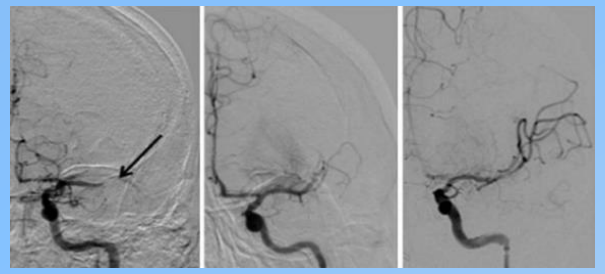
Cerebral Blood Flow Velocity Monitoring After Endovascular Treatment Tells The Story

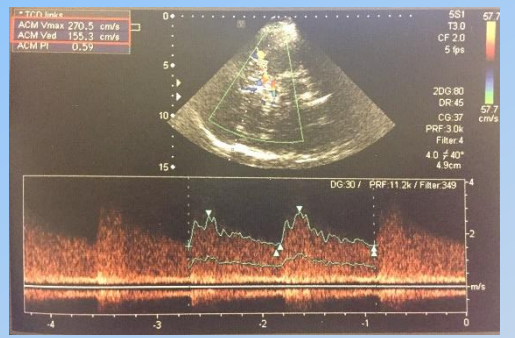
Anna Palmieri MD[1], Filippo Farina MD[1], Caterina Kulyk MD[1], Alessio Pieroni MD[1], Federica Viaro MD[1], Giacomo Cester MD[2], Francesco Causin MD[2], Renzo Manara MD[2], Claudio Baracchini MD[1]

[1] Stroke Unit and Neurosonology Laboratory, Department of Neuroscience, University of Padua School of Medicine, Padua, Italy
[2] Neuroradiology Unit, University of Padua School of Medicine, Padua, Italy.

ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Background





Endovascular treatment (EVT) is the treatment of choice in patients with acute stroke due to **large anterior circulation vessel occlusion** (LAO), in addition to intravenous thrombolysis.

After EVT, some patients do not improve in spite of **successful recanalization (mTICI 2b-3**), while others recover even if partially recanalized.

We performed a **trans-cranial ultrasound (TCCS)** study to see if post-EVT **hemodynamic changes** could explain this **clinical variability.**

ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Subjects and Methods

Patients Selection

All consecutive patients admitted to our Stroke Unit (Jan 2015 – Dec 2017) with a first-ever ischemic stroke due to **anterior circulation LAO**, undergoing EVT (independently from rt-PA administration).

Endovascular Treatment

Decision for EVT was based on: ASPECT > 5; LAO on CT-angiogram; NIHSS > 6 or evolving symptoms.

Treatment was initiated < 6 hours from onset.

Successful recanalization was defined as **mTICI2b-3**.

Ultrasound Assessment

TCCS was performed **immediately after EVT** and repeated at **48 hours**, **1 week**, and **1, 6, and 12 months** after stroke.

Mean **PSV Ratio** (PSV recanalized MCA/PSV contralateral MCA) was recorded.

We **excluded** patients with:

- ≥70% stenosis or occlusion of the extracranial ICA
- ≥50% stenosis of the contralateral MCA.

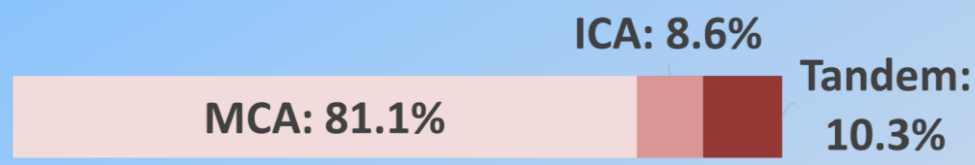
ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Results: Baseline Characteristics

n=185

Age (years), mean ± SD	**69.5±12.3**
Male, n (%)	**109 (58.9%)**
Hypertension	136 (73.5%)
Diabetes mellitus	28 (15.1%)
Hypercholesterolemia	36 (19.4%)
Smoking	48 (25.9%)
Atrial Fibrillation	56 (30.3%)
Antiplatelet therapy	88 (47.6%)
Anticoagulant therapy	23 (12.4%)
NIHSS score, median (range)	**18 (5-26)**
mRS score, median (range)	0 (0-4)
Bridging Thrombolysis	**110 (59.5%)**

