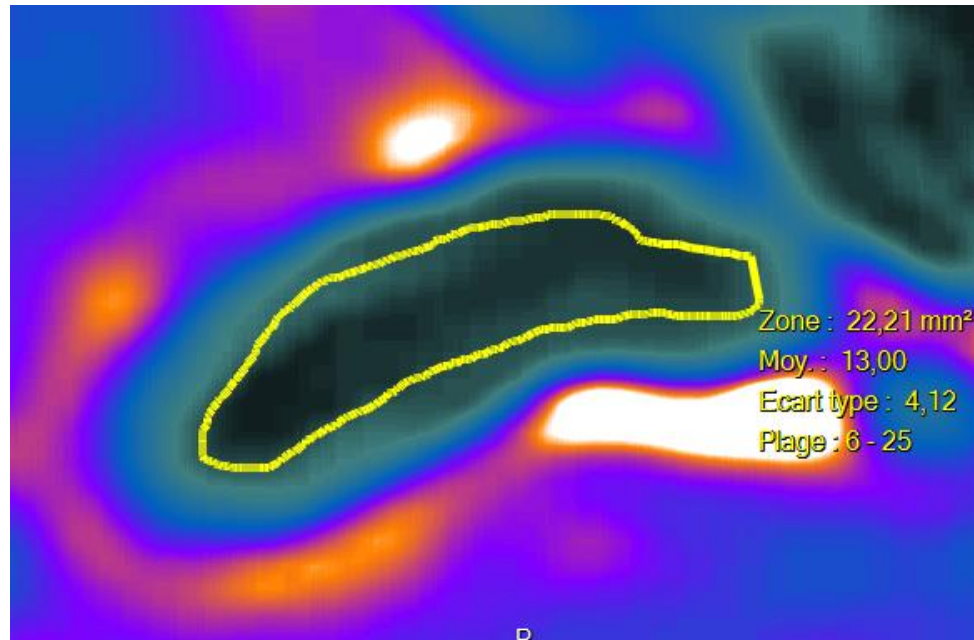


Imagerie des occlusions artérielles à la phase aiguë de l'AVC ischémique

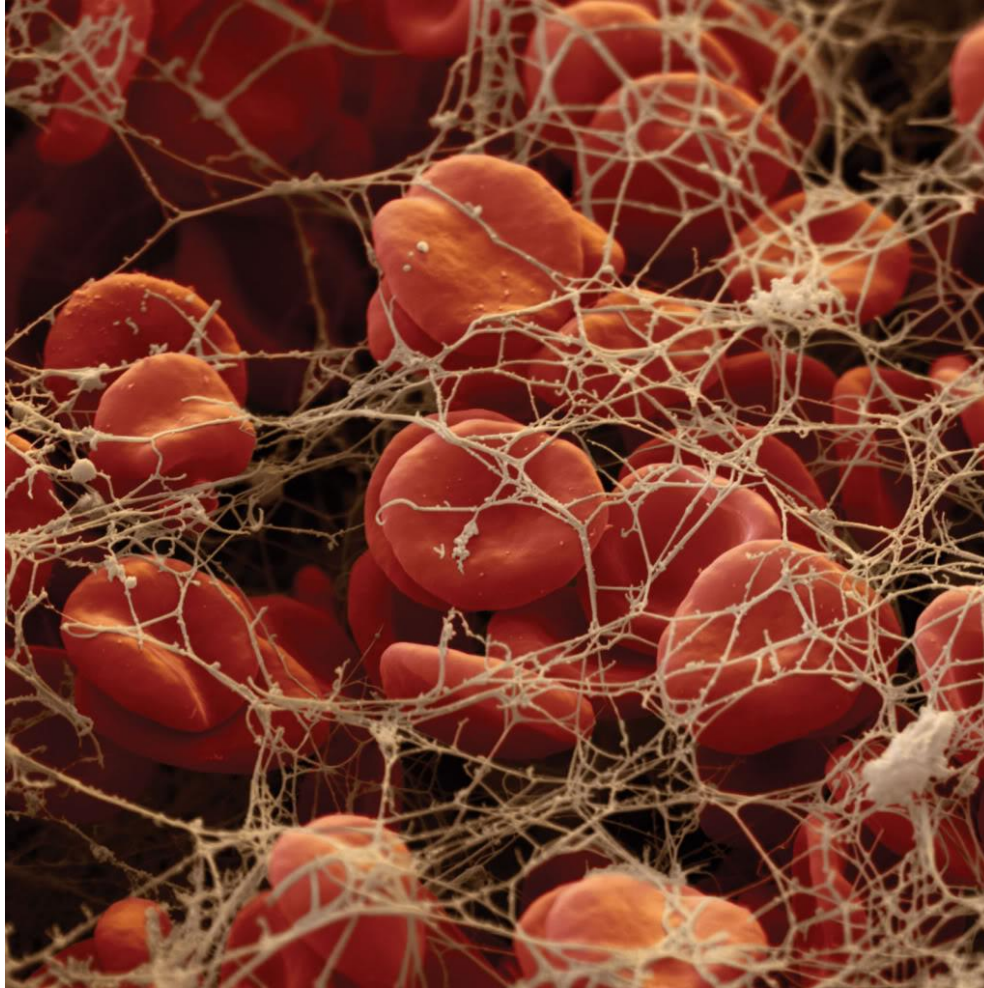


Romain Bourcier (CHU de Nantes)

Claire Toquet, Lili Detraz, Elisabeth Auffray-Calvier, Benjamin Daumas Duport, Alina Lintia-Gaultier, Cédric Lenoble, Pierre-Louis Alexandre, Jean Michel Serfaty, Hubert Desal.

