Thrombectomy for Large Vessels Occlusion : How Does Imaging Influence Triage?

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Disclosure

- I have no financial conflict of interest to disclose for the content of this lecture.

- I use Rapid Software for Hyper-acute Stroke detection.

Learning Objectives

- 1) Review the imaging inclusion criteria for Thrombectomy candidates up to 24 hours;
- 2) Illustrate the role of CTP using Rapid software and other CTP programs;
- 3) Discuss management of exemplary cases;
- 4) Recommend a practical algorithm for patient's management.

Summary Results of Trials for EVT up to 12 hours

	MR CLEAN		ESCAPE		EXTEND-IA		SWIFT-PRIME		REVASCAT	
Pts	500		316		70		196		206	
Circulation	Anterior		Anterior		Anterior		Anterior		Anterior	
Imaging	CT-CTA		CT-CTA dynamic		CT-CTA-CTP		CT-CTA-CTP		CT-CTA	
Time Window	6		12		6		6		8	
Pt's Age	65		70		69		66		66	
RANDOMIZATION	ENDO	CTRL	ENDO	CTRL	ENDO	CTRL	ENDO	CTRL	ENDO	CTRL
NIHSS	17	18	16	17	17	13	17	17	17	17
IV-TPA (%)	87.1	90.6	72.7	78.7	100%		100%		68	77.7
Perfusion Delay (h)	5.5		4.0		4.1		4.2		5.9	
mRS 0-2 at 90days (%)	32.6	19.1	53	29.3	71.4	40	60.2	35.3	43.7	28.2
NNT	7		4		3		4		6	
Symptomatic ICH	7.7	6.4	3.6	2.7	0	6	0	3	4.9	1.9
Death at 90 days(%)	18.9	18.4	10.4	19	9	20	9	12	18.4	15.5

Summary Trials 6 to 24 hours

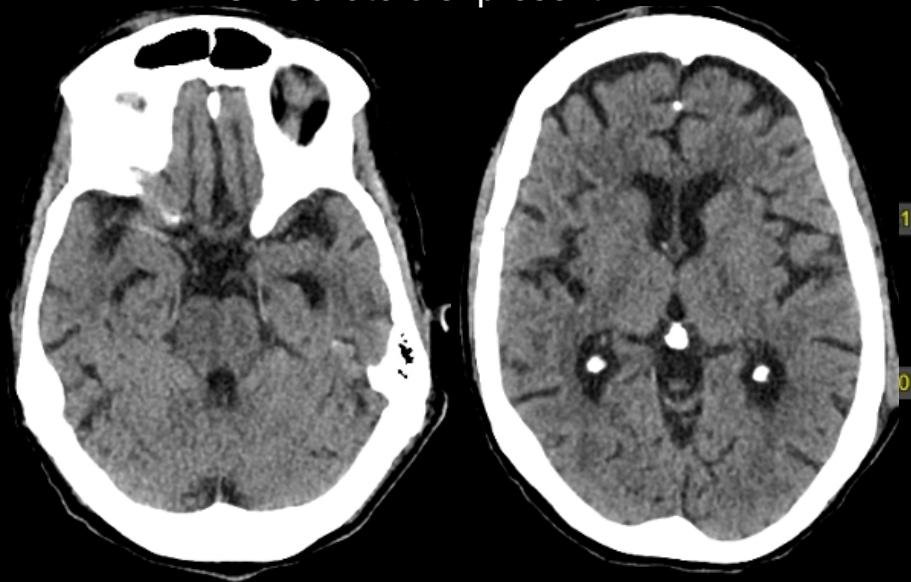
	DAWN*		DEFUSE 3**	
Pts	206		182	
Circulation	Anterior		Anterior	
Imaging	CTP-DWI		Rapid Software CT or MRI	
Time Window	6-24		6-16	
Pt's Age/ NIHSS/ Core Infarct Vol	Group A >80 / 10 or> / < 21ml. Group B <80/ 10 or> / <31ml. Group C <80/ 20 or >/ >31ml, < 51ml.		70 71 Infarct Core <70ml Mismatch 1.8 or >	
RANDOMIZATION	ENDO	CTRL	ENDO	CTL
NIHSS	17		16	
mRS 0-2 at 90days (%)	49	13	45	17
Symptomatic ICH (%)	6	3	7	4
Death at 90 days(%)	19	18	14	26

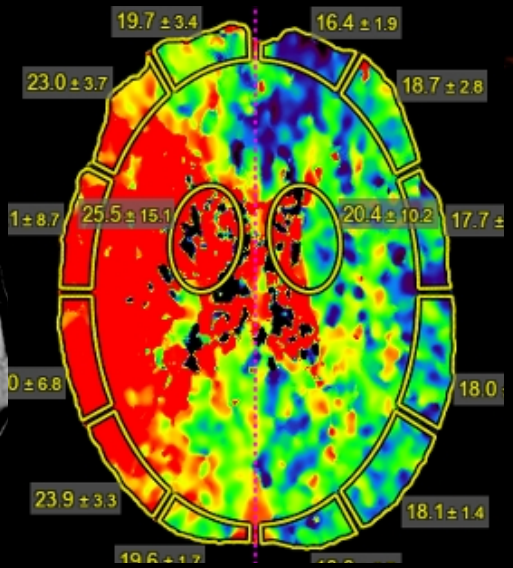
***Dawn Trial**
Nogueira et Al.
N Engl J Med 2018; 378:11-21

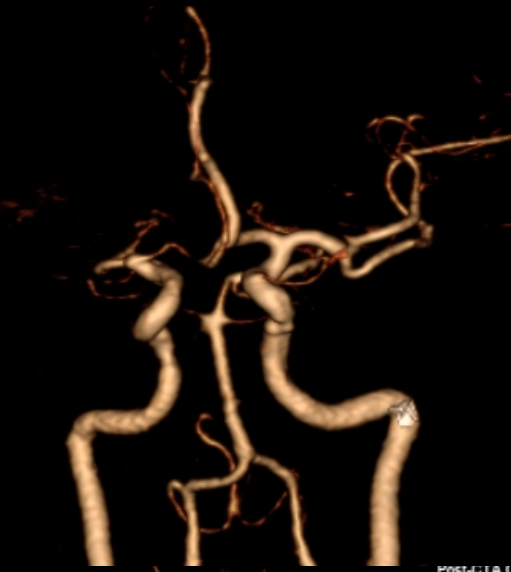
****Defuse 3 Trial**
Albers et Al.
N Engl J Med 2018; 378:708-718

Selection Criteria

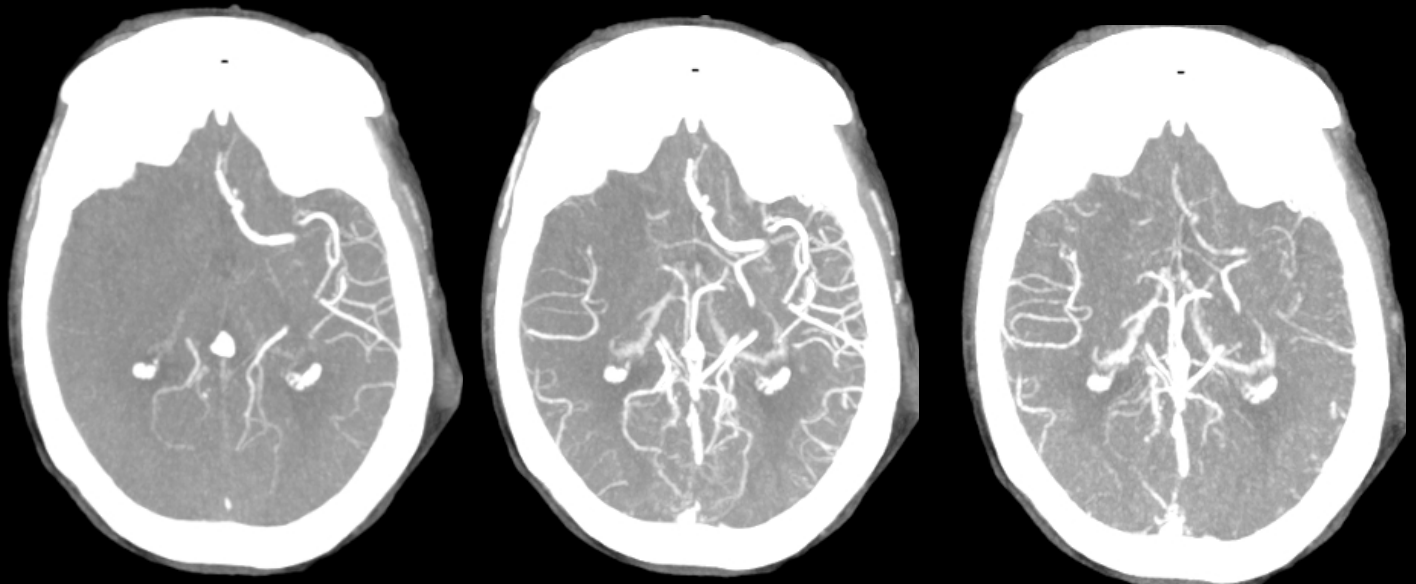
- P –Parenchyma : ASPECT 6 or more;
- P –Pipes: ICA,M1,may consider M2;
- C –Collaterals: present.

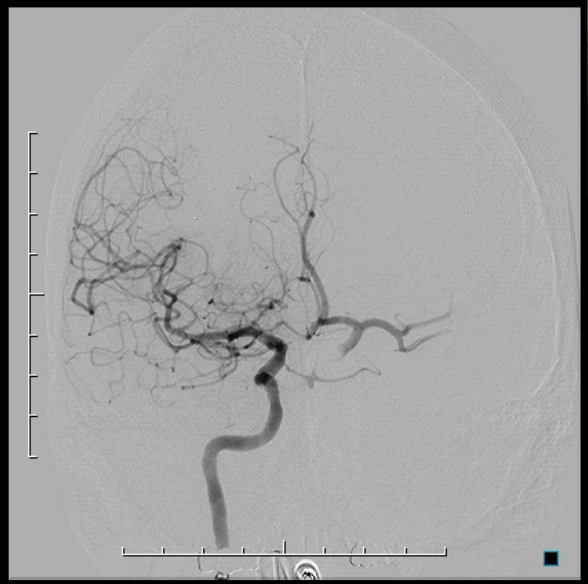


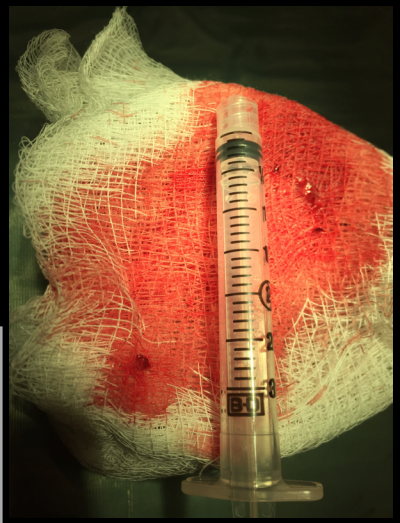




CTA Neck 60cc







Comparison of Perfusion CT Software to Predict the Final Infarct Volume After Thrombectomy

Friederike Austein, MD; Christian Riedel, MD; Tina Kerby, PhD; Johannes Meyne, MD; Andreas Binder, MD; Thomas Lindner, MSc; Monika Huhndorf, MD; Fritz Wodarg, MD; Olav Jansen, MD, PhD

Background and Purpose—Computed tomographic perfusion represents an interesting physiological imaging modality to select patients for reperfusion therapy in acute ischemic stroke. The purpose of our study was to determine the accuracy of different commercial perfusion CT software packages (Philips (A), Siemens (B), and RAPID (C)) to predict the final infarct volume (FIV) after mechanical thrombectomy.

