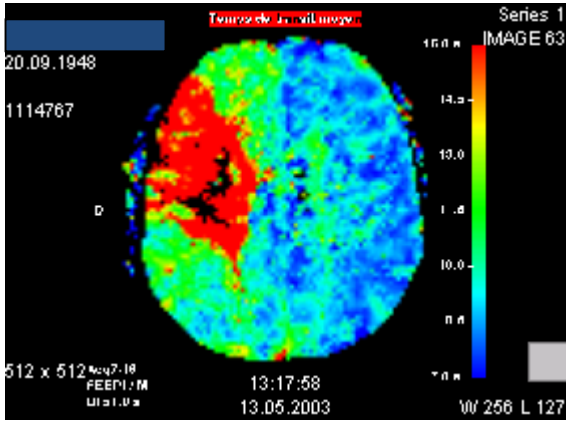

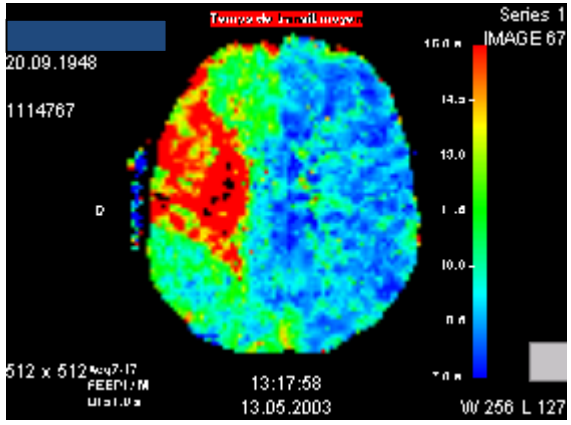

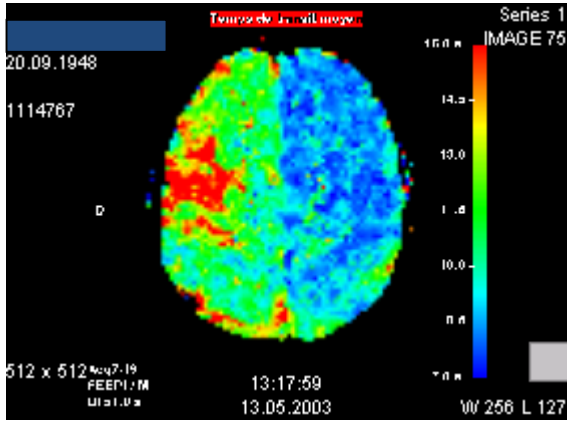

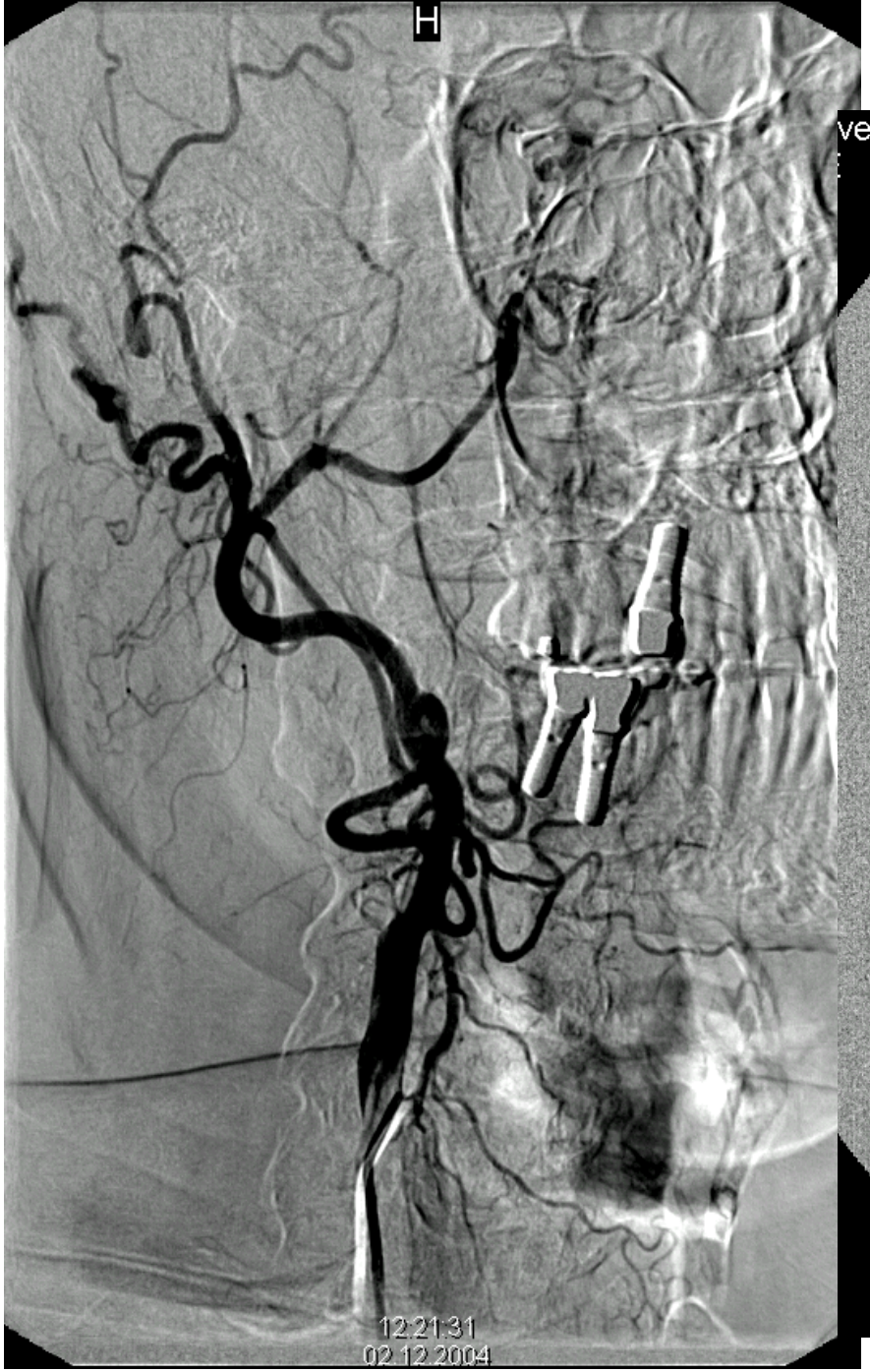
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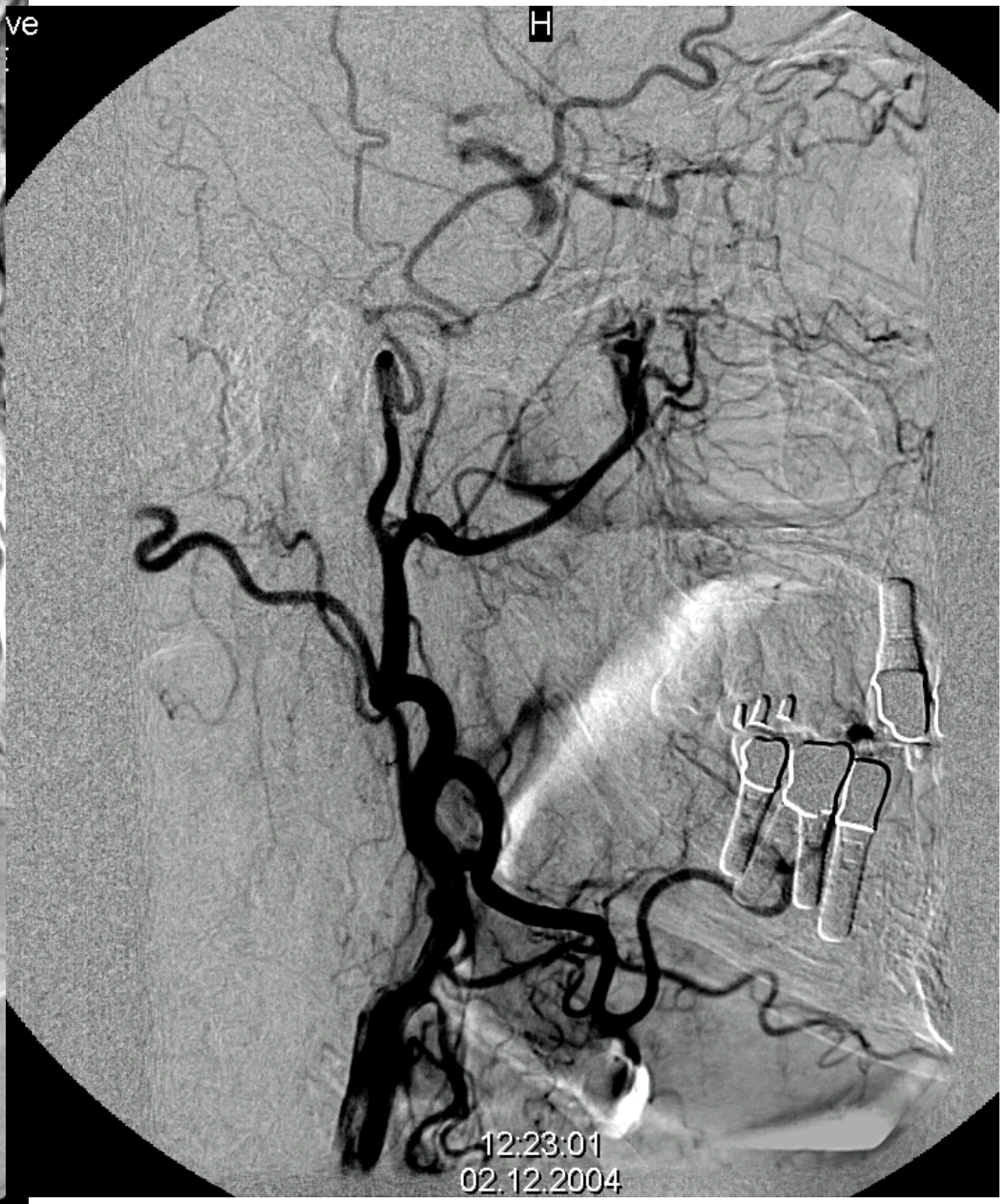
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H
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H