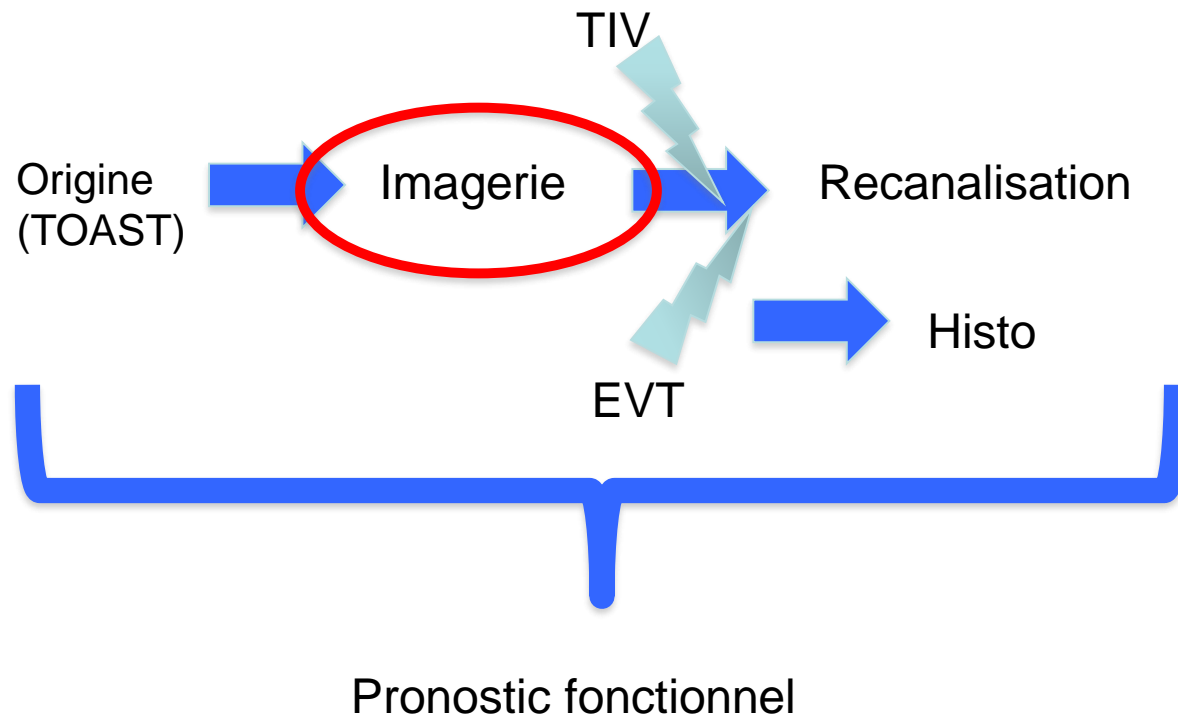
Ecole de la Thrombectomie 2023

Tout commence par une artère occluse !



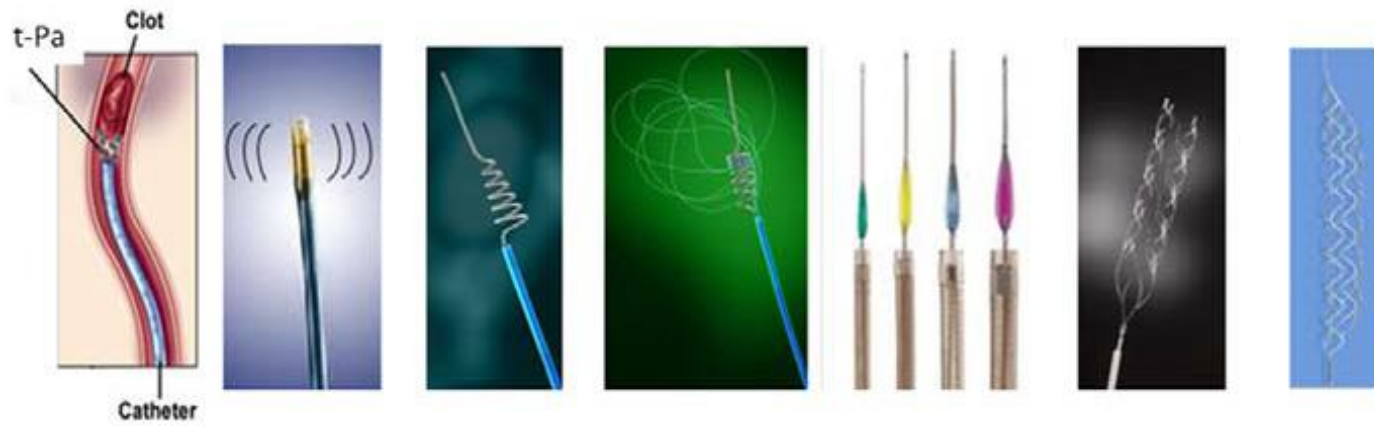
Mais à la différence des coronaires ...

Le thrombus ...



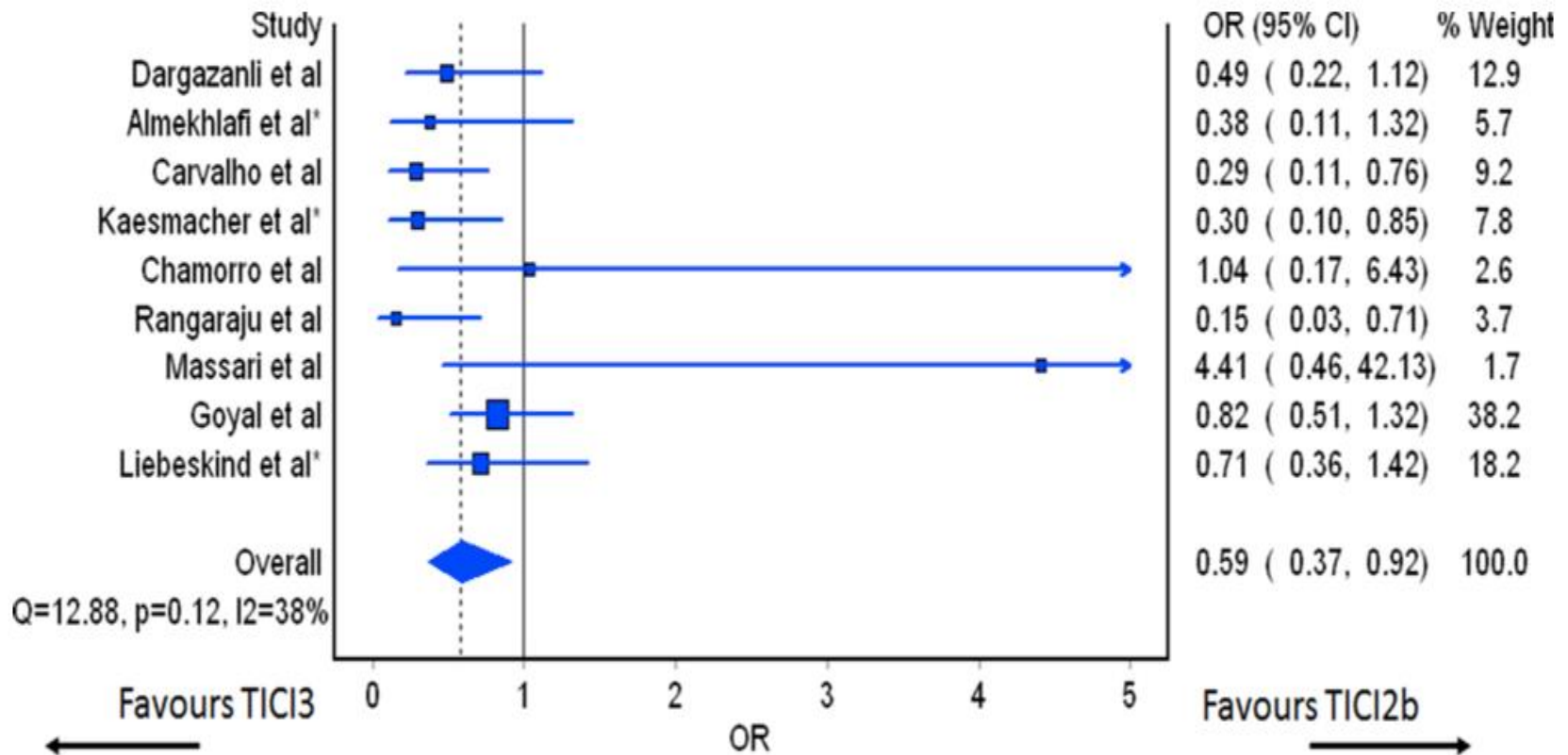
Alternatives aux EVT « classiques » ?