Occluded vessel at admission



Vessel status after EVT

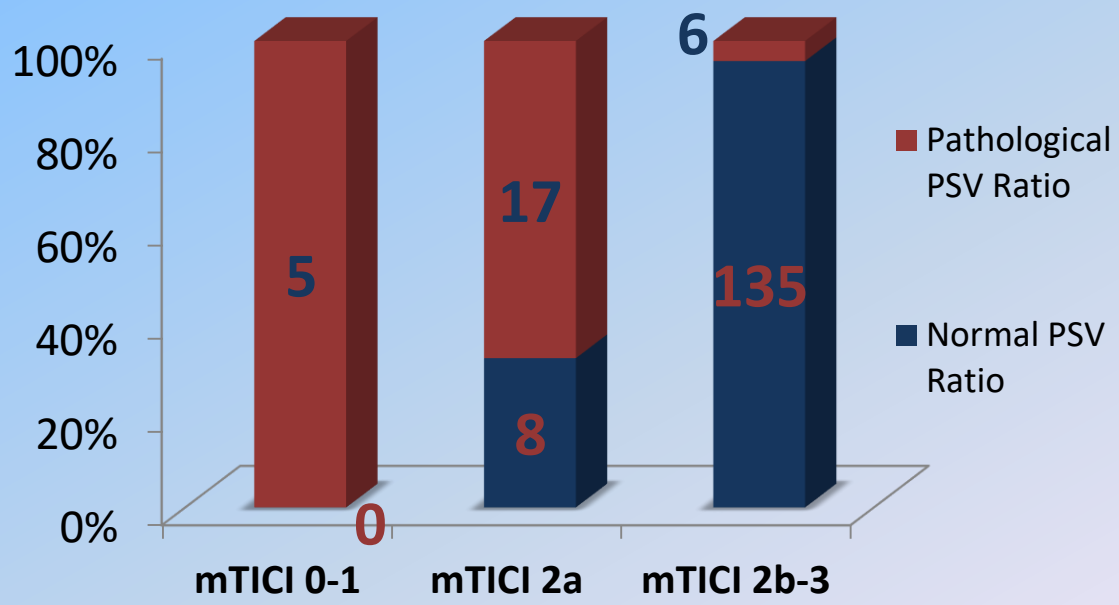
ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Results: Hemodynamic Changes After EVT