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H
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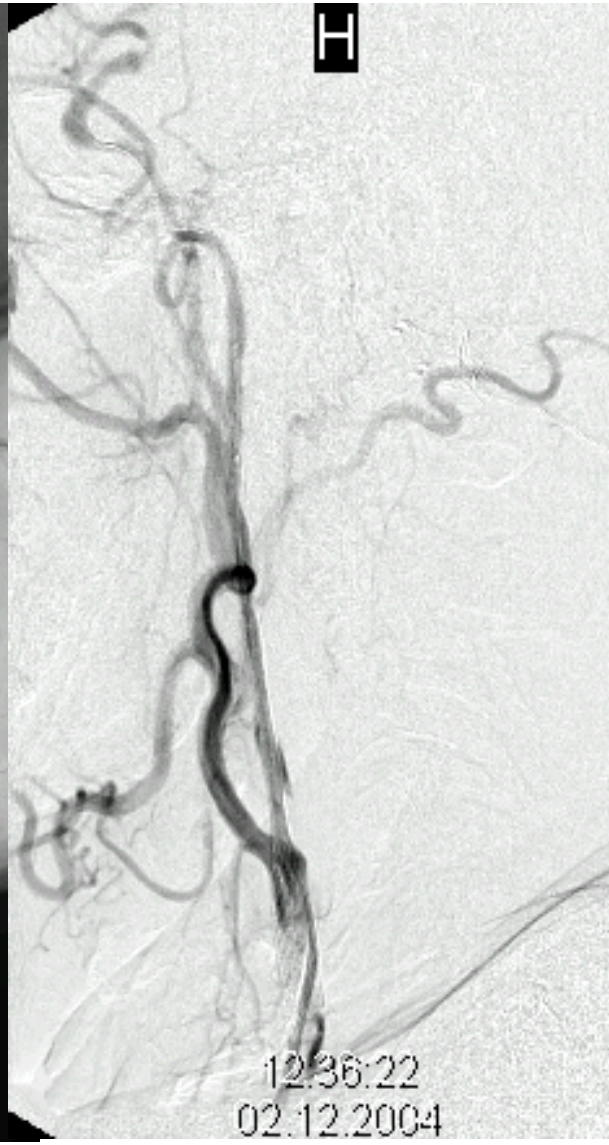
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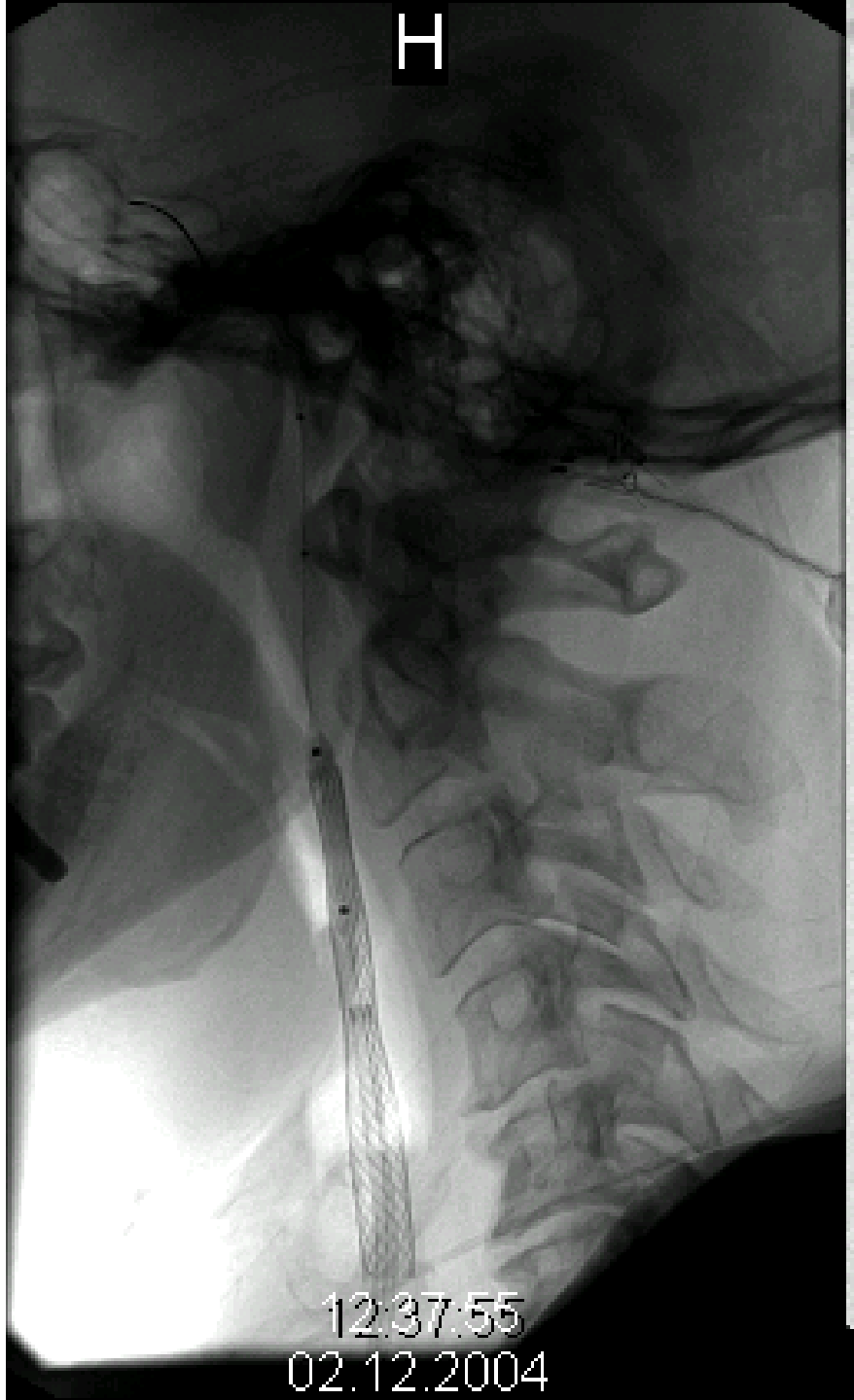
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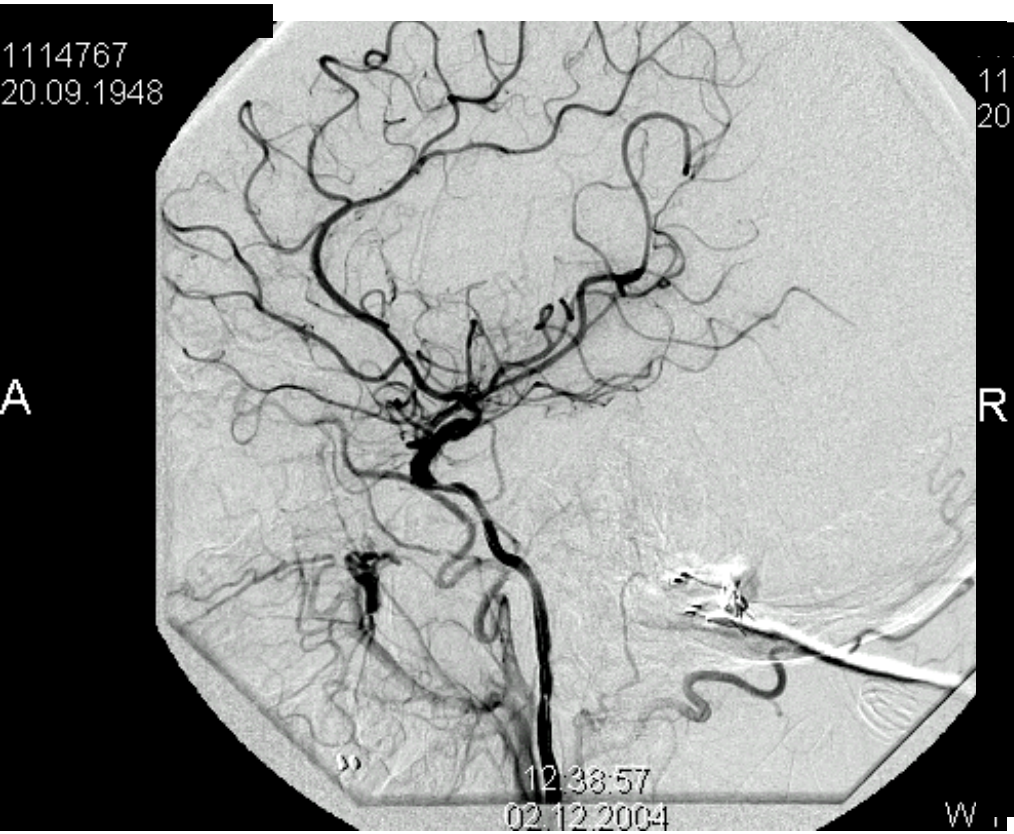