Methods—Single-institutional computed tomographic perfusion data from 147 mechanically recanalized acute ischemic stroke patients were postprocessed. Ischemic core and FIV were compared about thrombolysis in cerebral infarction (TICI) score and time interval to reperfusion. FIV was measured at follow-up imaging between days 1 and 8 after stroke.

Results—In 118 successfully recanalized patients (TICI 2b/3), a moderately to strongly positive correlation was observed between ischemic core and FIV. The highest accuracy and best correlation are shown in early and fully recanalized patients (Pearson r for A=0.42, B=0.64, and C=0.83; $P<0.001$). Bland–Altman plots and boxplots demonstrate smaller ranges in package C than in A and B. Significant differences were found between the packages about over- and underestimation of the ischemic core. Package A, compared with B and C, estimated more than twice as many patients with a malignant stroke profile ($P<0.001$). Package C best predicted hypoperfusion volume in nonsuccessfully recanalized patients.

Conclusions—Our study demonstrates best accuracy and approximation between the results of a fully automated software (RAPID) and FIV, especially in early and fully recanalized patients. Furthermore, this software package overestimated the FIV to a significantly lower degree and estimated a malignant mismatch profile less often than other software. **(*Stroke*. 2016;47:2311-2317. DOI: 10.1161/STROKEAHA.116.013147.)**

Imaging

- Imaging plays a central role in triage of patients with early hyper-acute stroke (0-6 hours) and late (6-24hrs) presentation.
- Large amount of imaging acquired .
- Few critical features to assess:

  ASPECT score,

  LVO,

  Size of infarct core and Mismatch,

  Location of the Stroke,

  Clinical findings (NE, mRS, co-morbidities).

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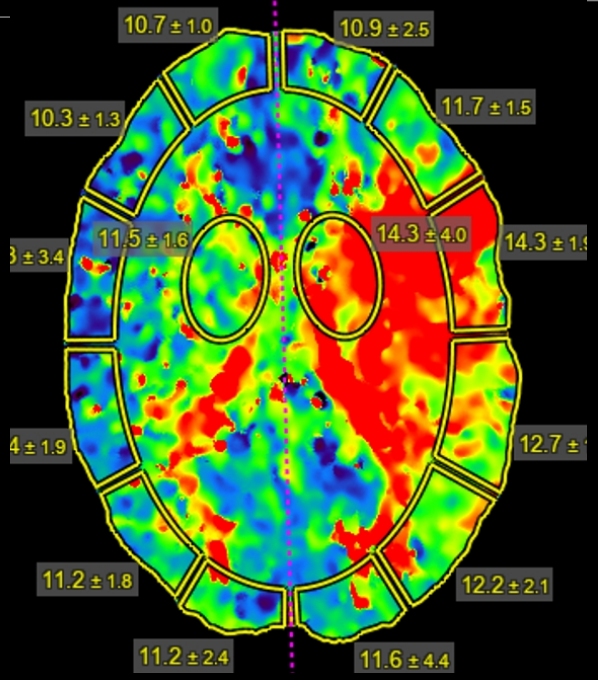
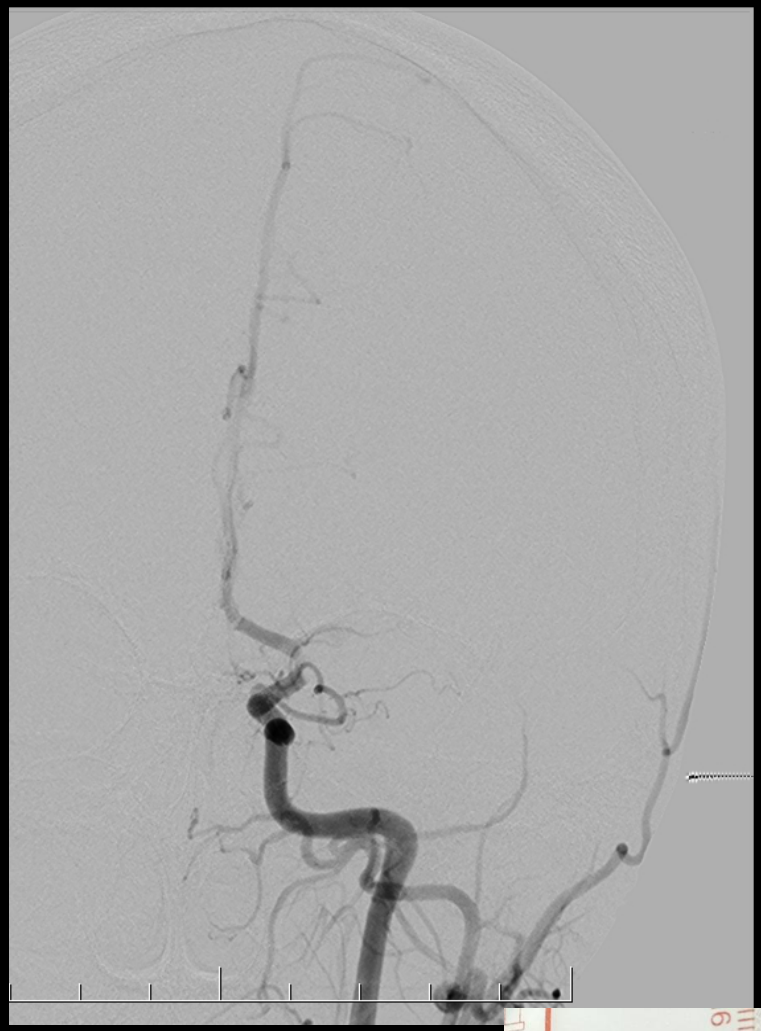
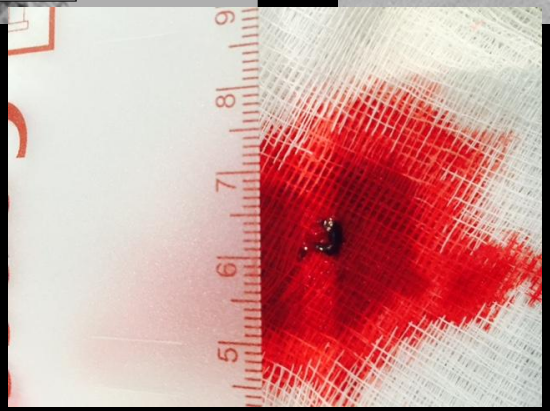
19 year-old female patient with right arm weakness



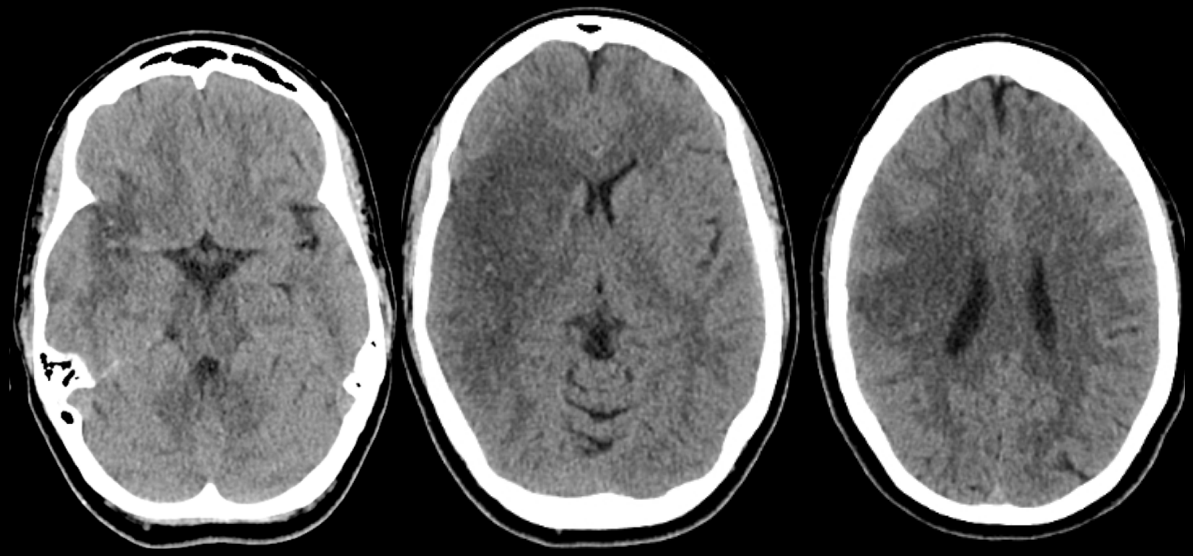




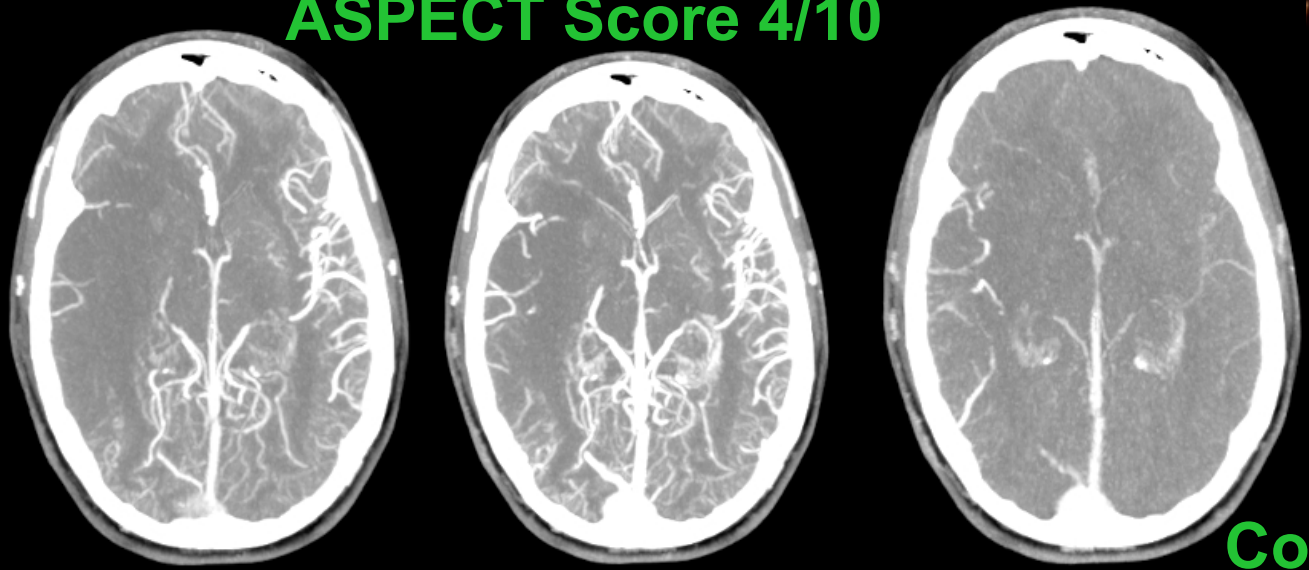
Case #1: 36 years old female.

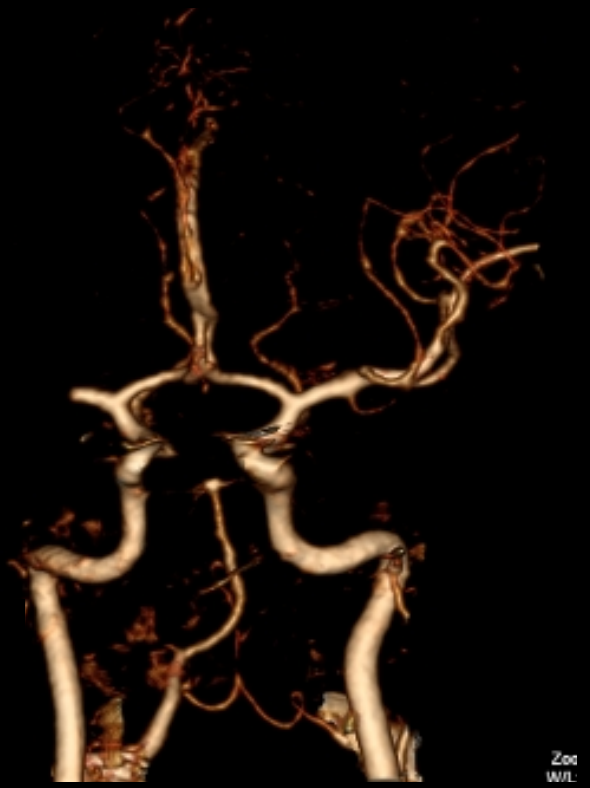
Presenting with left hemiplegia and aphasia, stroke un-witnessed.