- Pinching
- Angioplastie
- Lasso
- Fibrinolyse in situ
- Largage du stent



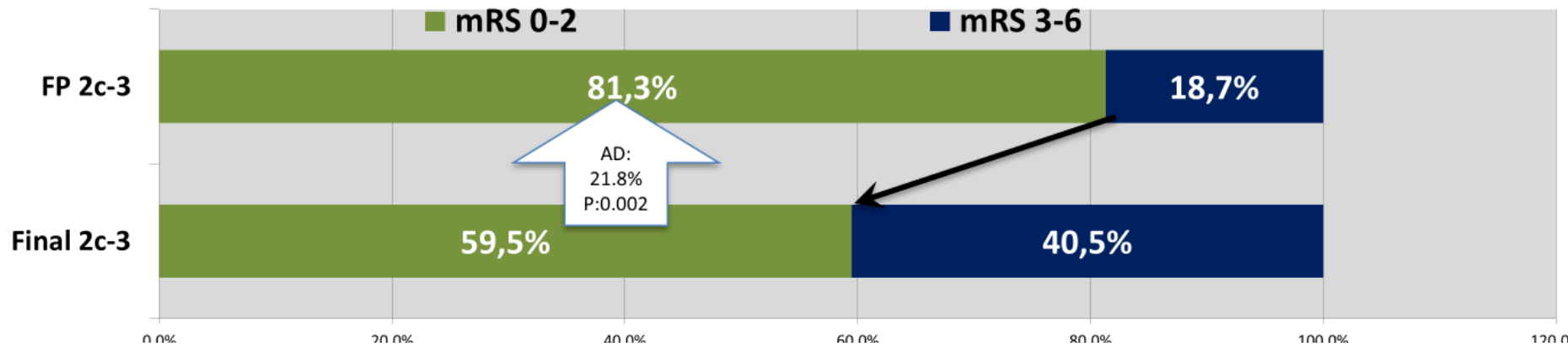
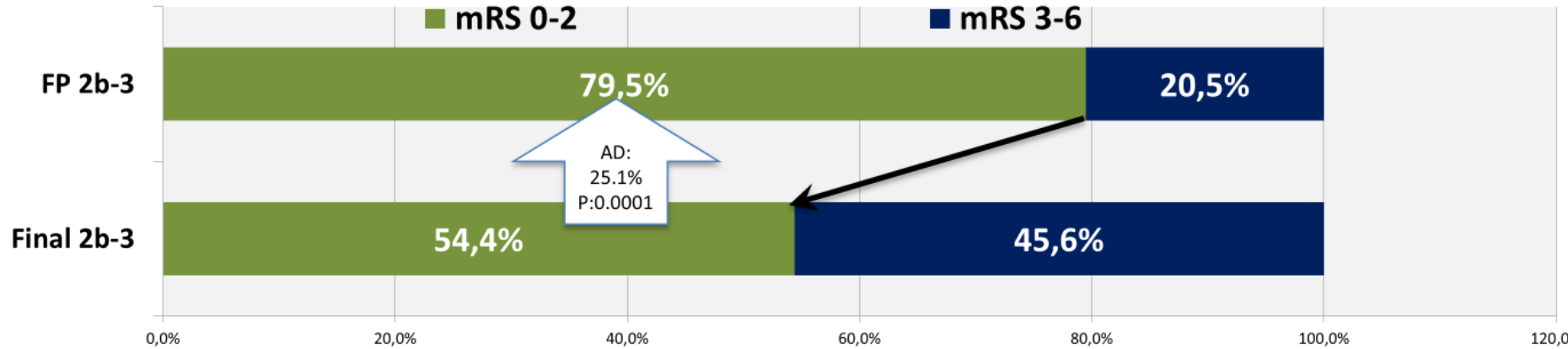
→ Stent 4 ème génération ?

TICI 2b = “bonne” recanalisation?



Systematic review and meta-analysis on outcome differences among patients with TICI2b versus TICI3 reperfusions: success revisited - Johannes Kaesmacher, et al. JNNP 2018

Nombre de passage et Evolution clinique



Primary Results of the Multicenter ARISE II O. Zaidat et al. Stroke 2018

First Pass Effect, A New Measure for Stroke Thrombectomy Devices O. Zaidat, et al. Stroke 2018

« Sudden » recanalization

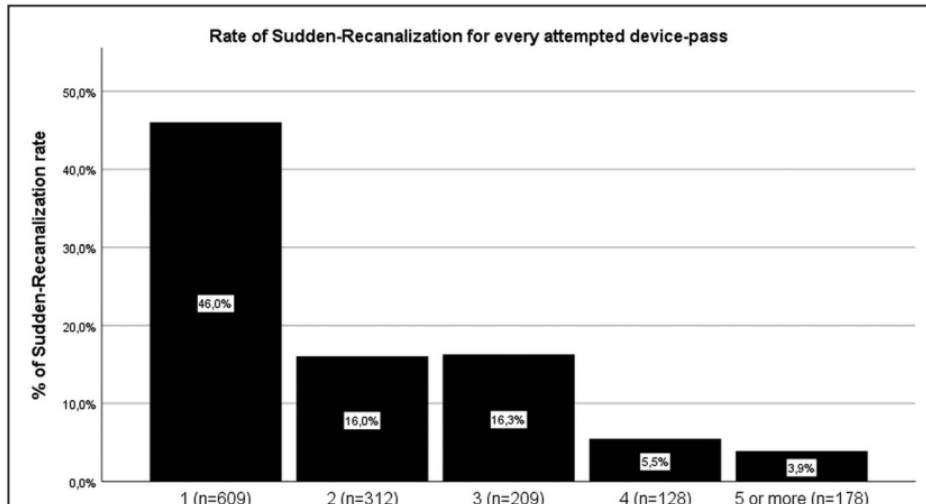
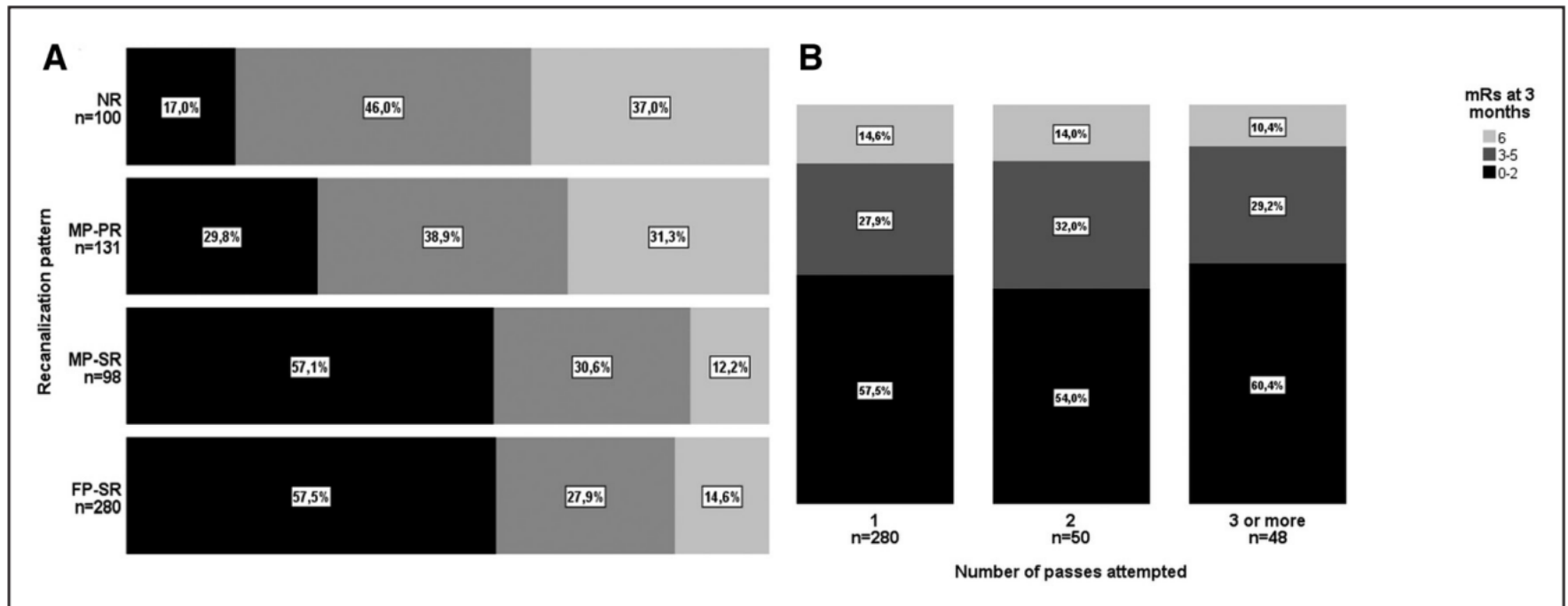