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1114767
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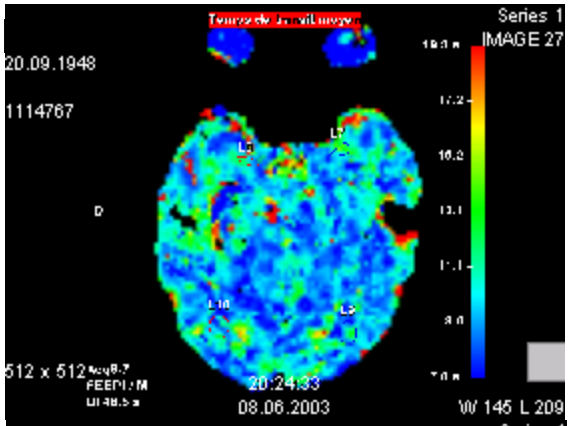
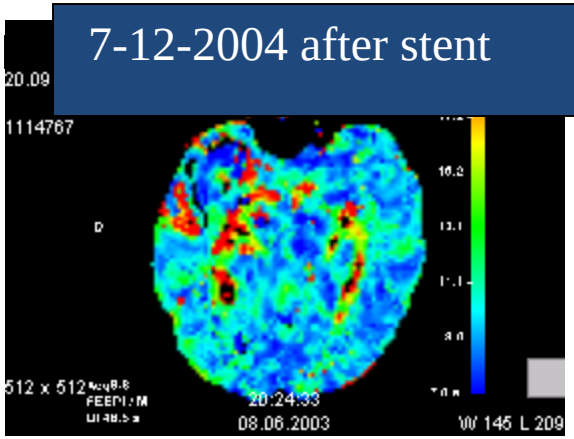
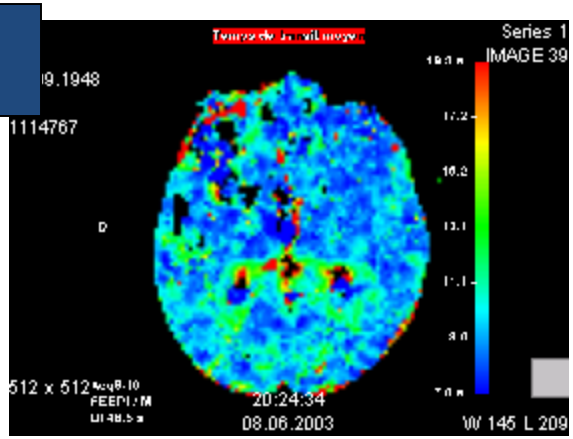
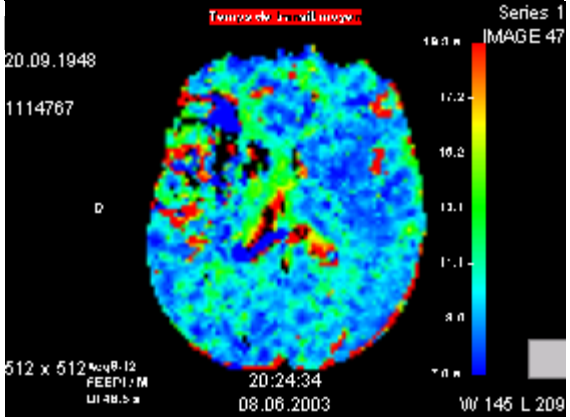
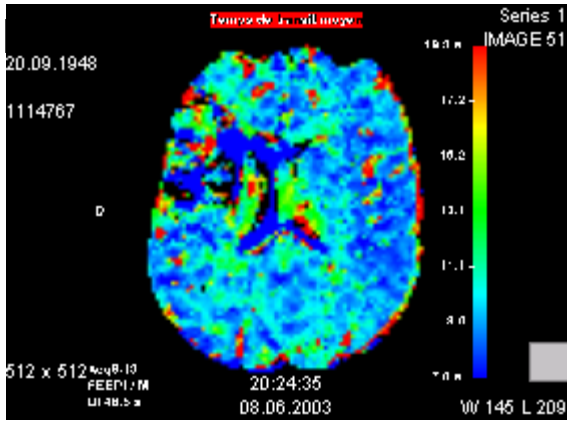
7-12-2004 after stent