BFV changes after successful recanalization

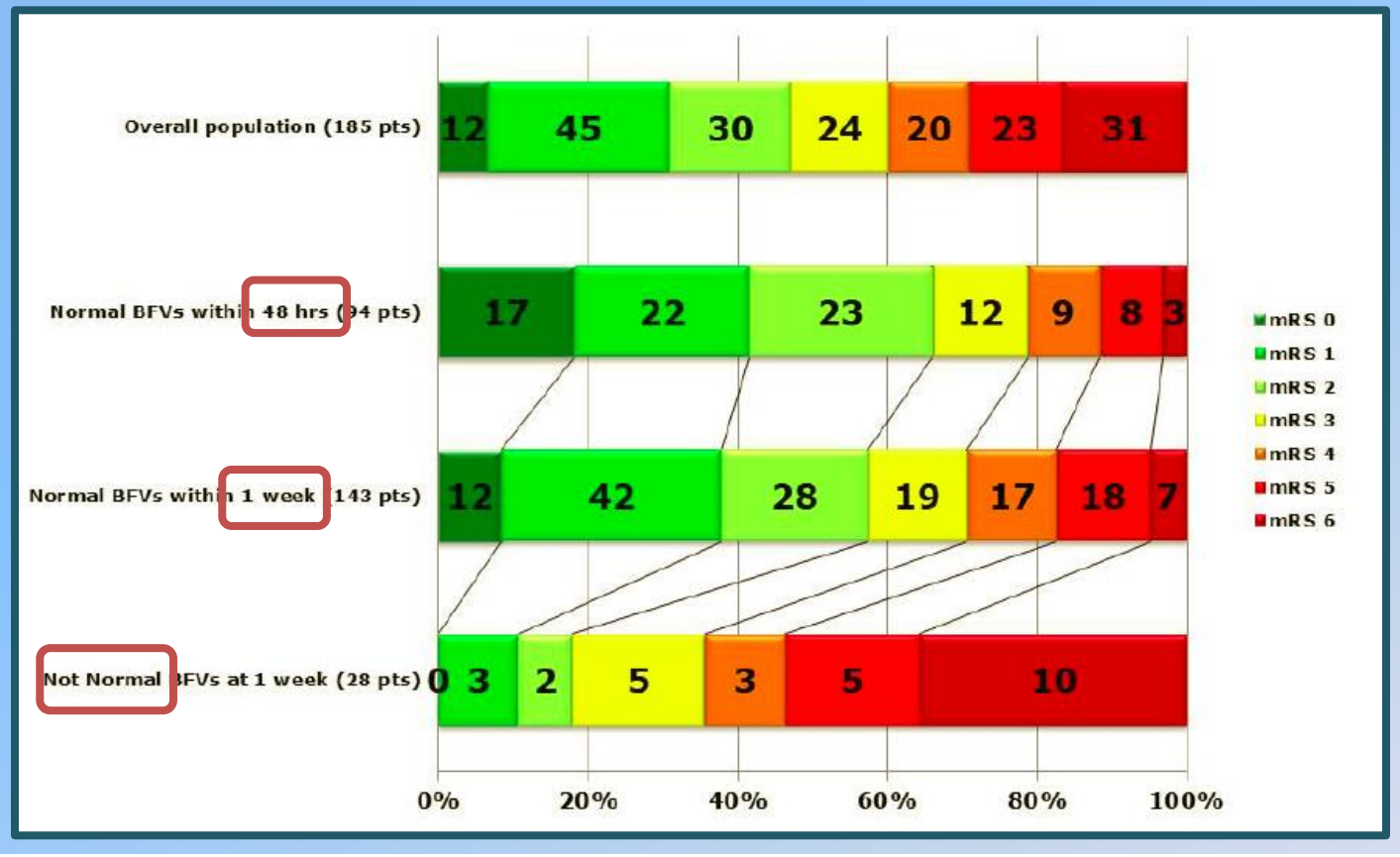
Time	Mean PSV (cm/s)	Mean PSV Ratio
Post-EVT (same day)	278.9 ± 29.2	2.6 ± 0.2
Post-EVT (48 h)	**212.0 ± 22.7***	**1.9 ± 0.1 ***
Post-EVT (1 week)	**114.5 ± 12.4 *°**	**1.2 ± 0.1 *°**
Post-EVT (1 month)	110.7 ± 15.4	1.1 ± 0.1
Post-EVT (1 year)	108.6 ± 12.6	1.1 ± 0.1

Post-EVT vessel status and BFVs



ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Results: Timing of Hemodynamic Normalization and Outcome



ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Results: Clinical, Radiological and Ultrasound Parameters Related to Prognosis - I

	mRS 0-2 (N=87)	mRS 3-6 (N=98)	P value (univariate analysis)	P value (multivariate analysis)
Age (years), mean±SD	**67.1±11.4**	**71.6±13.0**	**0.01**	NS
Male, n (%)	52 (59.8%)	57 (58.2%)	NS	NS
Hypertension	**56 (58.6%)**	**80 (86.7%)**	**0.02**	NS
Diabetes mellitus	13 (14.9%)	15 (15.3%)	NS	NS
Hypercholesterolemia	17 (19.5%)	19 (19.4%)	NS	NS
Smoking	21 (24.1%)	27 (27.6%)	NS	NS
Coronary syndromes	14 (16.1%)	18 (18.4%)	NS	NS
Atrial Fibrillation	24 (27.6%)	32 (32.7%)	NS	NS
Antiplatelet therapy	47 (54.0%)	41 (41.8%)	NS	NS
Anticoagulant therapy	11 (12.6%)	12 (12.2%)	NS	NS
NIHSS score, median (range)	**14 (5-18)**	**19 (14-26)**	**0.0316**	NS
Bridging Thrombolysis	**59 (67.8%)**	**51 (52.1%)**	**0.0358**	NS