Figure 2. Rate of sudden recanalization depending on the number of passes attempted.

Álvaro García-Tornel, et al. 2020



Résultats angiographiques du traitement endovasculaire aujourd'hui

~ 90 % de TICI 2b/3 final

MAIS

~ 65 % de TICI 2c/3 en ≤ 3 passes

ET

~ 30 % de TICI 3 en 1 passe

Primary Results of the Multicenter ARISE II Study (Analysis of Revascularization in Ischemic Stroke With EmboTrap) O. Zaidat et al. Stroke 2018

First Pass Effect, A New Measure for Stroke Thrombectomy Devices O. Zaidat, et al. Stroke 2018

Analyse du thrombus – Pourquoi?

- Etiologie → Prevention secondaire
- Recanalisation liée au pronostic clinique
- *Pb= avant le retirer, on ne connait pas le thrombus...*

Histologie

Analysis of Thrombi Retrieved From Cerebral Arteries of Patients With Acute Ischemic Stroke

Victor J. Marder, MD; Dennis J. Chute, MD; Sidney Starkman, MD; Anna M. Abolian; Chelsea Kidwell, MD; David Liebeskind, MD; Bruce Ovbiagele, MD; Fernando Vinuela, MD; Gary Duckwiler, MD; Reza Jahan, MD; Paul M. Vespa, MD; Scott Selco, MD, PhD; Venkatakrisna Rajajee, MD; Doojin Kim, MD; Nerses Sanossian, MD; Jeffrey L. Saver, MD

Background and Purpose—Information regarding the histological structure of thromboemboli that cause acute stroke provides insight into pathogenesis and clinical management.

Methods—This report describes the histological analysis of thromboemboli retrieved by endovascular mechanical extraction from the middle cerebral artery (MCA) and intracranial carotid artery (ICA) of 25 patients with acute ischemic stroke.

Results—The large majority (75%) of thromboemboli shared architectural features of random fibrin:platelet deposits interspersed with linear collections of nucleated cells (monocytes and neutrophils) and confined erythrocyte-rich regions. This histology was prevalent with both cardioembolic and atherosclerotic sources of embolism. “Red” clots composed uniquely of erythrocytes were uncommon and observed only with incomplete extractions, and cholesterol crystals were notably absent. The histology of thromboemboli that could not be retrieved from 29 concurrent patients may be different. No thrombus >3 mm wide caused stroke limited to the MCA, and no thrombus >5 mm wide was removed from the ICA. A mycotic embolus was successfully removed in 1 case, and a small atheroma and attached intima were removed without clinical consequence from another.

Conclusions—Thromboemboli retrieved from the MCA or intracranial ICA of patients with acute ischemic stroke have similar histological components, whether derived from cardiac or arterial sources. Embolus size determines ultimate destination, those >5 mm wide likely bypassing the cerebral vessels entirely. The fibrin:platelet pattern that dominates thromboembolic structure provides a foundation for both antiplatelet and anticoagulant treatment strategies in stroke prevention. (*Stroke*. 2006;37:2086-2093.)

Key Words: cerebral arteries ■ thrombi

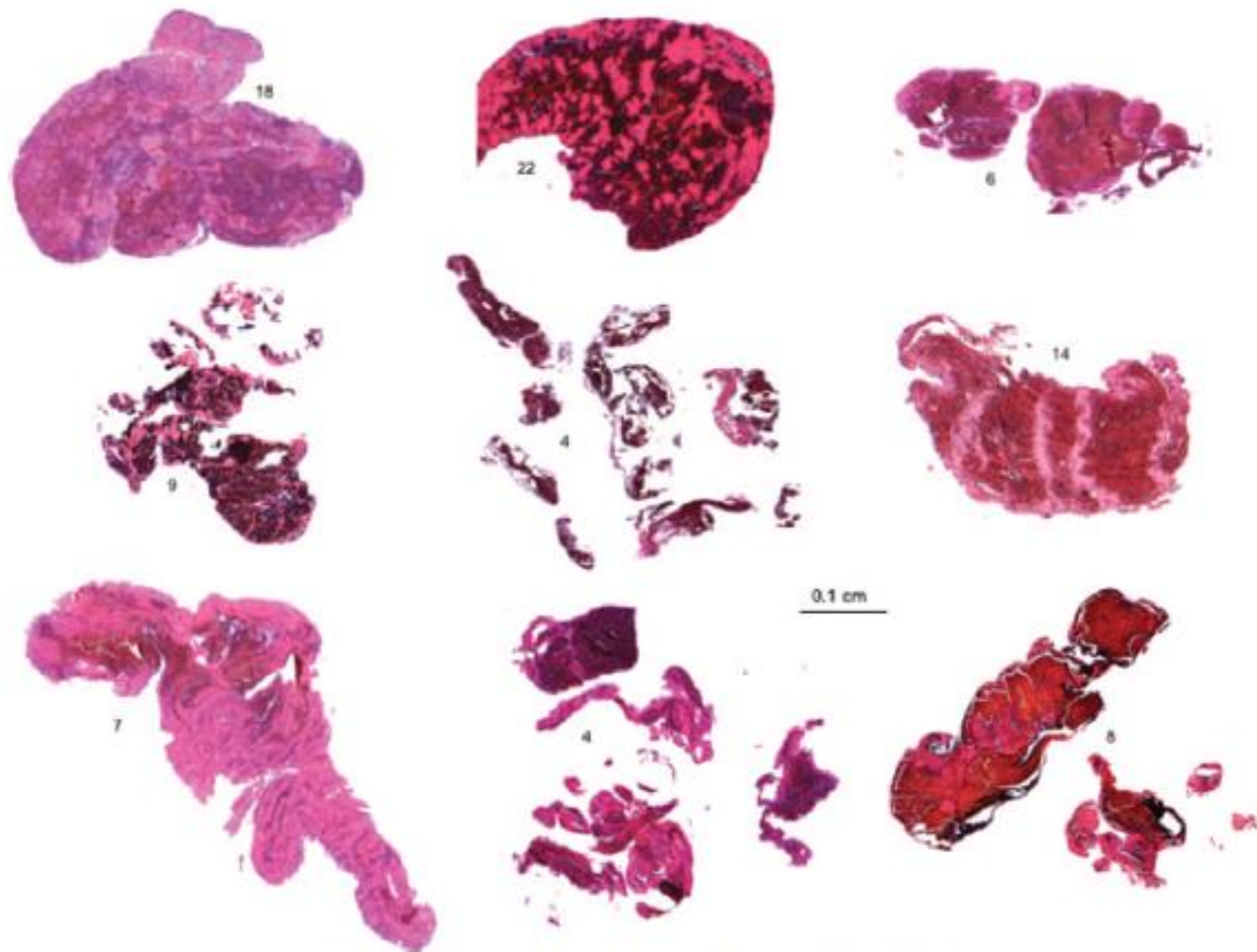


Figure 3. Hematoxylin and eosin-stained sections of 9 thrombi.