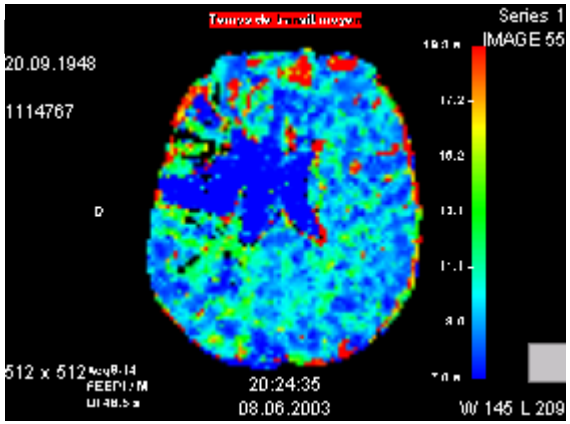


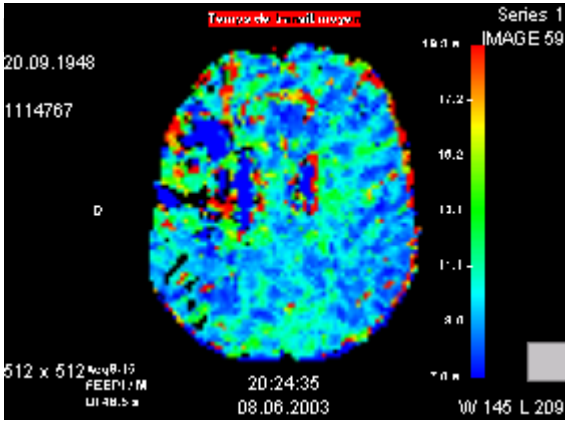


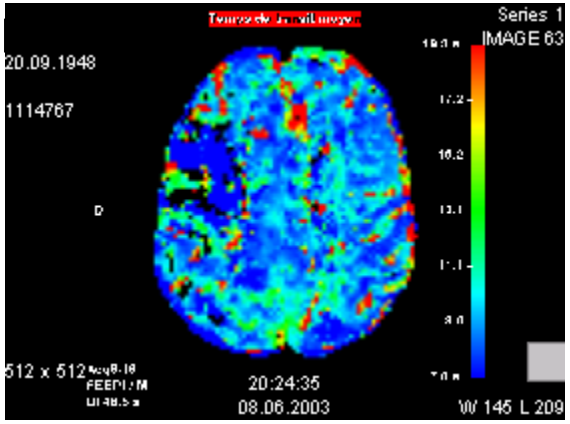


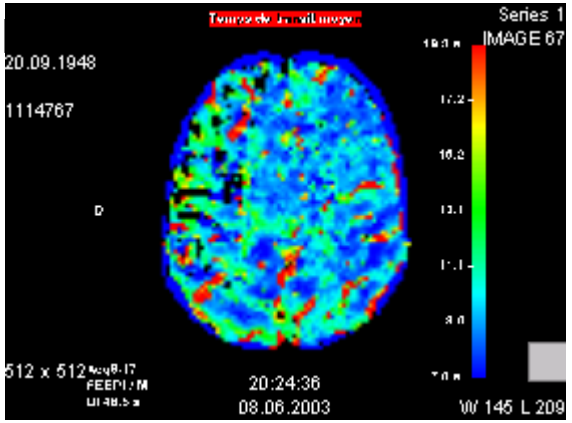












Room for studies

Should **bridging therapy** always be executed?

Should thrombectomy be performed in patients with

- **low NIHSS scores?**
- **low ASPECTS scores?**
- **posterior circulation strokes?**

What kind of imaging criteria should be used?

Perfusion Imaging Selection of Ischemic Stroke Patients for Endovascular Therapy (POSITIVE). Investigators include AIS patients with TLSW within 12 h with following neuroimaging criteria: (a) <1/3 MCA territory involvement on CT/MRI (b) LVO between distal ICA through M1 bifurcation, and (c) presence of ischemic penumbra on CT/MRI perfusion.

Case 4: 66 y, w

First symptoms of speech difficulties and weakness during holidays in France on 26, October 2017