NIHSS 24



ASPECT Score 4/10





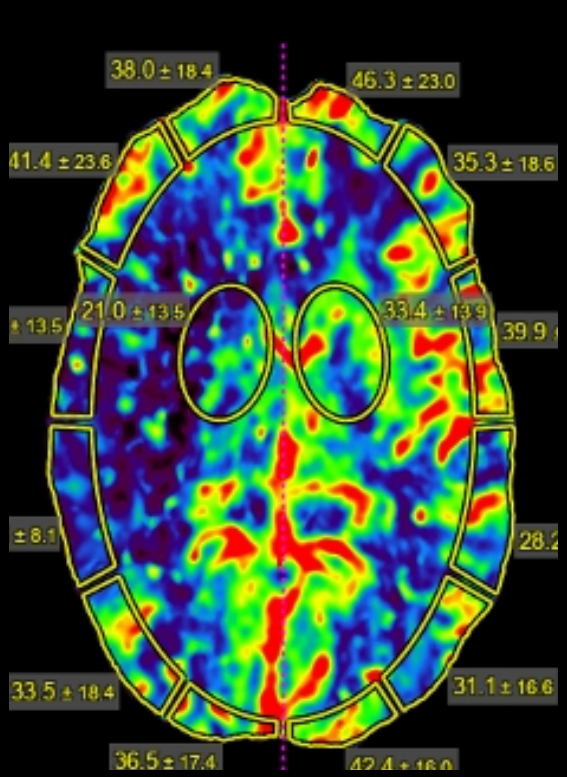
CTA:
Rt M1 occlusion

Collaterals: Adequate

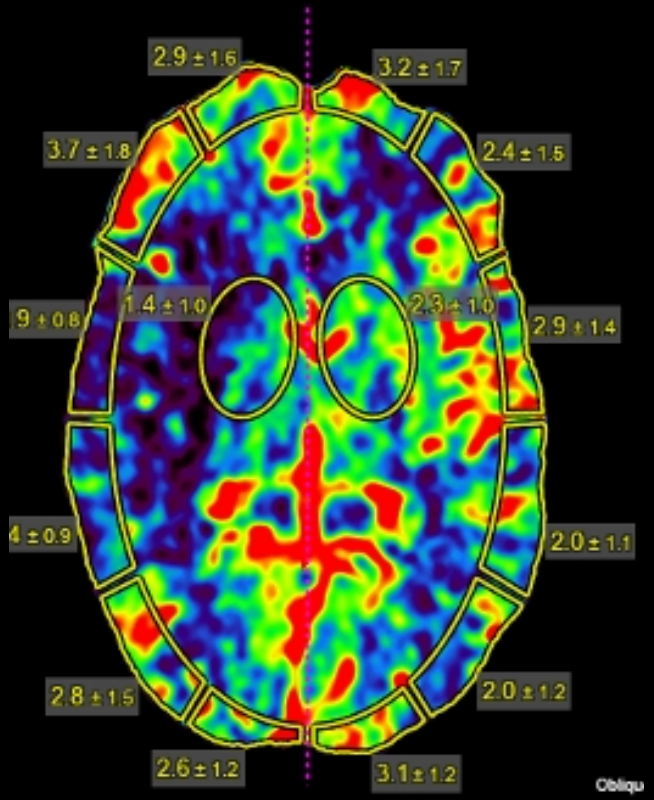
CTP

Is this patient an IV TPA candidate?

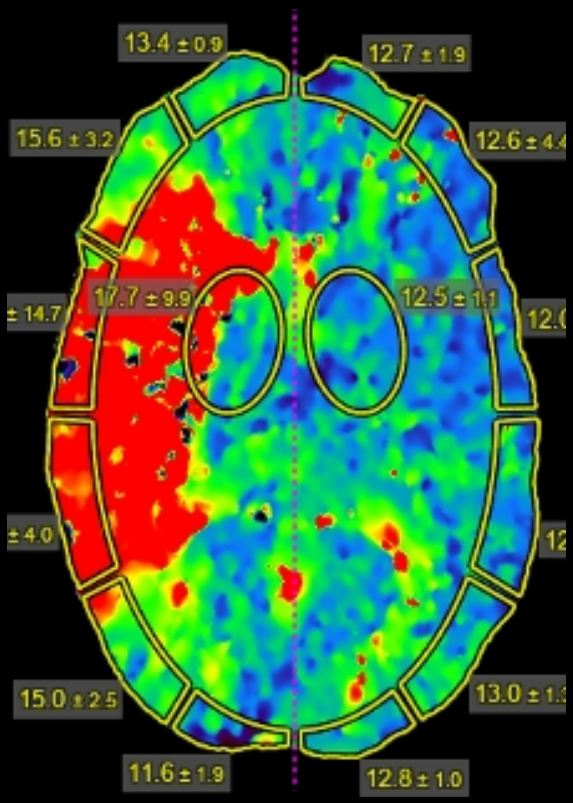
Is this patient a good thrombectomy candidate?



CBF



CBV

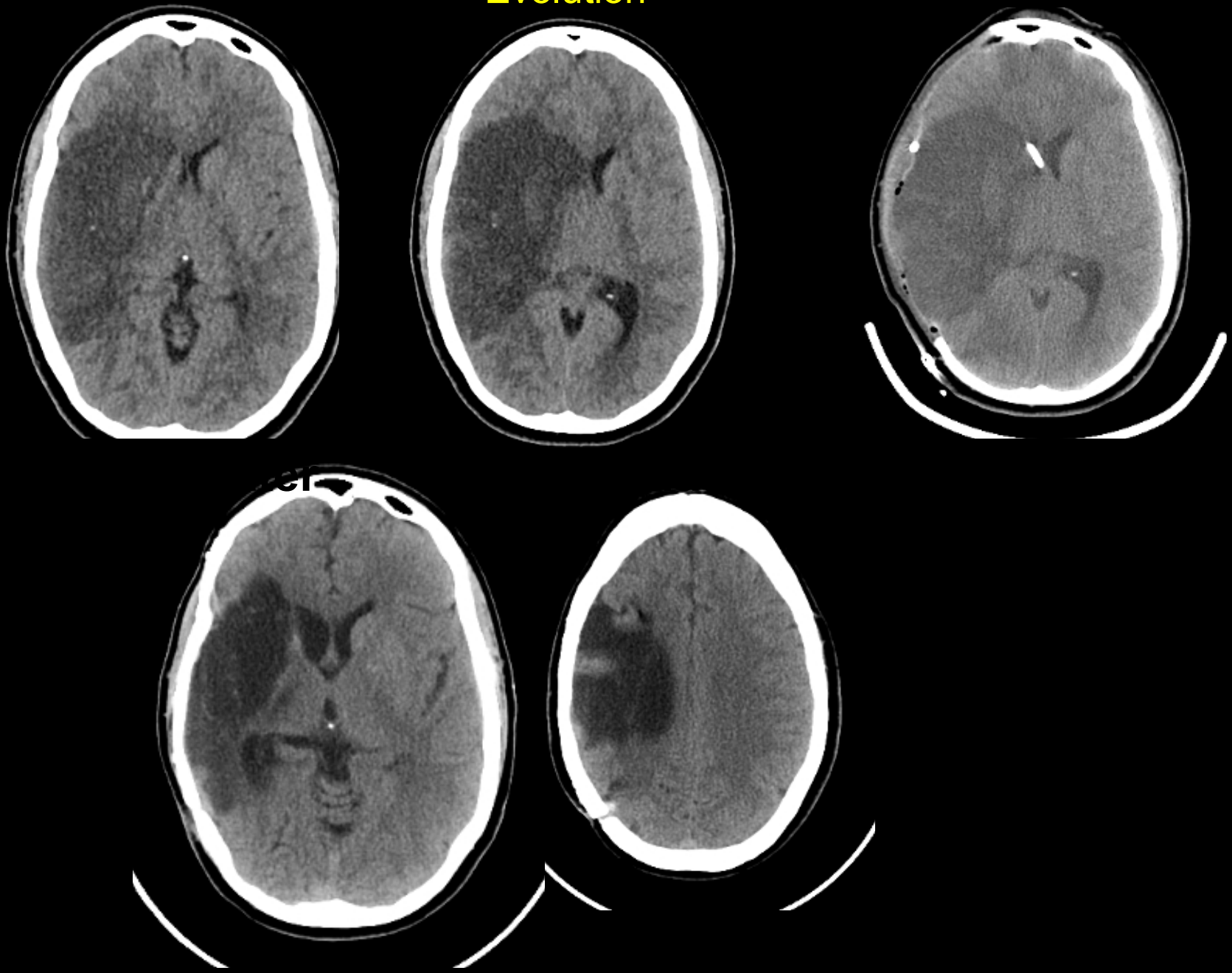


TTP

Case #1
Large Infarct Core without any viable penumbra.

- Un-witnessed event ➡ No IV TPA
- ASPECT score 4/10 ➡ No EVT
- No mismatch on CTP ➡ No EVT.

Evolution



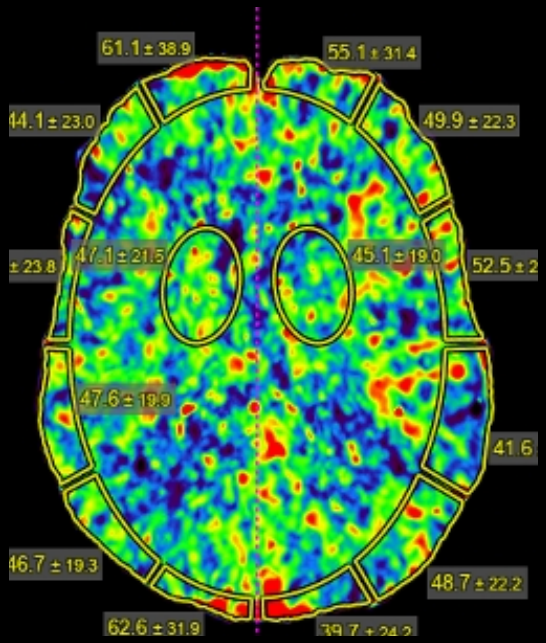
Case #2:

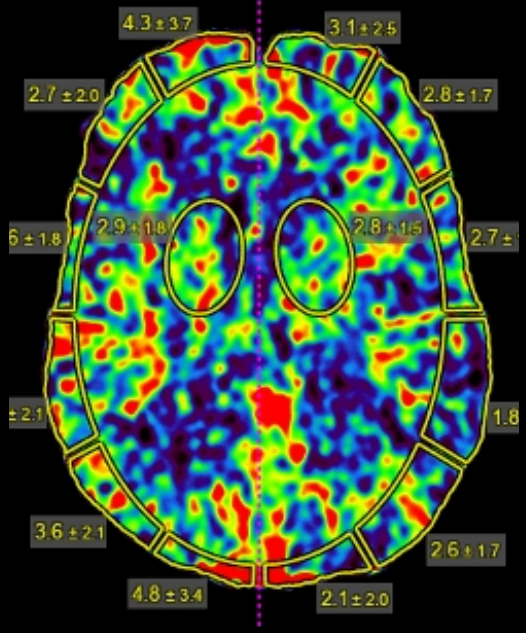
83 years old male, transferred from another hospital.
Patient has received IV TPA. He presents fluctuating symptoms of right hemiplegia, aphasia and facial droop for past 2 hours.
NIHSS 22