Original Contribution

Thrombus Histology Suggests Cardioembolic Cause in Cryptogenic Stroke

Tobias Boeckh-Behrens, MD; Justus F. Kleine, MD; Claus Zimmer, MD; Frauke Neff, MD;
Fabian Scheipl, PhD; Jaroslav Pelisek, PhD; Lucas Schirmer, MD; Kim Nguyen, MD;
Deniz Karatas, MSc; Holger Poppert, MD

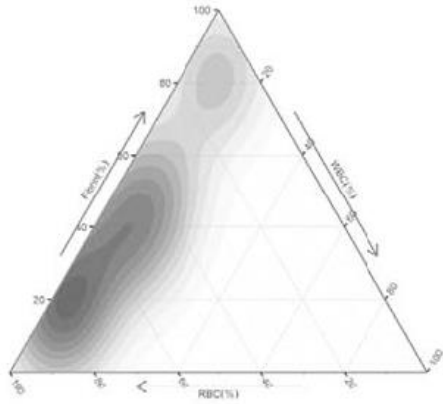
Background and Purpose—Ischemic stroke of undetermined cause is a major health issue because of its high frequency and clinical relevance. Histopathologic analysis of human thrombi, retrieved from stroke patients with large-vessel occlusion during mechanical thrombectomy, may provide information about underlying pathologies. This study examines the relationship between stroke causes and histological clot composition to identify specific patterns that might help to distinguish causes of cryptogenic stroke.

Methods—Thrombi of 145 consecutive stroke patients with large-vessel occlusion were collected during intracranial mechanical recanalization. The hematoxylin and eosin–stained specimens were quantitatively analyzed in terms of the relative fractions of the main constituents (red and white blood cells and fibrin/platelets). These data, along with additional clinical and interventional parameters, were compared for different stroke subtypes, as defined by the international Trial of Org 10172 in Acute Stroke Treatment criteria.

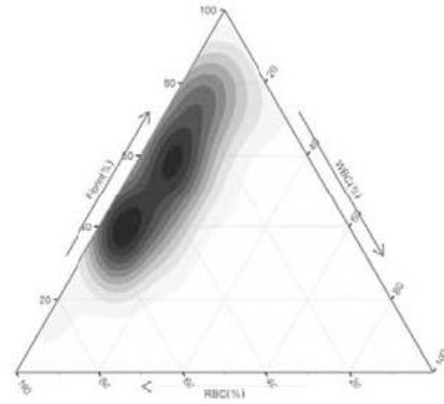
Results—The composition of thrombi from cardioembolic and noncardioembolic stroke patients differed significantly for all main thrombus components. Cardioembolic thrombi had higher proportions of fibrin/platelets ($P=0.009$), less erythrocytes ($P=0.003$), and more leucocytes ($P=0.035$) than noncardioembolic thrombi. Cryptogenic strokes showed strong overlap with cardioembolic strokes but not with noncardioembolic strokes, in terms of both thrombus histology and interventional and clinical outcome parameters.

Conclusions—Quantitative evaluation of thrombus composition may help to distinguish between different stroke causes. Our findings support the notion that the majority of cryptogenic strokes are cardioembolic. (*Stroke*. 2016;47:00-00. DOI: 10.1161/STROKEAHA.116.013105.)

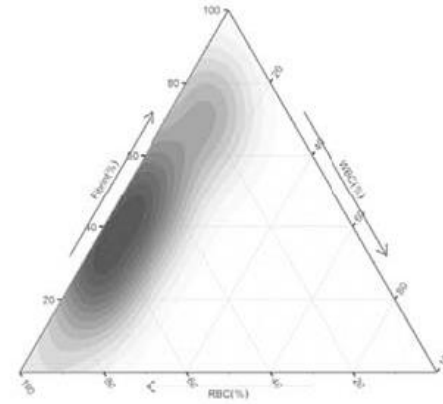
arterio-embolic



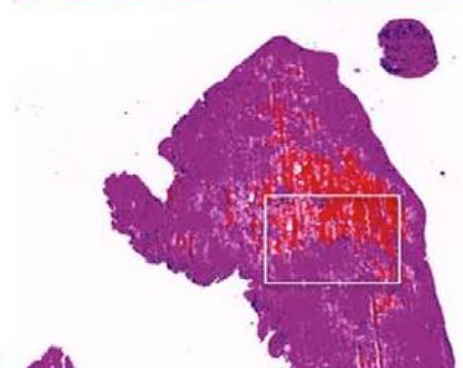
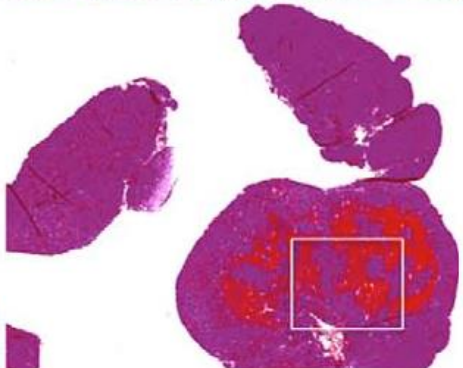
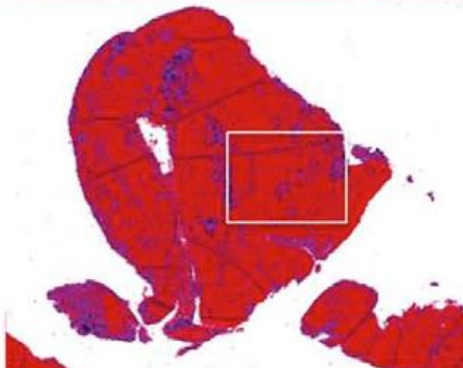
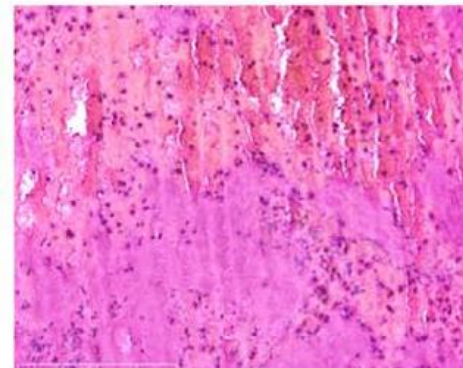
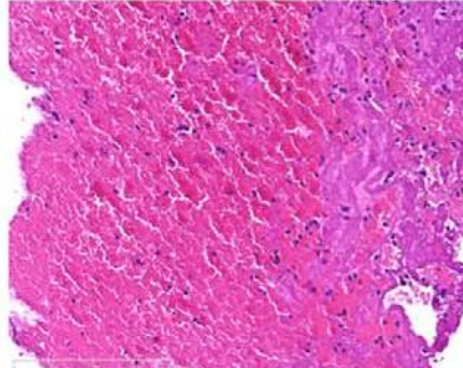
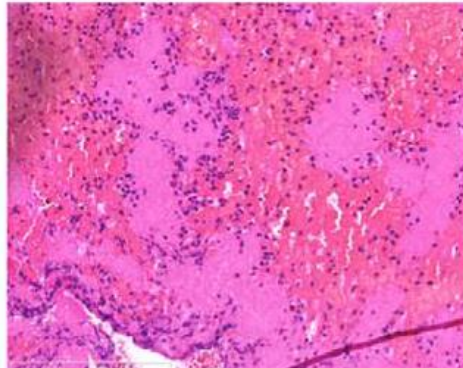
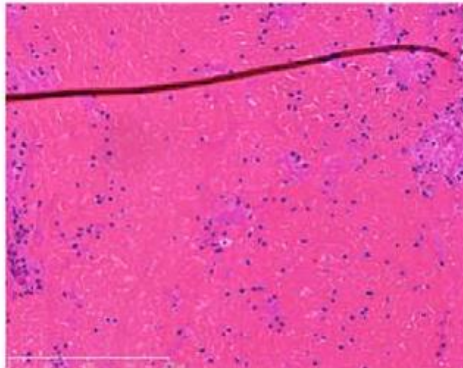
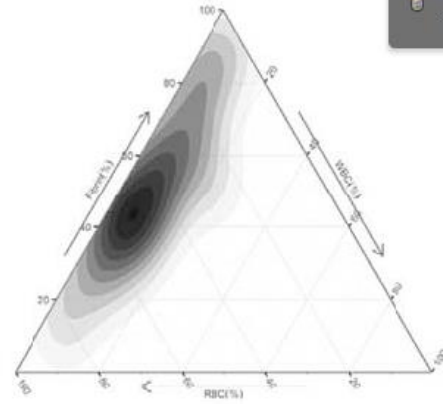
cardio-embolic