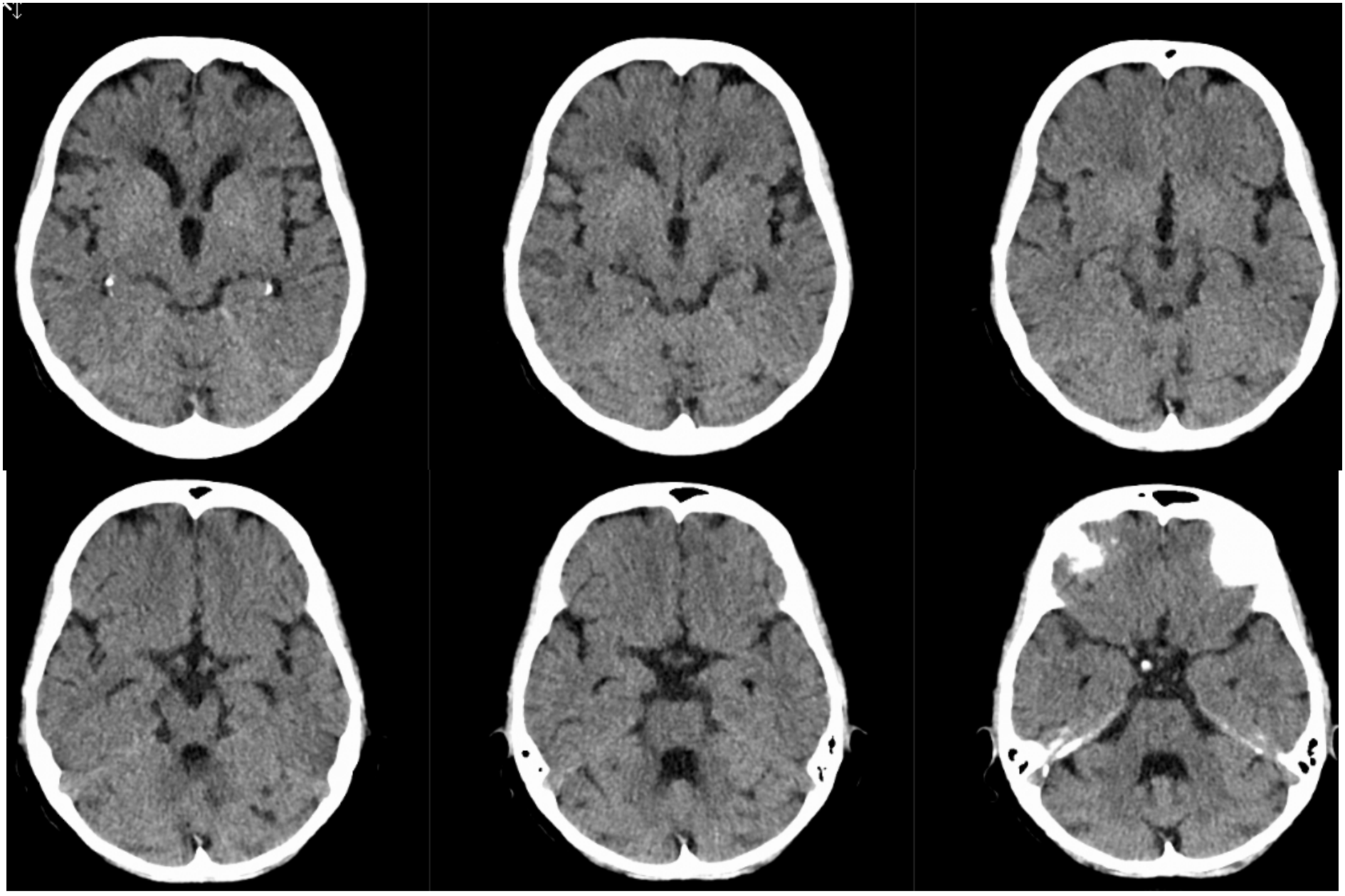
→ 3x500mg Aspirin from husband, travel back to CH

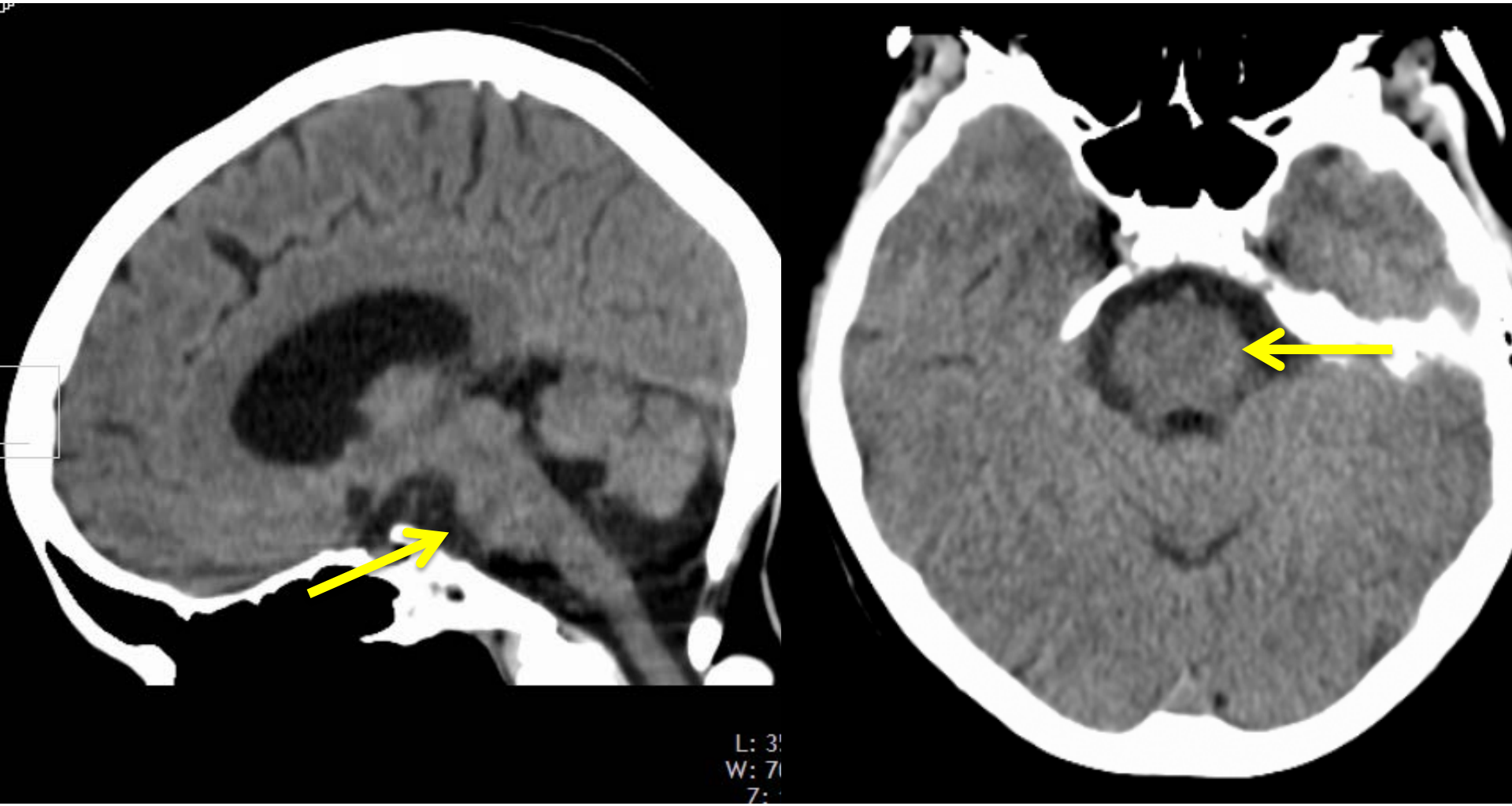
29th: admission with bilateral leg paresis and right sided arm paresis