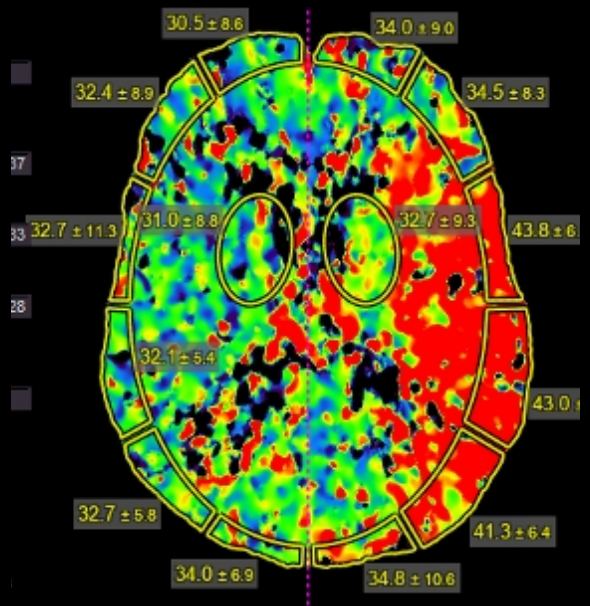
ASPECT score 10/10

CTA and Collaterals

CTP







CBV **CBF** **TTP-TMax**

Angiography:
complete recanalization, EVT not performed,

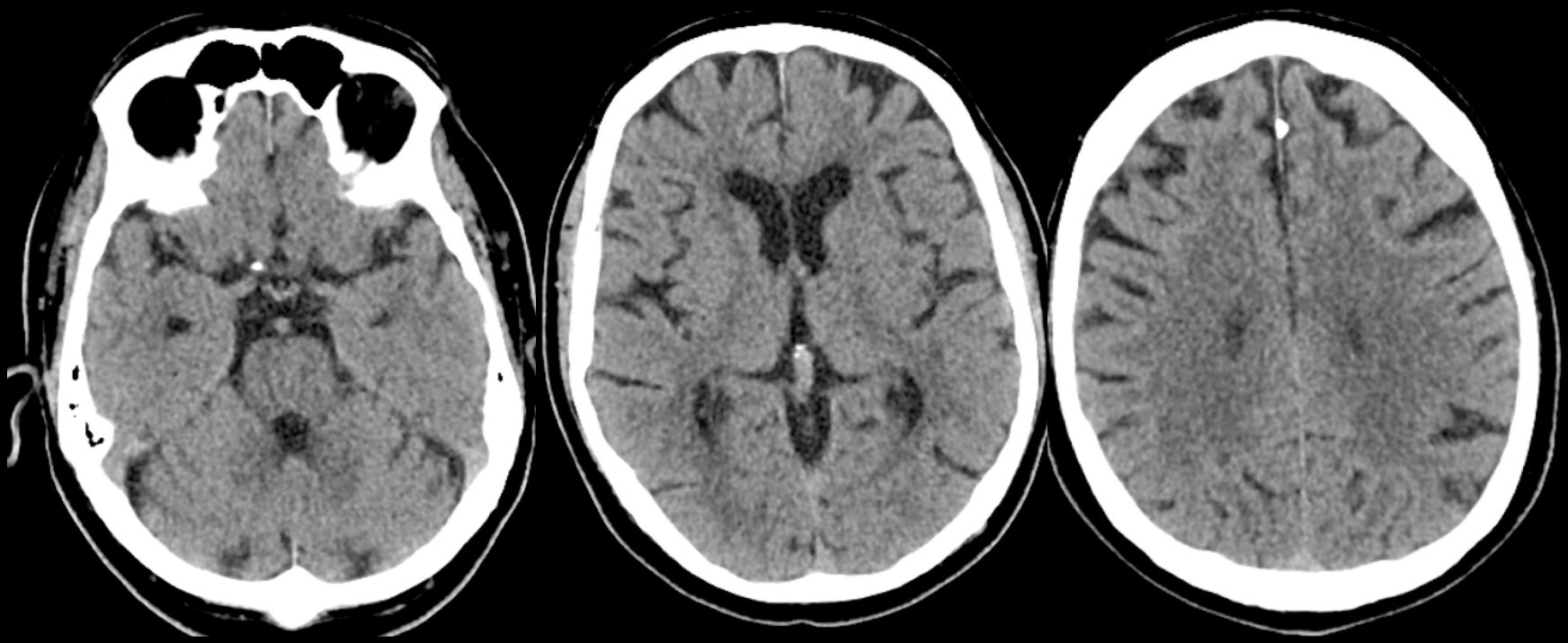
Recanalization with IV TPA

Thrombus > 8mm 0

Thrombus 0 - 5 mm 42%

Low rates of acute recanalization with intravenous recombinant tissue plasminogen activator in ischemic stroke: real-world experience and a call foraction. Stroke. 2010 41(10):2254-2258. Bhatia R, Hill MD, et al.

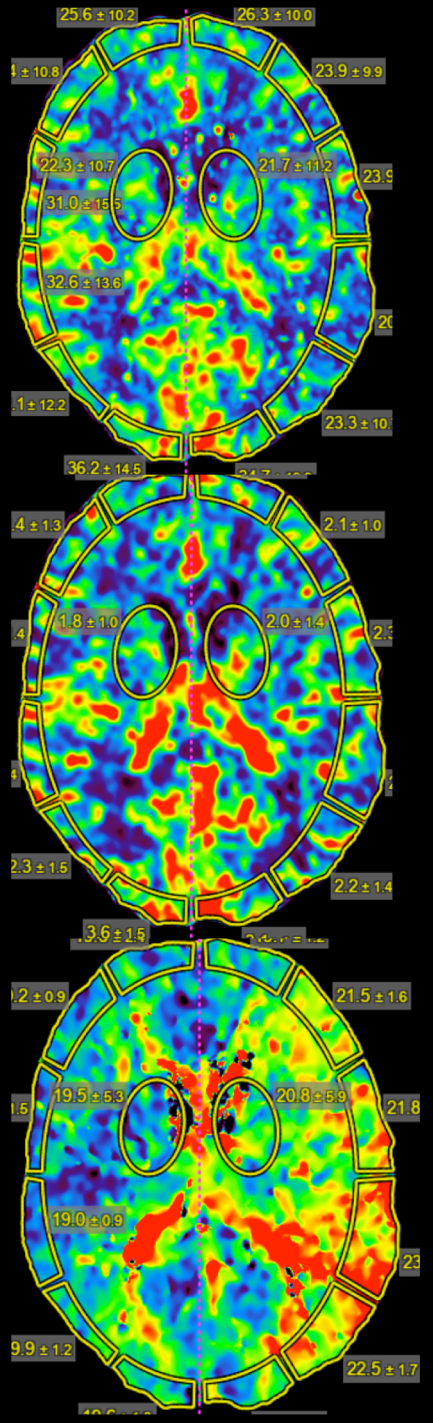
Case # 3: 82 years old male patient, right hemiplegia and speech impairment, NIHSS 17.