other determined cause



cryptogenic



Histopathologic Analysis of Retrieved Thrombi Associated With Successful Reperfusion After Acute Stroke Thrombectomy

Tetsuya Hashimoto, MD; Mikito Hayakawa, MD; Naoko Funatsu, MD;
Hiroshi Yamagami, MD, PhD; Tetsu Satow, MD, PhD; Jun C. Takahashi, MD, PhD;
Kazuyuki Nagatsuka, MD, PhD; Hatsue Ishibashi-Ueda, MD, PhD; Jun-ichi Kira, MD, PhD;
Kazunori Toyoda, MD, PhD

Background and Purpose—Histopathologic evaluation of occlusive thrombi retrieved from cerebral arteries using endovascular therapy is possible. We investigated the relationship between successful reperfusion after thrombectomy and histopathologic characteristics of retrieved thrombi.

Methods—Among consecutive patients with acute ischemic stroke treated with endovascular therapy at our institute from December 2010 to July 2015, we retrospectively reviewed those with acute major arterial occlusion from which retrieved thrombi were evaluated histopathologically. Obtained thrombi were assessed for the existence of atheromatous gruel, organization, and the ratios of erythrocyte and fibrin/platelet components. Successful reperfusion was defined as the modified Treatment in Cerebral Ischemia grade of 2b to 3.

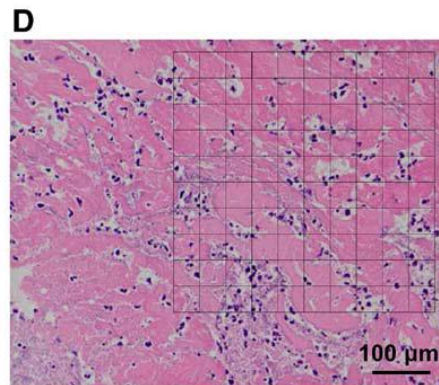
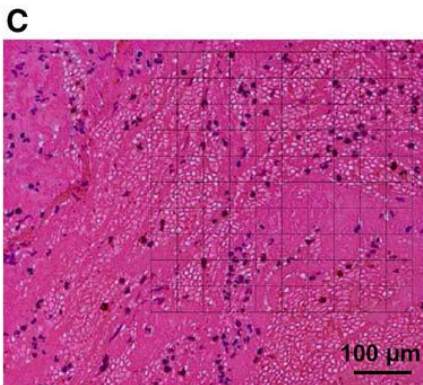
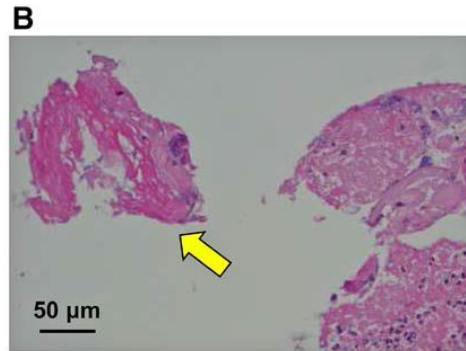
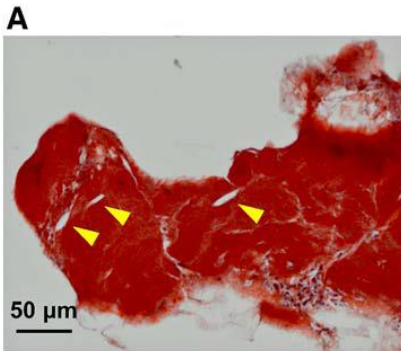
Results—Of 83 patients studied, 58 (70%) underwent successful reperfusion. Atheromatous gruel was less frequently identified (3% versus 20%; $P=0.024$), and the proportion of erythrocyte components was higher ($57\pm 23\%$ versus $47\pm 24\%$; $P=0.042$) in thrombi retrieved from the reperfused than the unreperfused group. On multivariate logistic regression analysis, atheromatous gruel was inversely related (odds ratio, 0.062; 95% confidence interval, 0.002–0.864), and $>64\%$ erythrocyte components (cutoff obtained from receiver operating characteristic curve) were positively related (odds ratio, 4.352; 95% confidence interval, 1.185–19.363) to successful reperfusion.

Conclusions—Successful reperfusion could be associated with the histopathology of occlusive thrombi, including the existence of atheromatous gruel and proportion of erythrocyte components.

Clinical Trial Registration—URL: <http://www.clinicaltrials.gov>. Unique identifier: NCT02251665.

(*Stroke*. 2016;47:00-00. DOI: 10.1161/STROKEAHA.116.015228.)

	Overall (n=83)	mTICI 2b- 3 (n=58)	mTICI 0-2a (n=25)	<i>P</i> Value*
Atheromatous gruel	7 (8)	2 (3)	5 (20)	0.024
Organization	19 (23)	16 (28)	3 (12)	0.159
Ratio of erythrocyte components, mean±SD, %	53±24	57±23	47±24	0.042
Erythrocyte-rich thrombus†	34 (41)	29 (51)	5 (20)	0.014
Ratio of fibrin/platelet components, mean±SD, %	44±23	42±22	48±24	0.166



Thrombi humains extraits

→ compositions variables mais ...