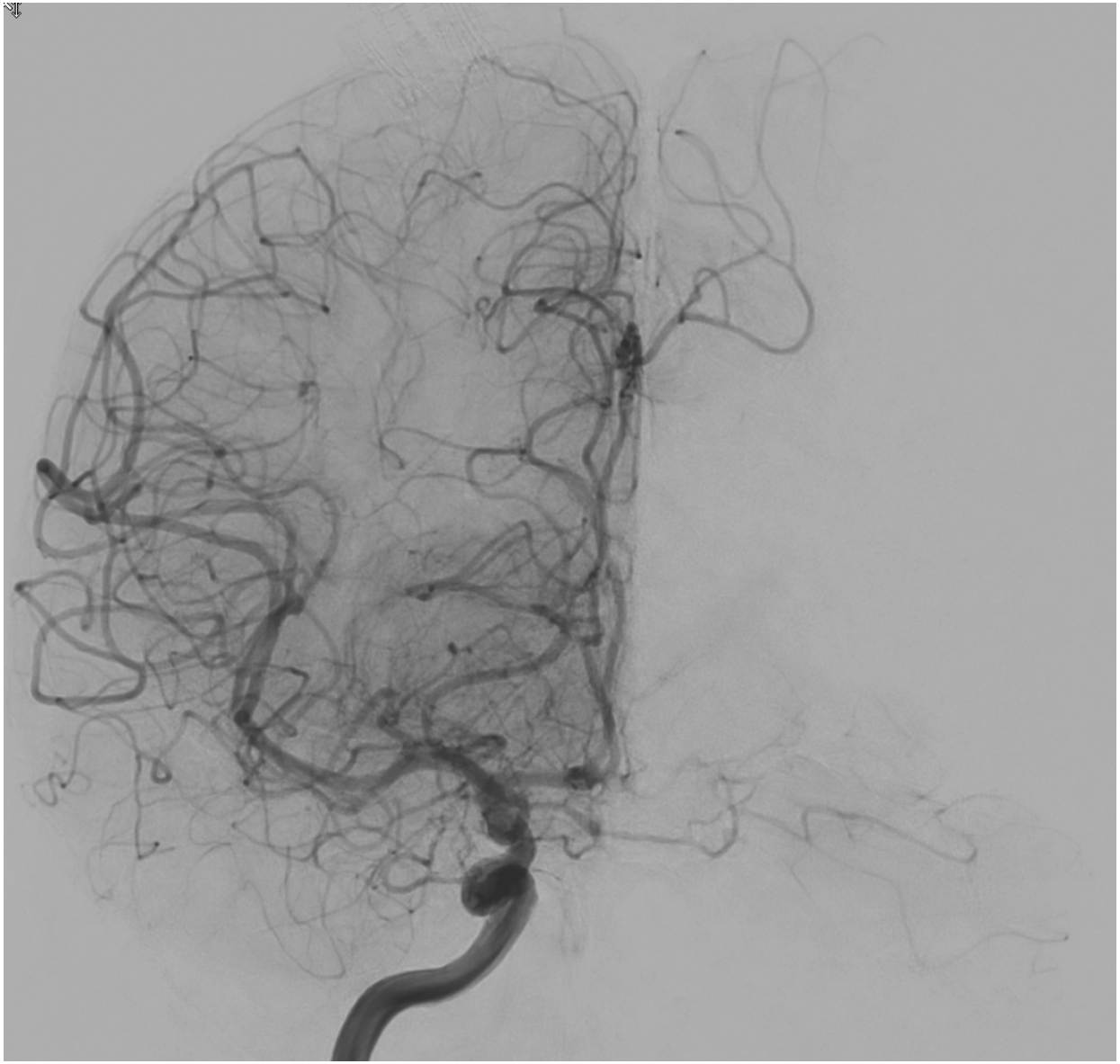
On CT-angiography: short occlusion of basilar artery

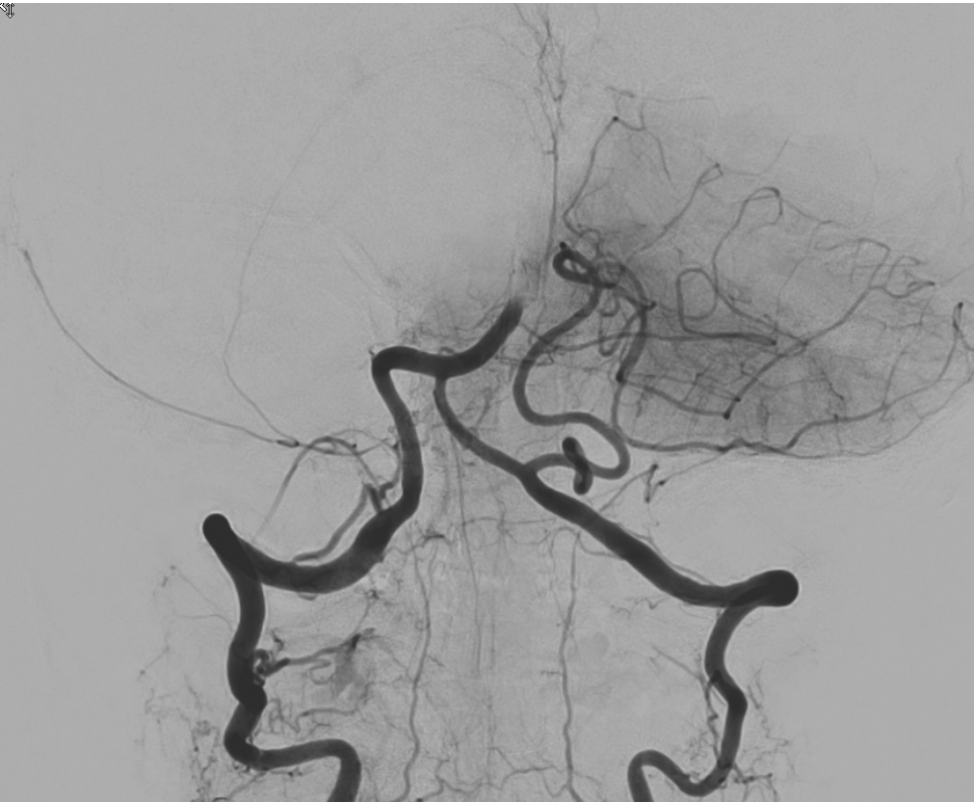
→ Send to recanalisation of basilar artery