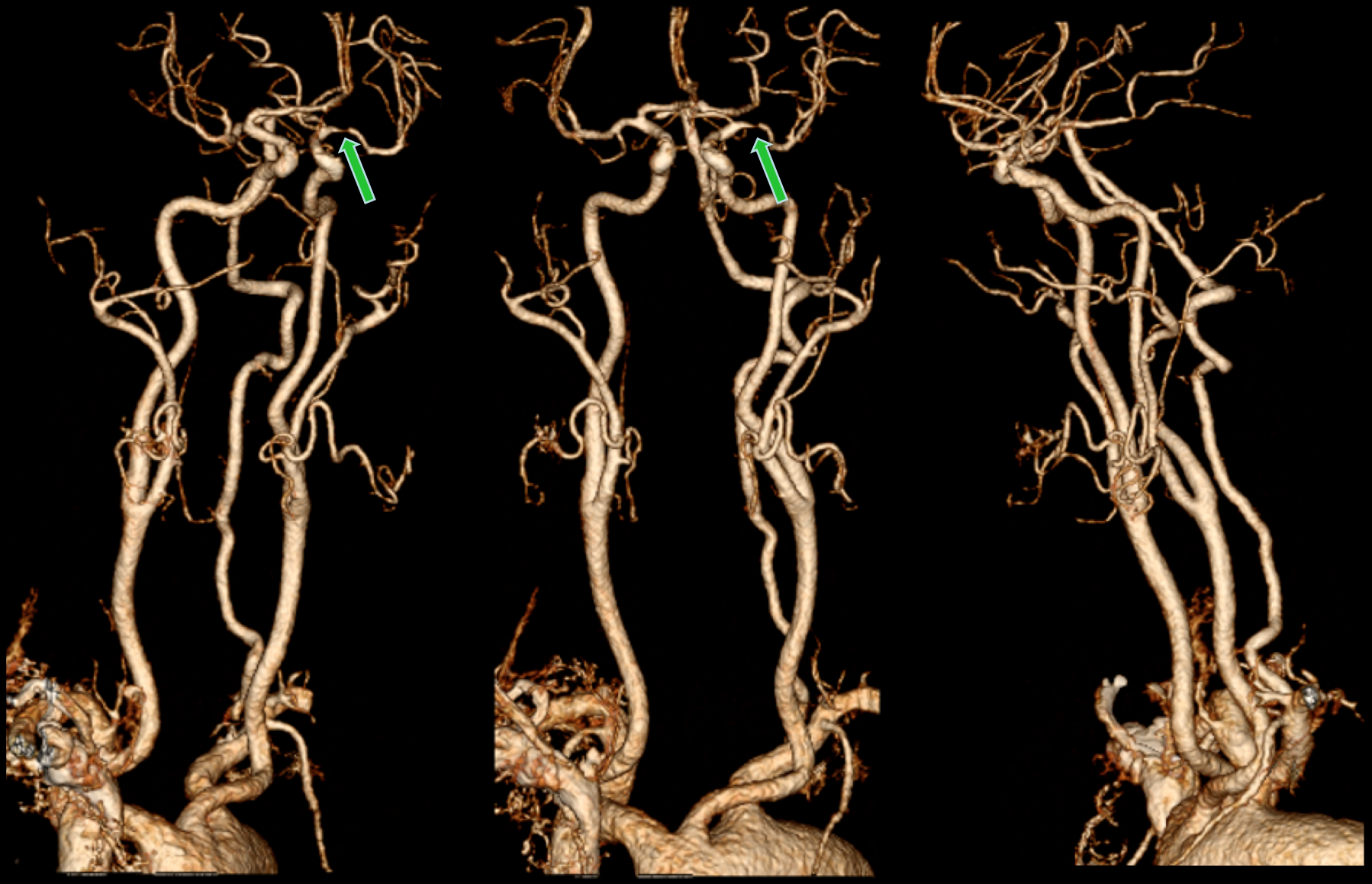
ASPECT score 10/10

CTA and CTP

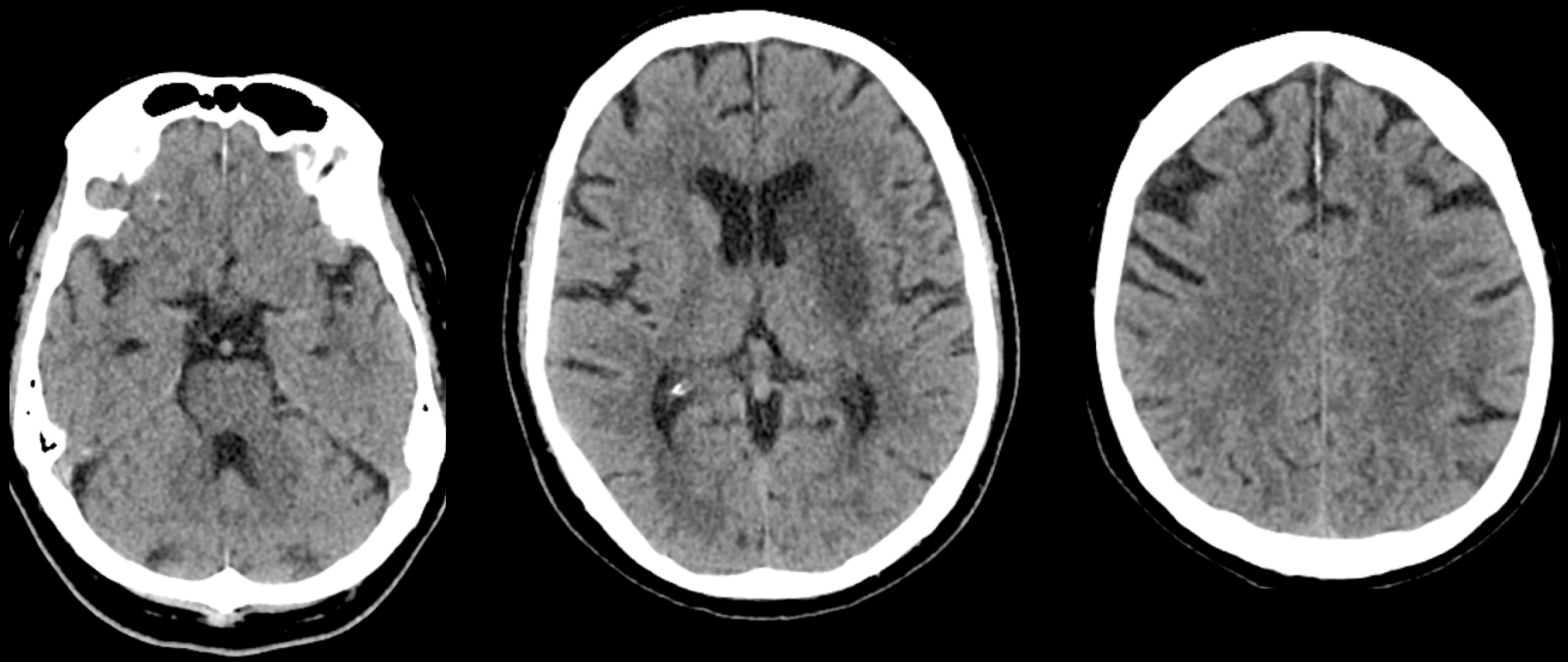

82 years
M
19 Oct 2017
14:02:10
CT
MNH CT HEAD ANGIO -TC
Head Axial SUB CE
R
L


25.6 ± 10.2
26.3 ± 10.0
23.9 ± 9.9
22.3 ± 10.7
21.7 ± 11.2
31.0 ± 15.5
32.6 ± 13.6
23.3 ± 10.
36.2 ± 14.5
2.1 ± 1.0
1.8 ± 1.0
2.0 ± 1.4
2.2 ± 1.4
3.6 ± 1.5
21.5 ± 1.6
19.5 ± 5.3
20.8 ± 5.9
19.0 ± 0.9
22.5 ± 1.7

CTA neck: no carotid stenosis, left M1 stenosis



CT f/u 10 days later

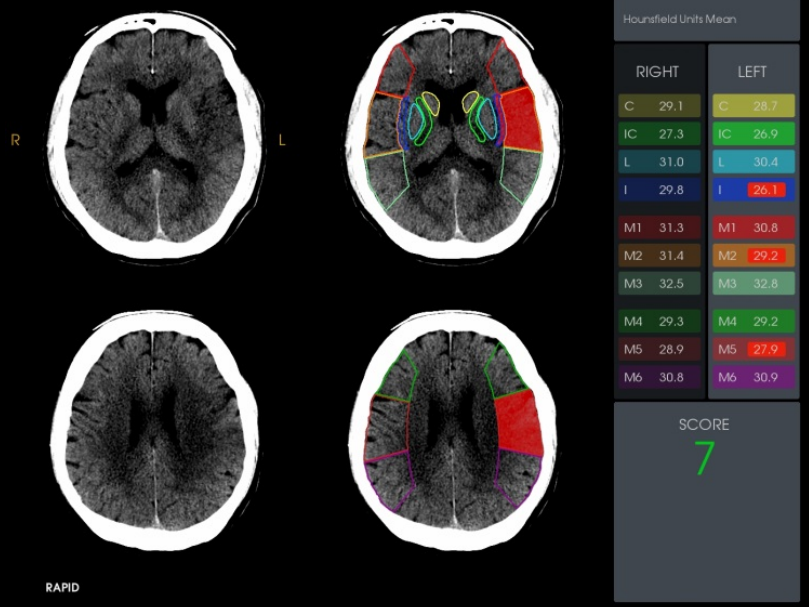


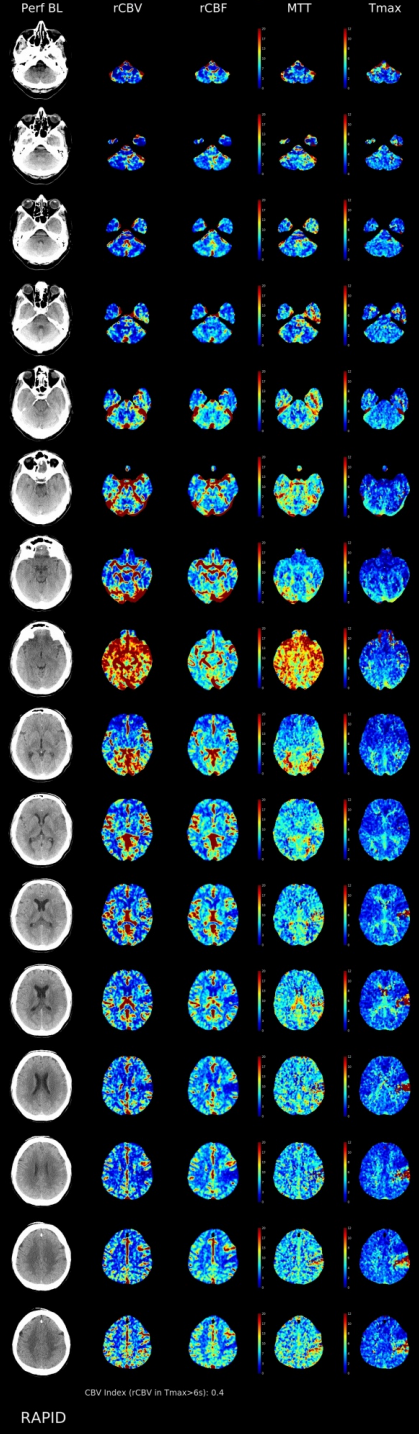
WASID: **ASA effective and safer that Warfin to prevent recurrent stroke**
High recurrence stroke rate if stenosis is 70-99%.*

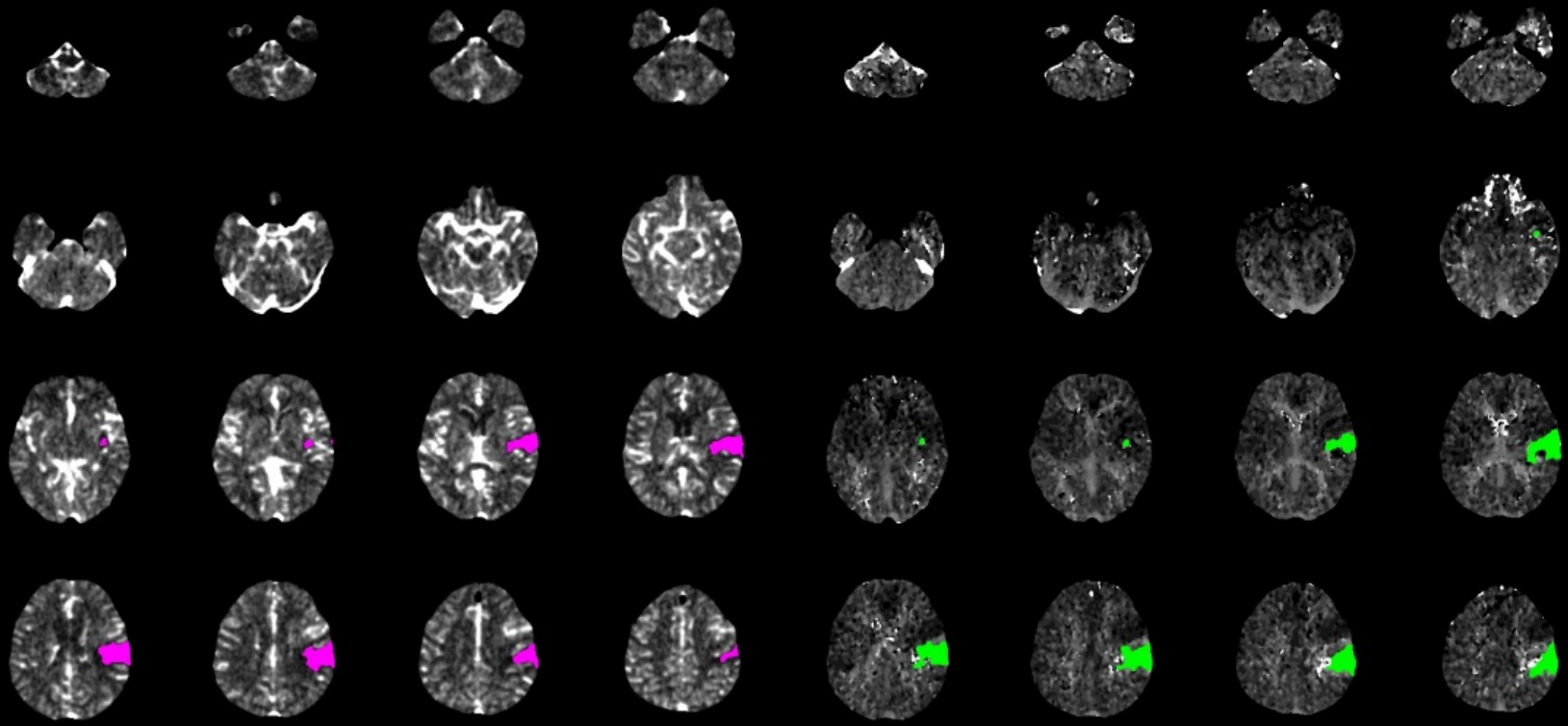
SAMMPRIS: **aggressive medical treatment superior to PTAS, high level of peri-procedural stroke.****

*T Turan et al Stroke 2009 40(6):2257-2261
**Cderdeyn et al. Lancet 2014, 383:333-341

57 y.o. Male
Lt MCA syndrome
NIHSS23
Last seen normal
at 9:00 am.
CTA done at 6:33 pm.