Results: Clinical, Radiological and Ultrasound Parameters Related to Prognosis - II

	mRS 0-2 (N=87)	mRS 3-6 (N=98)	P value (univariate analysis)	P value; OR (95% CI) (multivariate analysis)
Time to Revascularization (minutes), mean±SD	228±48	243±53	0.0461	NS
ASITN/SIR < 2	47 (54.0%)	41 (41.8%)	NS	NS
EVT for MCA occlusion	77 (88.5%)	73 (74.5%)	0.0231	NS
EVT for ICA+MCA occlusion	4 (9.2%)	15 (11.2%)	0.0268	NS
EVT for ICA occlusion	3 (3.4%)	13 (13.5%)	0.0193	NS
mTICI 0-1	**0 (0%)**	**12 (12.2%)**	**0.0004**	**0.02, OR 10.22 (1.47-45.53)**
mTICI 2a	8 (0.9%)	19 (19.4%)	NS	NS
mTICI 2b-3	**79 (90.1%)**	**67 (68.4%)**	**0.0002**	**0.02, OR 0.25 (0.11-0.61)**
Normal PSV Ratio at 48 hrs from EVT	**62 (71.3%)**	**32 (32.6%)**	**0.0001**	**0.03, OR 0.22 (0.15-0.64)**
Normal PSV Ratio at 1 week from EVT	**82 (94.3%)**	**61 (62.2%)**	**0.0001**	**0.02, OR 0.11 (0.07-0.31)**
Still abnormal PSV Ratio at 1 week from EVT	**5 (5.7%)**	**23 (23.5%)**	**0.0008**	**0.04, OR 15.23 (4.54-46.72)**

Results: Post-EVT Intracranial Hemorrhages After Successful Recanalization - I

n=21 (14%; only 3% symptomatic)

	No ICH (N=125)	Post-EVT ICH (N=21)	P value
Hypertension	86 (68.8%)	20 (95.2%)	P=0.01
NIHSS score, median (range)	16 (5-26)	18 (10-23)	P=0.01
Intrahospital Mortality	2 (1.6%)	3 (14.3%)	P=0.02
mRS 0-2 at 90 days	79 (63.2%)	6 (28.6%)	P=0.03
mRS 3-5 at 90 days	35 (28.0%)	12 (57.1%)	P=0.01

ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Results: Post-EVT Intracranial Hemorrhages After Successful Recanalization - II

	ICH (N=21)	No ICH (N=125)	P-value
Mean PSV Ratio soon after EVT	3.5 ± 0.2	2.4 ± 0.1	< 0.0001
P.I. values after EVT	1.13 ± 0.32	1.11 ± 0.31	NS
Mean PSV Ratio 48 hrs after EVT	2.4 ± 0.2	1.9 ± 0.1	< 0.0001

ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Conclusions

- In patients with ischemic stroke due to anterior circulation LAO, **intracranial hemodynamic normalization** after EVT occurs at **variable time** and correlates with **prognosis**.

- Persistent pathological BFVs identify patients at increased risk of **post-interventional ICH** and worse outcome.

- Post-EVT ultrasound monitoring of stroke patients might be effective for assessing treatment efficacy and prognosis.

ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO

Thank you for your attention!

Stroke Unit and Neurosonology Lab
University Hospital of Padua - Italy

Many thanks to:

Dr. Claudio Baracchini

Dr.ssa Federica Viaro
Dr.ssa Silvia Favaretto
Luana Donà
Dr. Filippo Farina
Dr.ssa Caterina Kulyk
Dr.ssa Francesca Vodret

ASN 42ND ANNUAL MEETING
JANUARY 24-26, 2019
PUERTO RICO