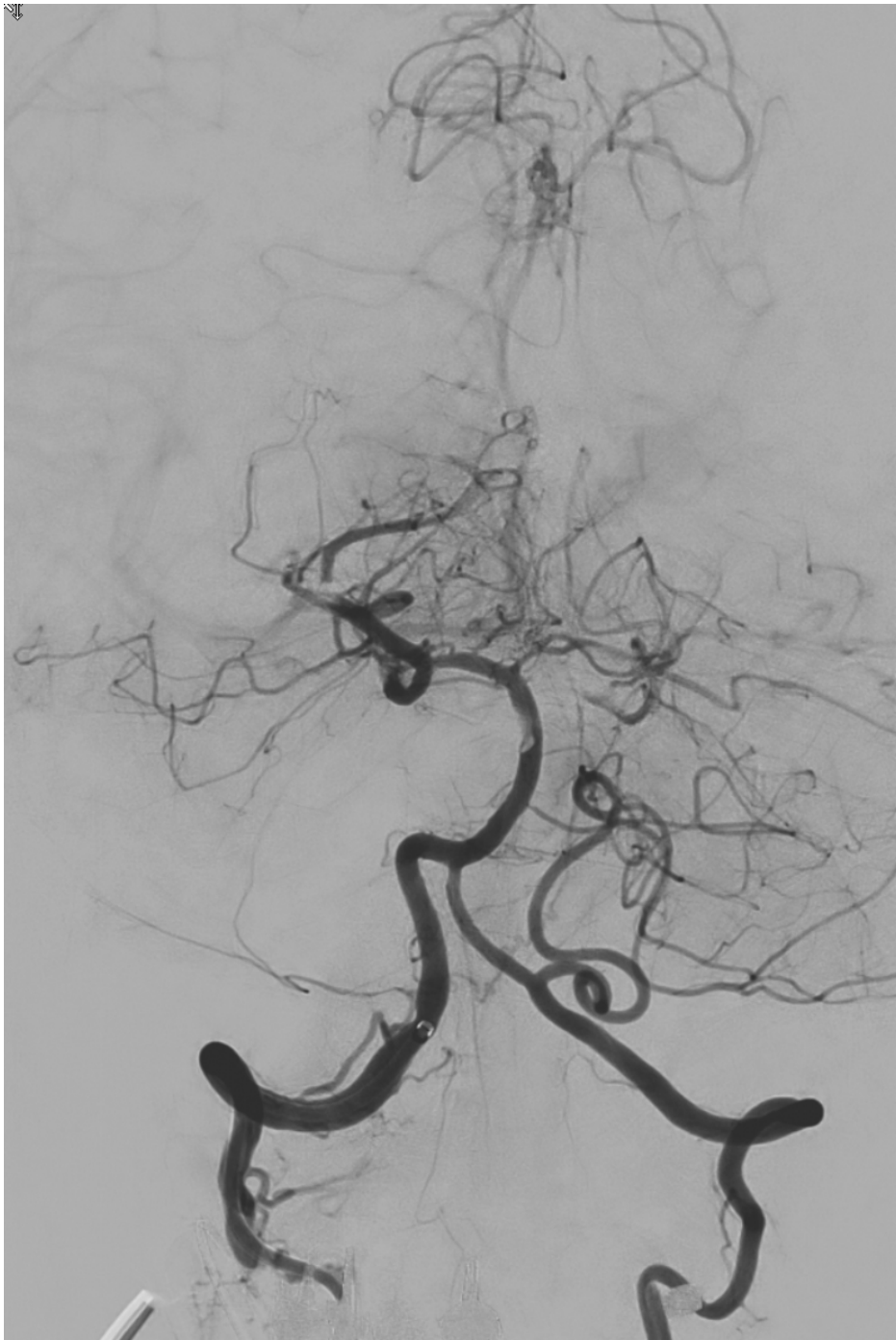
29.10.2017

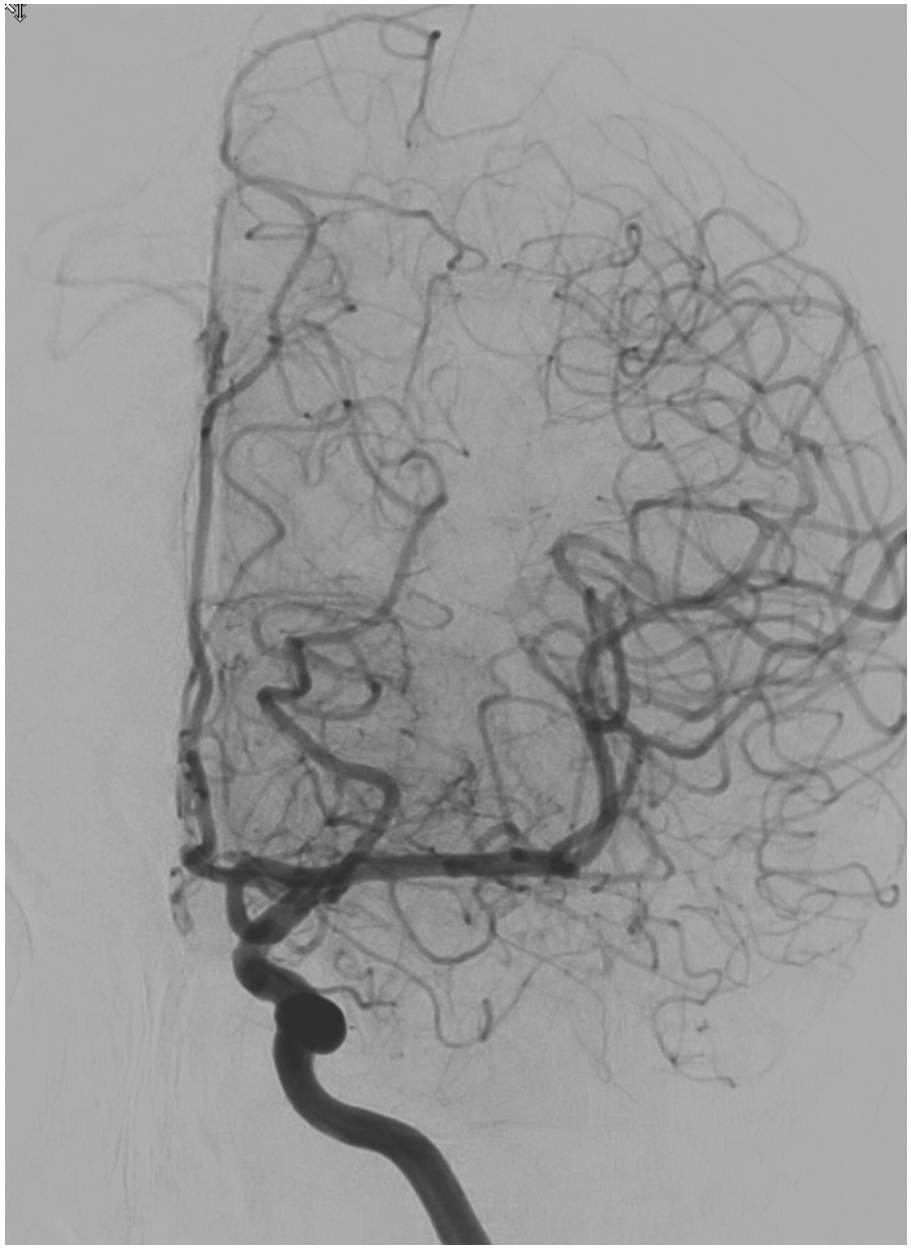






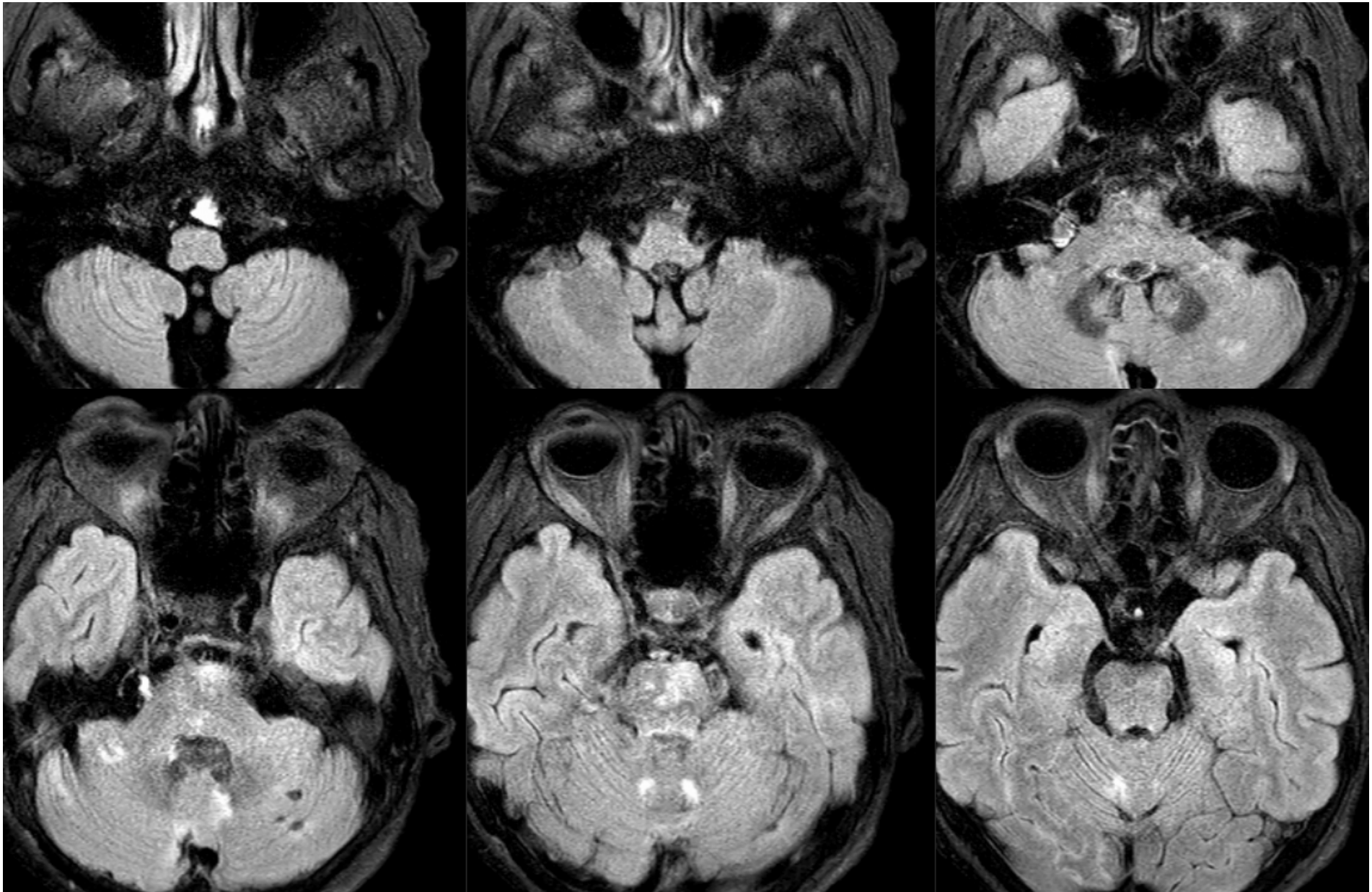






Posterior cerebral artery perfused via ICA

At discharge residual dysarthria

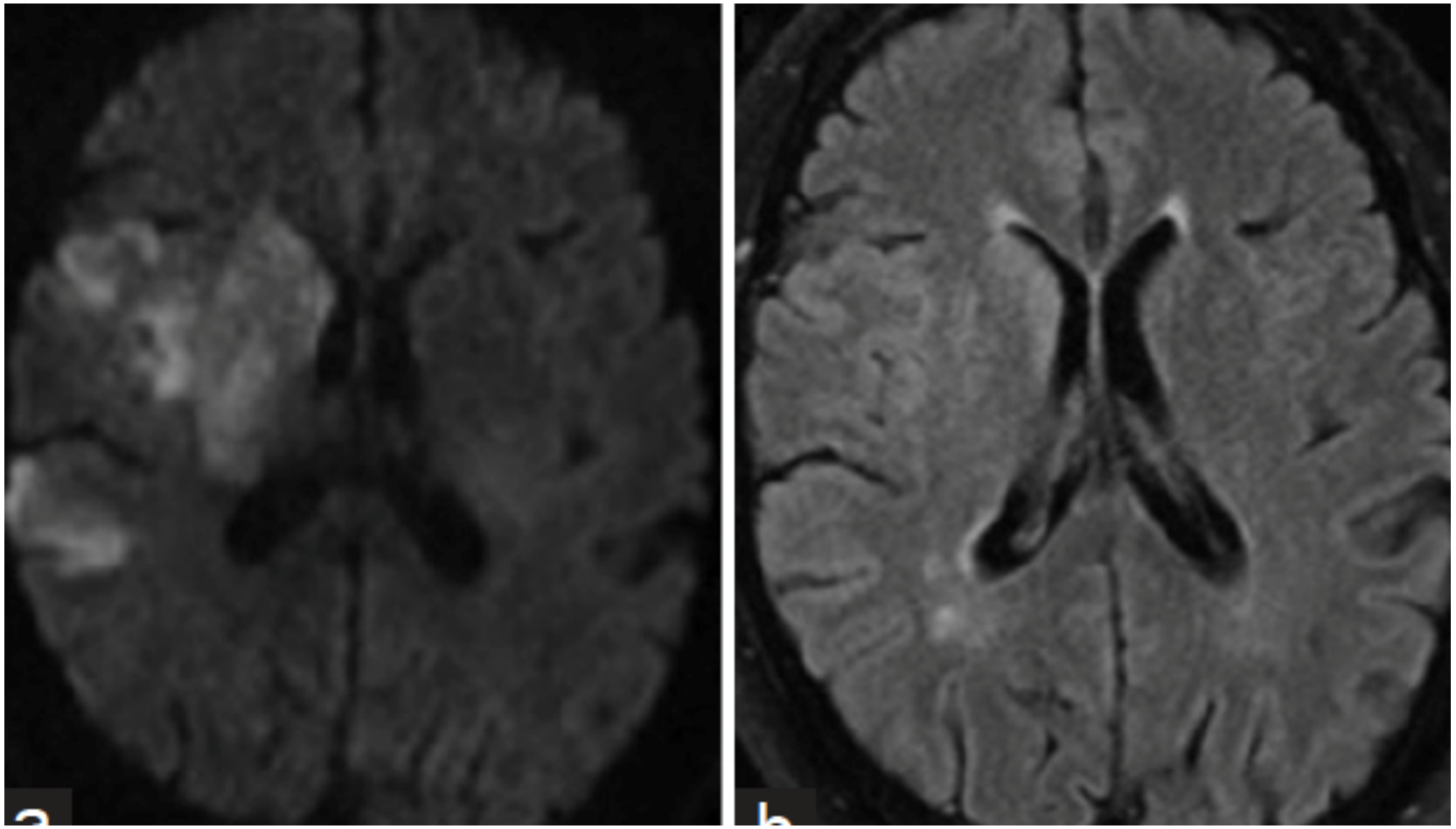


Imaging

- DAWN: MRI (DWI) or CTP-rCBF maps
  MR-angiography or CT-angiography

→ Evidence of clinical imaging mismatch has to be detected

- DWI/PWI (specific time point)
- DWI/FLAIR (bleeding risk using these sequences remains yet to be determined)


a
b

Fluid-Attenuated Inversion Recovery (FLAIR) Signal Intensity Can Identify Stroke Within 6 and 8 Hours

John Legge, MD,* Ada Graham, MD,* Shailesh Male, MD,† David Copeland, MD,* Richard Lee, MD,* Nitin Goyal, MD,† and Ramin Zand, MD, MPH†‡

CONCLUSION: Quantitative assessment of FLAIR sequence can be used to identify patients within 6 and 8 hours of stroke onset.

Among patients with no visible FLAIR hyperintensity, 83% (95% CI, 77%-89%) were within the 6-hour window

FLAIR helps to determine age of infarct but did not prove to become selection criteria yet

J Stroke Cerebrovasc Dis. 2017

Conclusion

- Recanalisation feasible any time, even in chronic occlusive disease
- Good candidates:
  - Patient with large vessel occlusion and small infarct core → clinical mismatch
  - Patient with fluctuating symptoms
- Clinical symptoms and imaging findings do play major role
- Time window not limiting!

Conclusion

- Recanalisation feasible any time, even in chronic occlusive disease
- Good candidates:
  - Patient with large vessel occlusion and small infarct core
  - Patient with fluctuating symptoms
- Clinical symptoms and imaging findings do play major role
- Time window not limiting!

Window officially open

Time is still brain