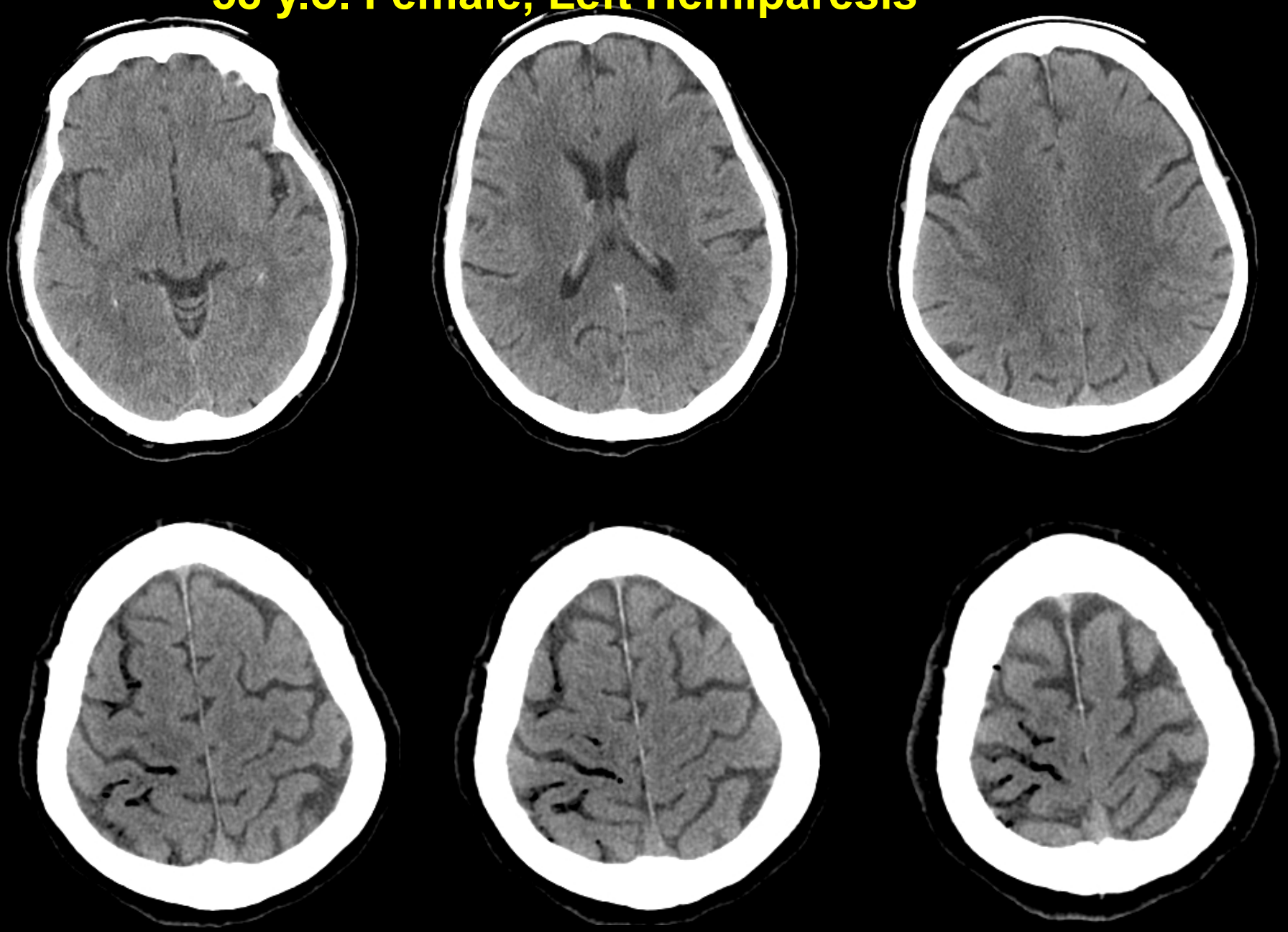
CBF<30% volume: 15 ml

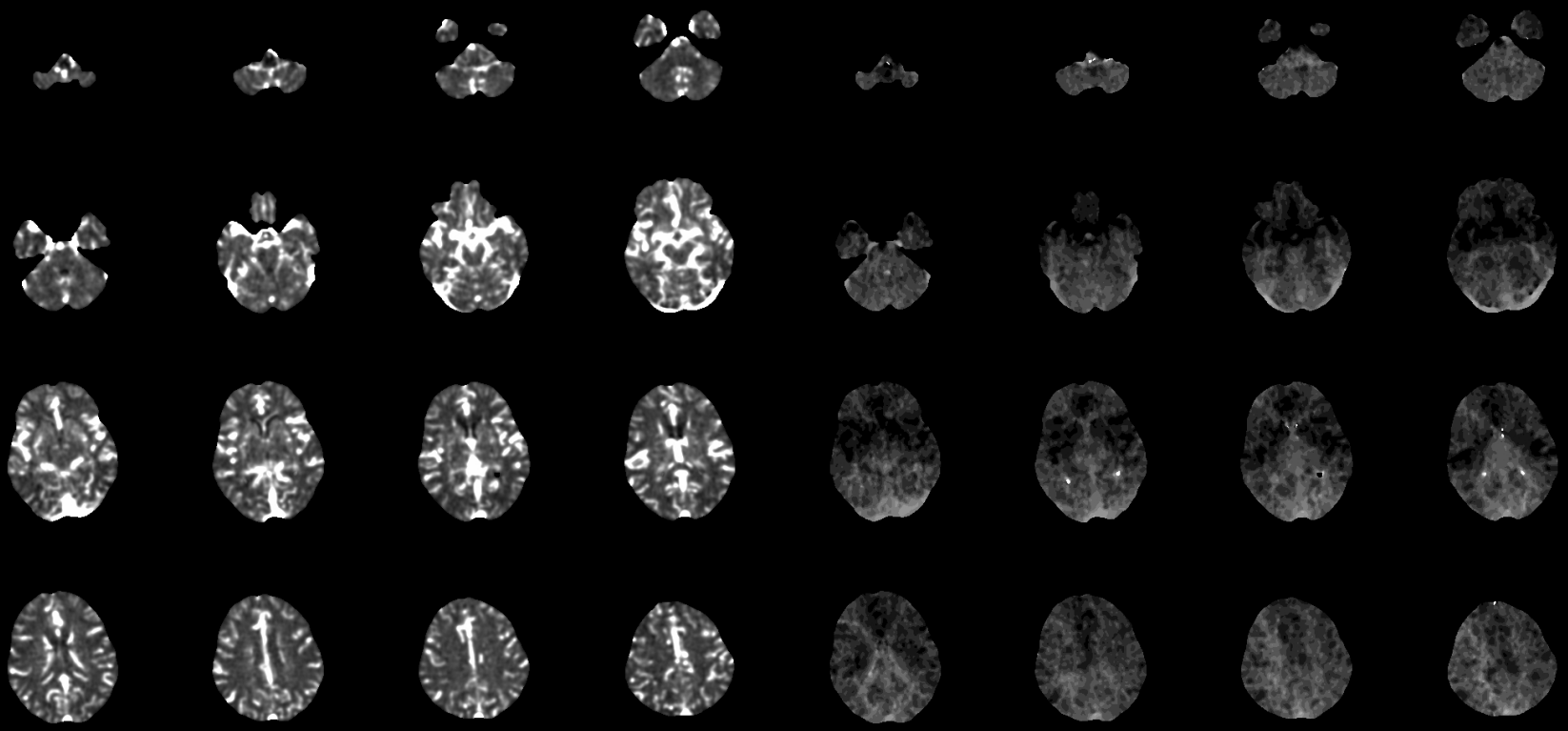
Mismatch volume: 5 ml
Mismatch ratio: 1.3