→ Biais inhérent à l'histologie dans ce contexte:

Techniques histo différentes

Analyse des caillots retirés seulement

Analyse partielle des caillots retirés

TIV entre avant l'histologie

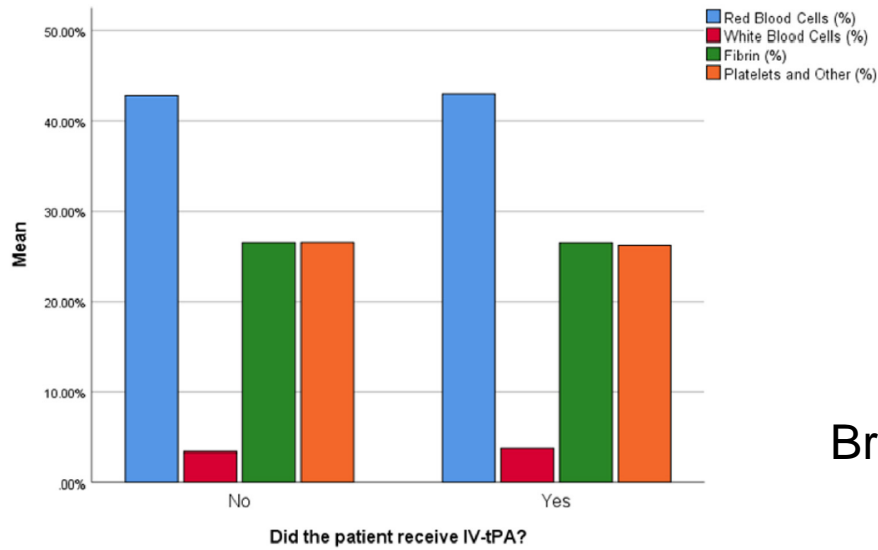
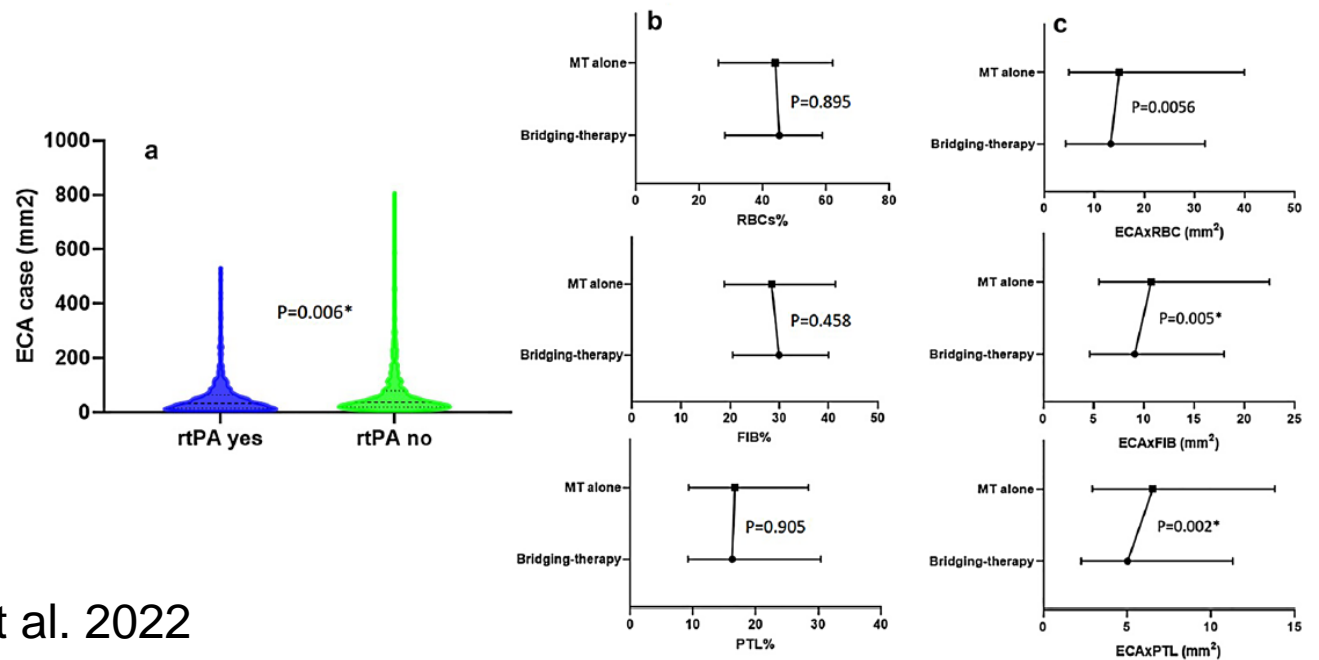


Fig. 1. Comparison of clot composition between tPA and non-tPA.

Brinjikji et al. 2022



Doyle et al. 2022

Imagerie de l'occlusion

Hyperdense middle cerebral artery: incidence and quantitative significance

T. A. Tomsick¹, T. G. Brott², C. P. Olinger², W. Barsan³, J. Spilker², R. Eberle², and H. Adams^{2, 4}

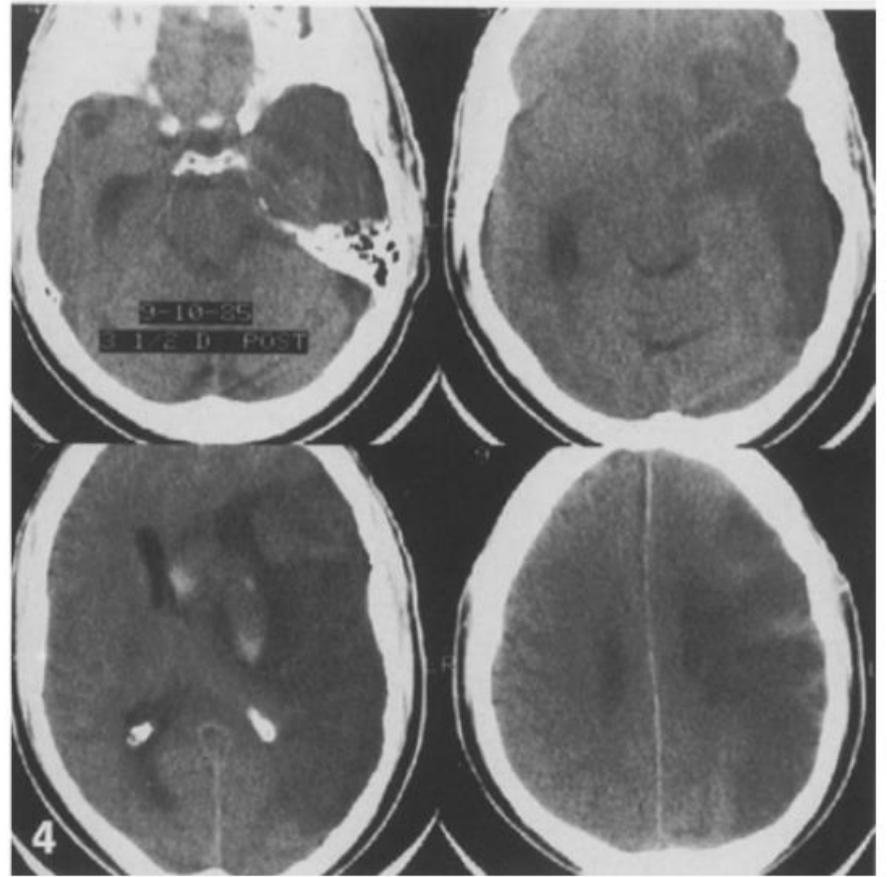
Departments of ¹ Radiology, ² Neurology, and ³ Emergency Medicine, University of Cincinnati Medical Center, and
⁴ University of Iowa Hospitals, Iowa City, USA

Summary. The hyperdense middle cerebral artery sign (HMCAS) is recognized as a CT finding that indicates thrombus or embolus within the middle cerebral artery. The incidence and significance of this sign are quantitatively evaluated in 50 patients entered into experimental drug studies for treatment of cerebral infarction.