Tmax>6.0s volume: 20 ml

RAPID

58 y.o. Female, Left Hemiparesis



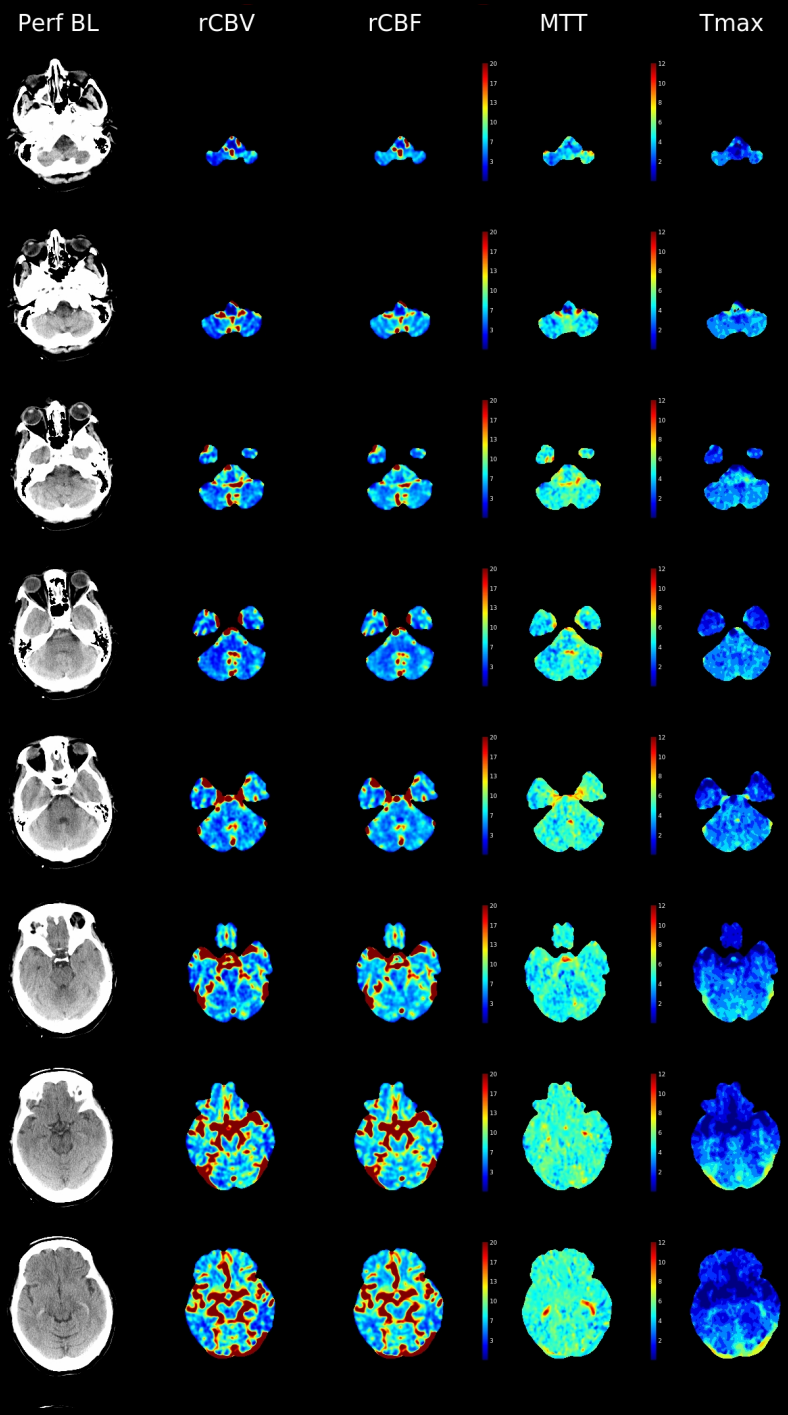


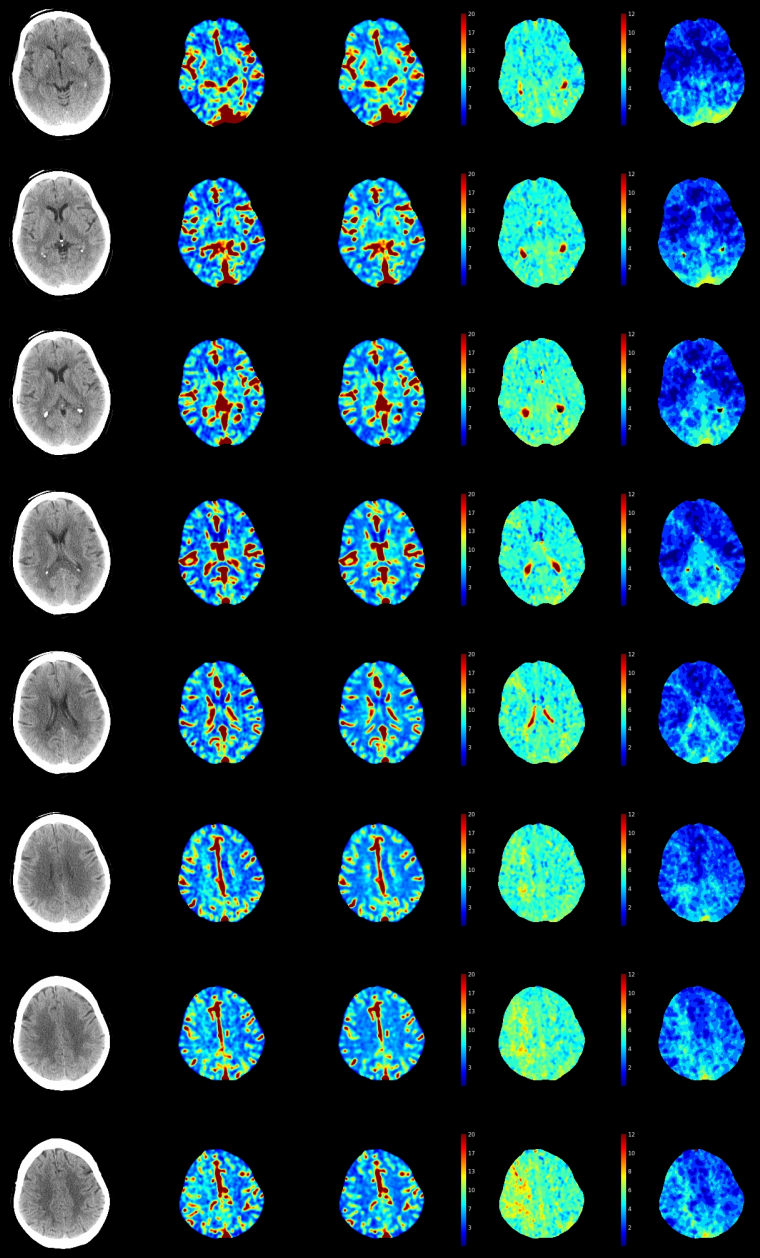
CBF<30% volume: 0 ml

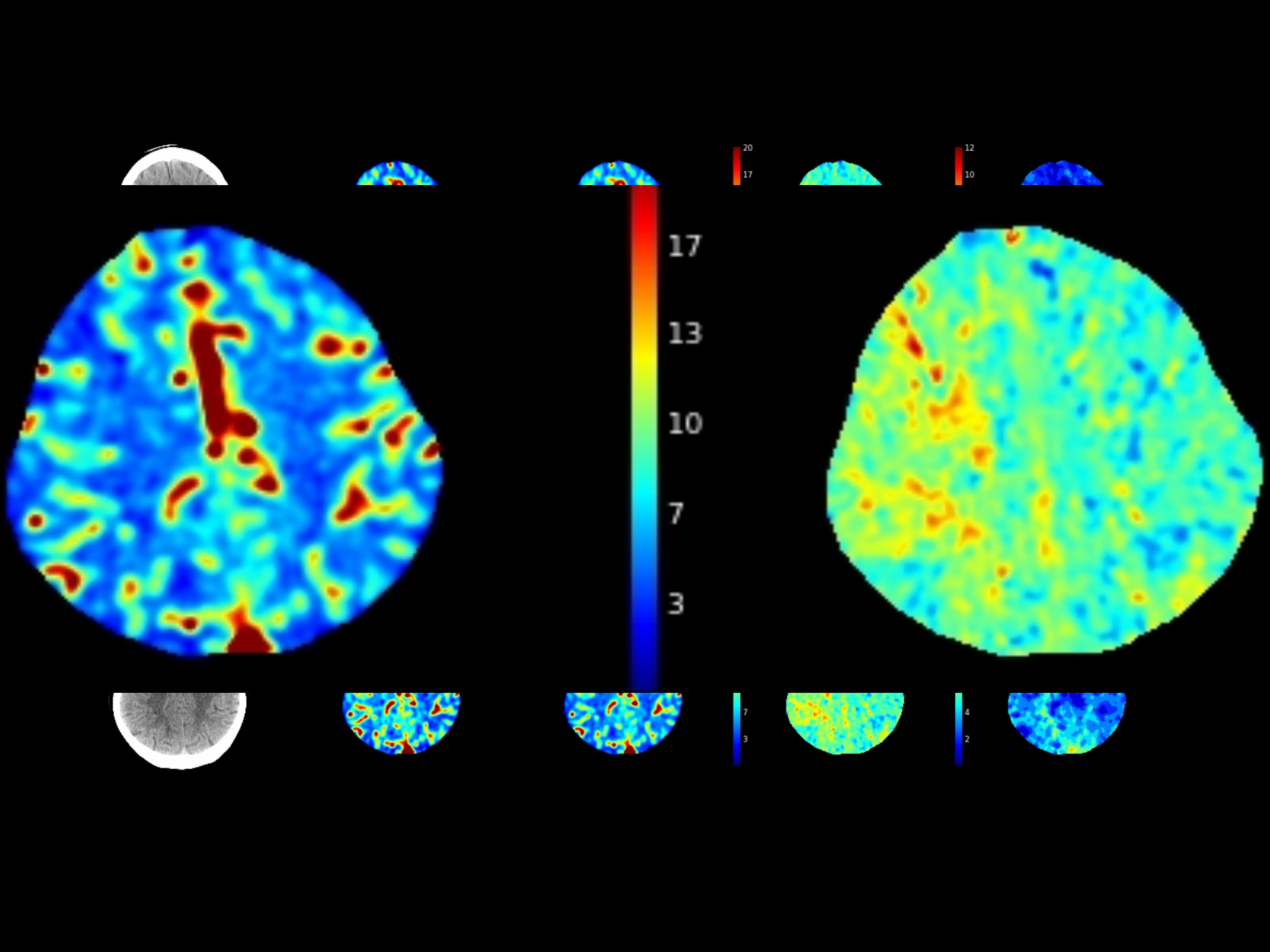
Tmax>6.0s volume: 0 ml

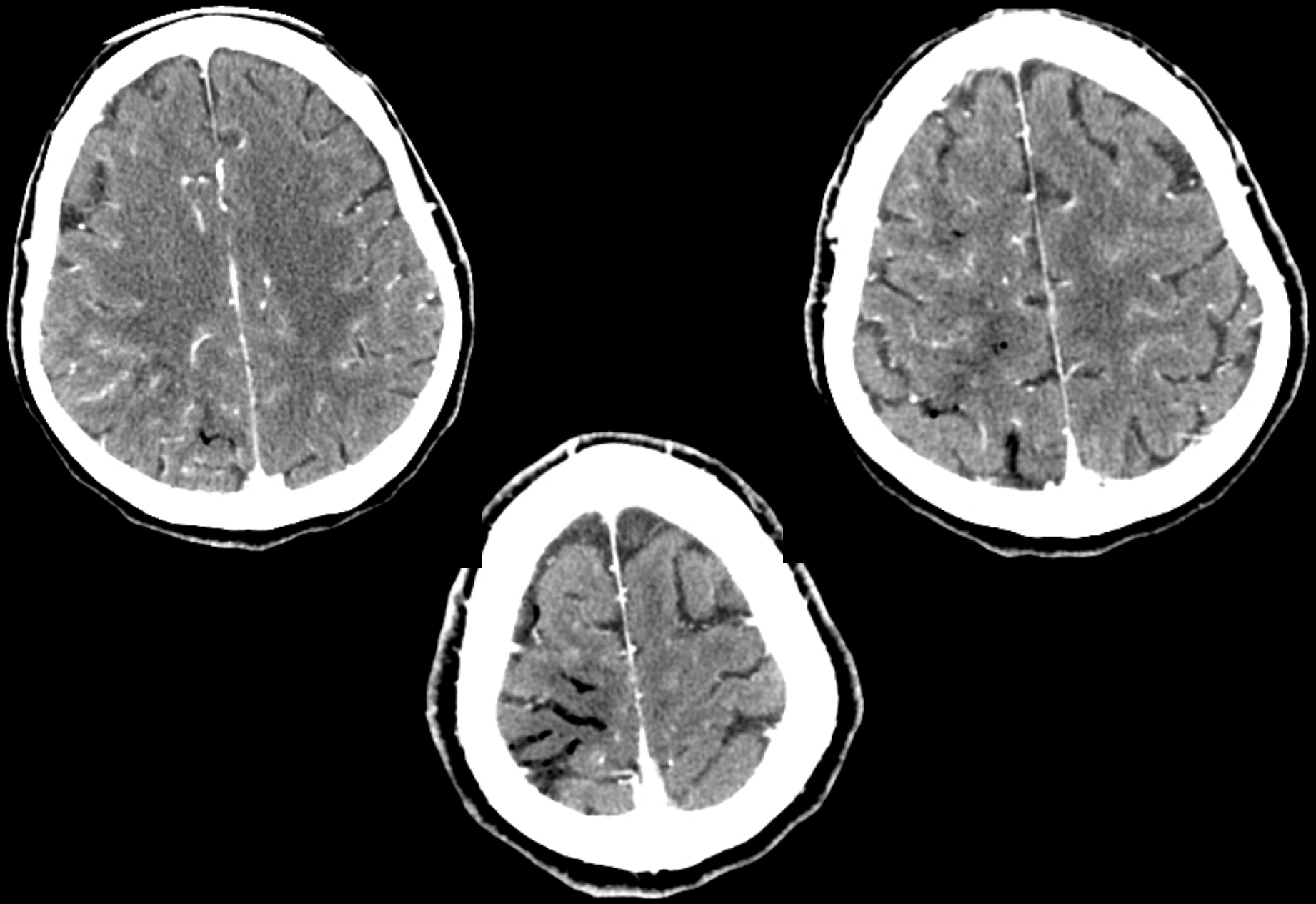
Mismatch volume: 0 ml
Mismatch ratio: none

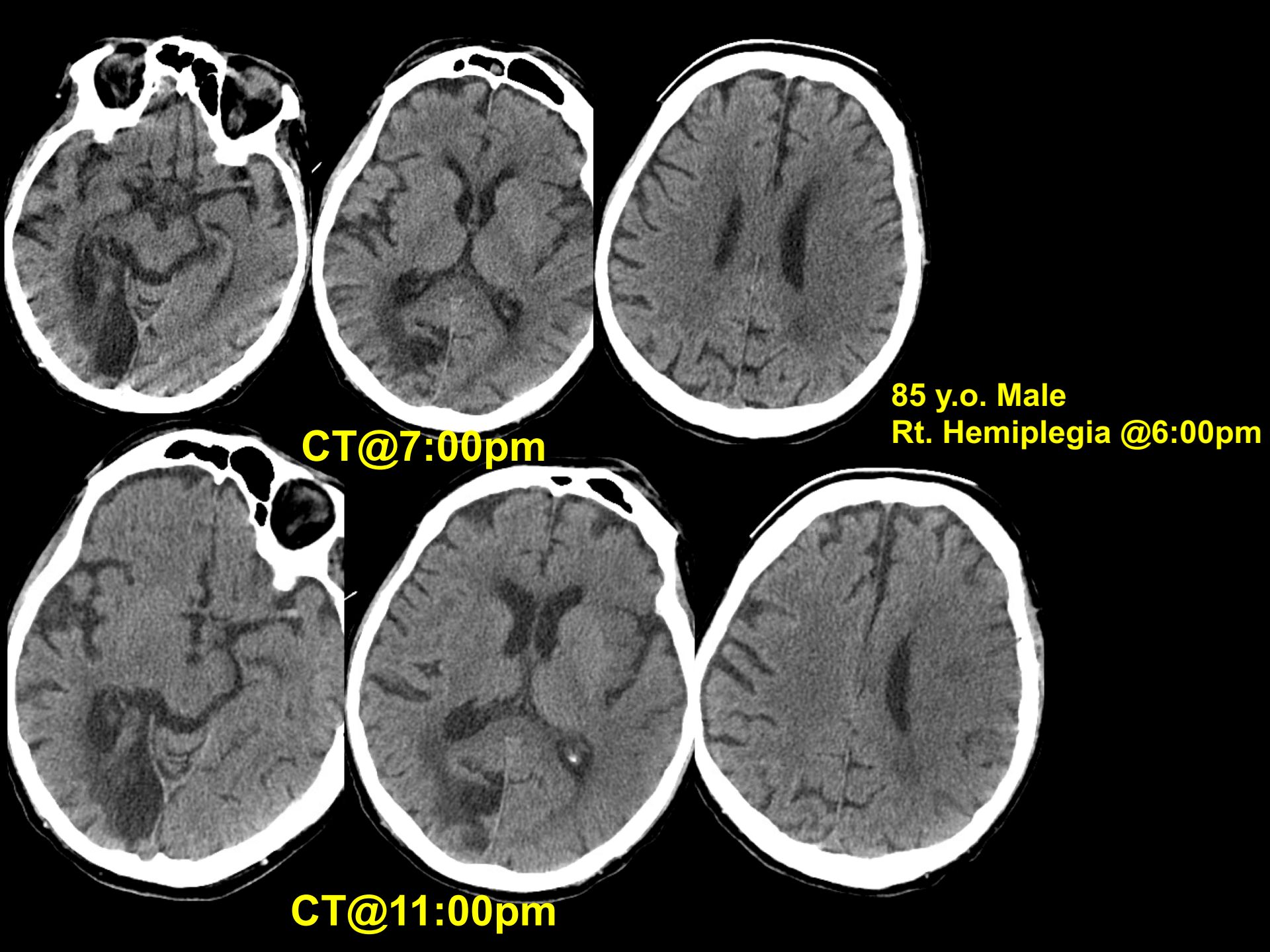
RAPID

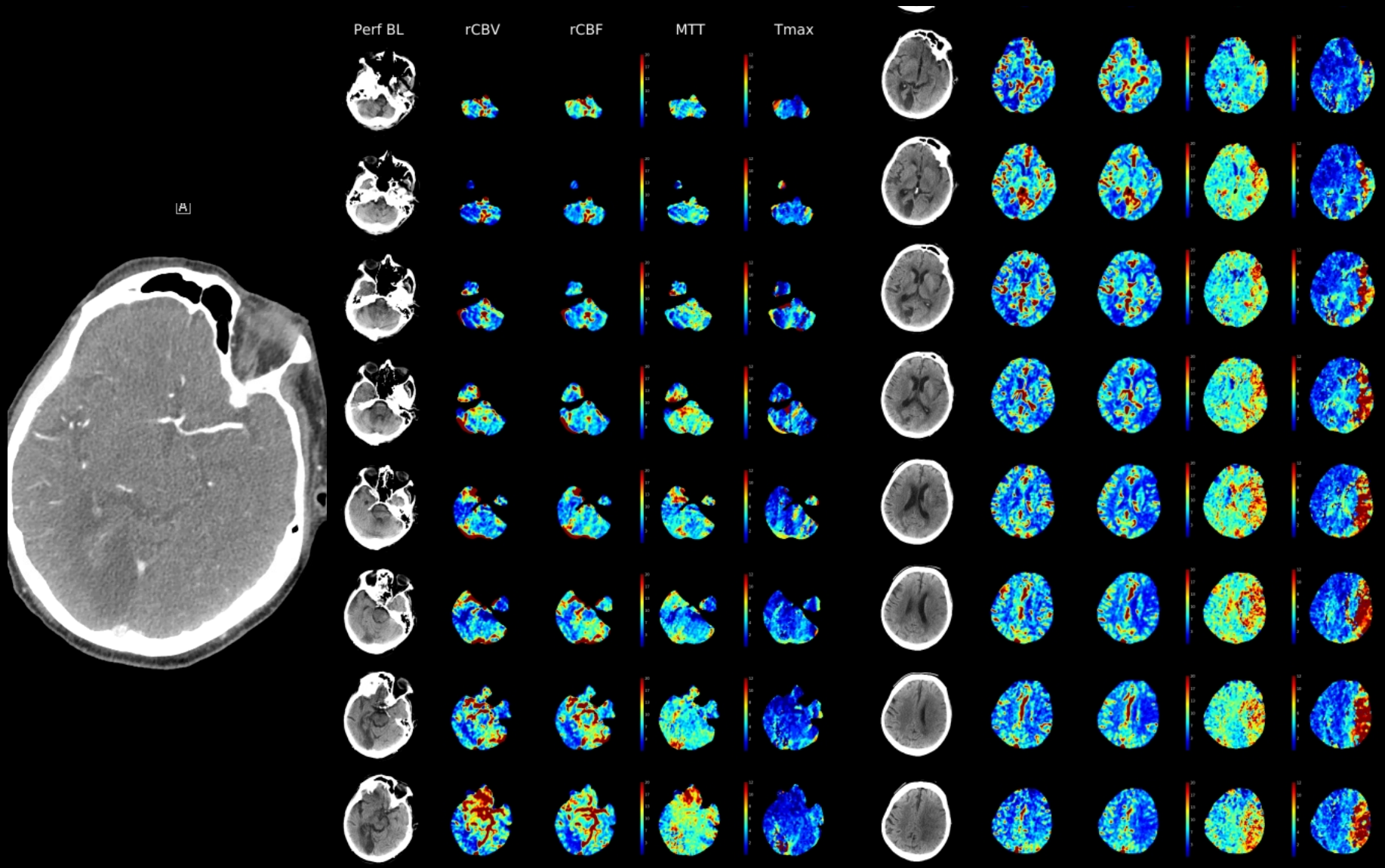

Perf BL
rCBV
rCBF
MTT
Tmax

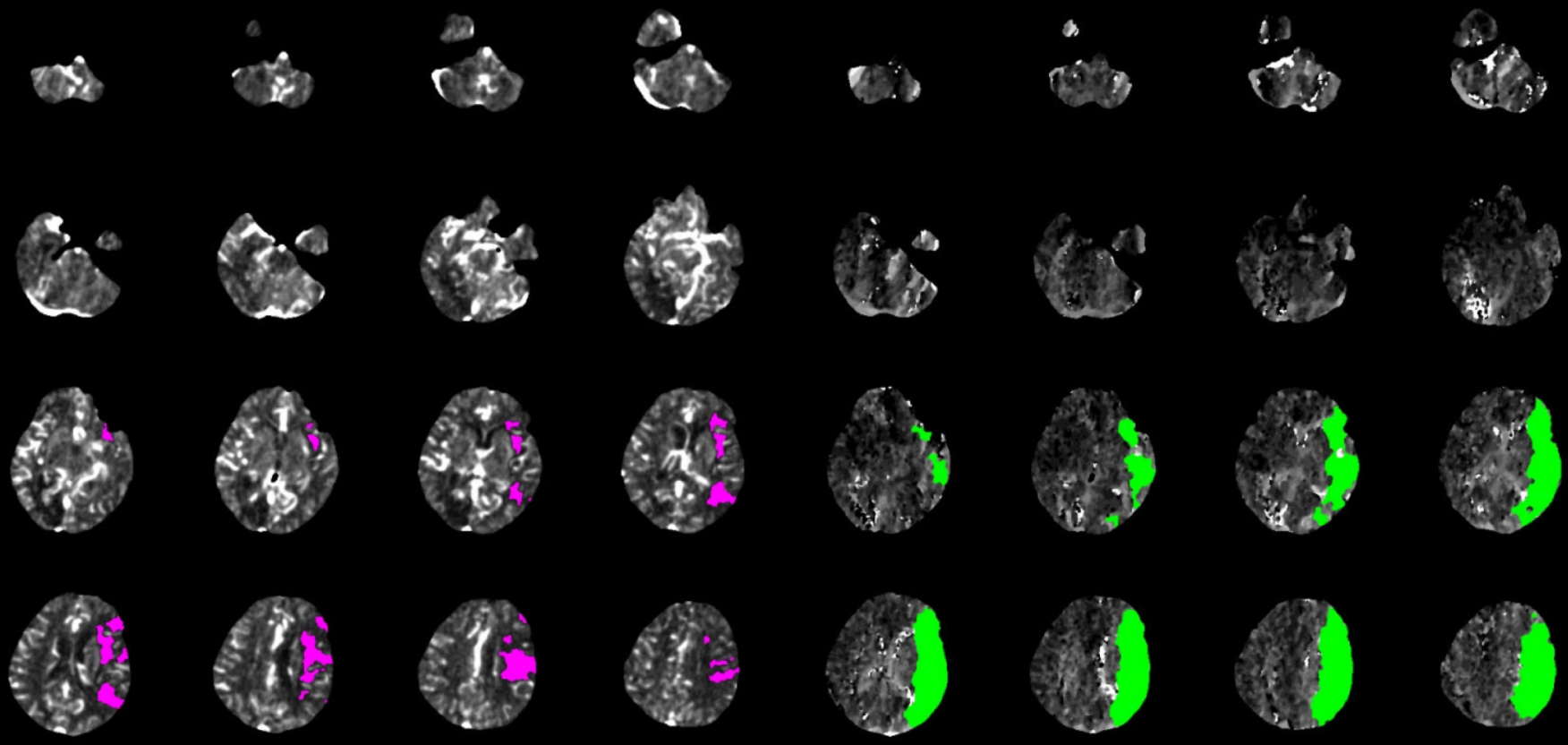

CBV Index (rCBV in Tmax>6s): ---
RAPID
rCBV.
rCBF.
MTT.
Tmax


17
13
10
7
3




CT@7:00pm
85 y.o. Male
Rt. Hemiplegia @6:00pm
CT@11:00pm


Perf BL
rCBV
rCBF
MTT
Tmax
CBV Index (rCBV in Tmax>6s): 0.7
RAPID
Not for primary diagnosis.


CBF<30% volume: 26 ml
Tmax>6.0s volume: 111 ml
Mismatch volume: 85 ml
Mismatch ratio: 4.3

Conclusions

- The success of revascularization in hyperacute stroke (0-24 Hours) is linked to imaging;
- The CTP has expanded the window of opportunity for successful thrombectomy;
- Be practical , no time to lose:

From 0-6 Hours: CT- CTA Willis-CTP-CTA Neck

From 6-24 Hours: CT- CTP- CTA Willis- CTA Neck

Ask pertinent clinical information:

1. mRS at baseline (usually patient looses one point at the time of a stroke);
2. NIHSS (eloquent vs non-eloquent stroke territory);
3. co-morbidities.

Do not engage in futile interventions!

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Musculoskelatal Radiologist
University of Toronto

Dr. Claudia Kirsch
Neuroradiologist
Zucker Hofstra School of Medicine at Northwell

Dr. Roberta LaPiana
Paediatric Neurologist
MNI - McGill University

Dr. Nicola Schieda
Abdominal Imaging Radiologist
University of Ottawa

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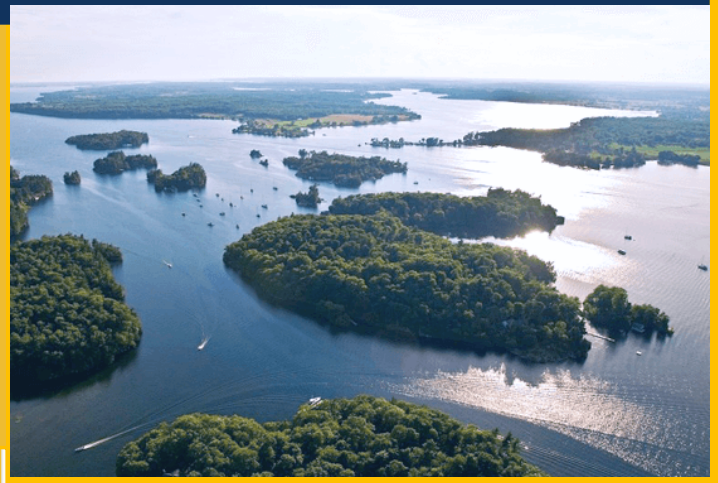

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