Key words: Computed tomography - Thrombosis - Embolism - Cerebral infarction - Middle cerebral artery

development of a large infarct in the vascular distribution involved [1-3]. Previous retrospective studies suggest its presence in 1 to 2.5% of stroke patients [1, 2]. No prospective analysis of the incidence of the sign or its quantitative significance has been published.

We report here our prospective analysis of the incidence of the HMCAS and its significance in relation to infarct volume development in acute stroke patients.



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Patricia Orellana, MD
Jose Alvarez-Sabin, MD,
PhD
Juan F. Arenillas, MD
Xavier Aymerich, MSc
Ellsenda Grivé, MD
Carlos Molina, MD
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Index terms:

Arteries, middle cerebral, 174.4311,
174.4312, 174.4352
Brain, infarction, 17.4352, 17.781,
174.4352, 174.781
Brain, MR, 174.121411, 174.121412,
174.121413, 174.121415,
174.121416, 174.12142,
174.12143, 174.12144
Magnetic resonance (MR), vascular
studies, 17.12144, 174.12144

Published online before print
10.1148/radiol.2322030273
Radiology 2004; 232:466–473

Abbreviations:

DW = diffusion weighted
ICA = internal carotid artery
MCA = middle cerebral artery
NIHSS = National Institutes of Health
Stroke Scale
PW = perfusion weighted

¹ From the Department of Radiology, Magnetic Resonance Unit (A.R., P.O., X.A., E.G., A.R.G.) and Department of Neurology, Cerebrovascular Unit (J.A.S., J.F.A., C.M.), Hospital Universitari Vall d'Hebron, Passeig Vall d'Hebron 119–129, 08035 Barcelona, Spain. Received February 19, 2003; revision requested

Hyperacute Ischemic Stroke: Middle Cerebral Artery Susceptibility Sign at Echo-planar Gradient-Echo MR Imaging¹

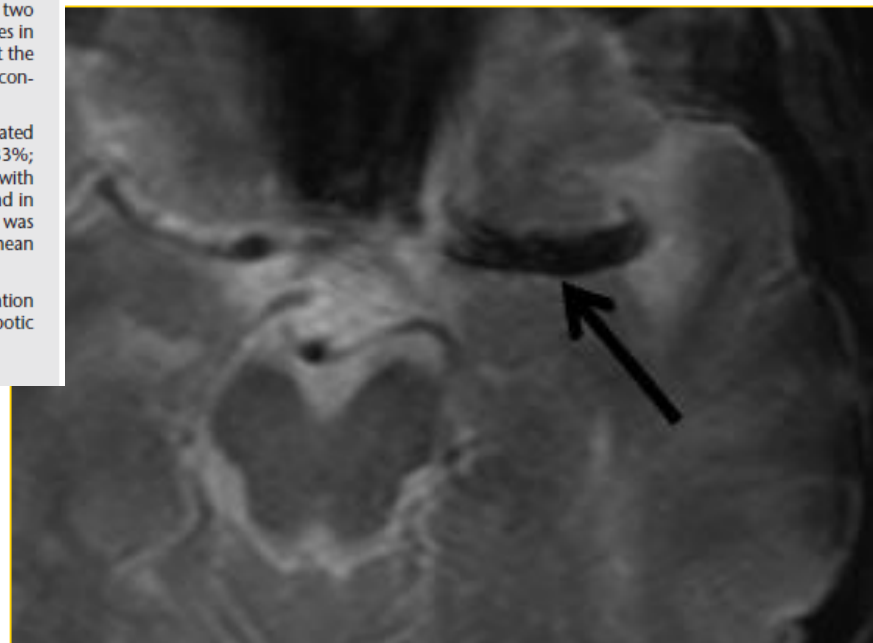
PURPOSE: To evaluate the accuracy of echo-planar T2*-weighted magnetic resonance (MR) sequences in detection of acute middle cerebral artery (MCA) or internal carotid artery (ICA) thrombotic occlusion.

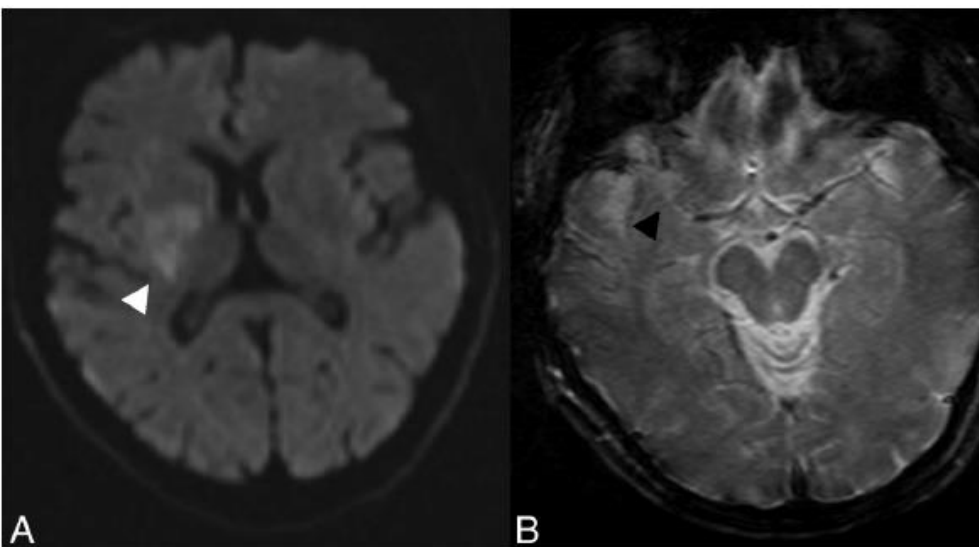
MATERIALS AND METHODS: Forty-two consecutive patients with stroke involving the MCA territory underwent MR imaging within 6 hours after clinical onset. MR examination included echo-planar T2*-weighted, diffusion-weighted (DW), and perfusion-weighted (PW) imaging and MR angiography. Presence or absence of the susceptibility sign on echo-planar T2*-weighted images, which is indicative of acute thrombotic occlusion involving MCA or ICA, was assessed in consensus by two observers blinded to clinical information and other MR imaging data. Differences in lesion volume on DW and PW images between patients with and those without the susceptibility sign were evaluated with the Mann-Whitney test. $P < .05$ was considered to indicate a significant difference.

RESULTS: Thirty patients (71%) had a positive susceptibility sign that correlated with MCA or ICA occlusion at MR angiography in all cases (sensitivity, 83%; specificity, 100%). Mean lesion volume on PW images was higher in patients with a positive susceptibility sign ($P = .01$), but no significant differences were found in mean lesion volume on DW images. Cases in which the susceptibility sign was identified proximal to MCA divisional bifurcation (27 patients) showed a mean perfusion deficit of 83.9% of the total MCA territory (range, 50%–100%).

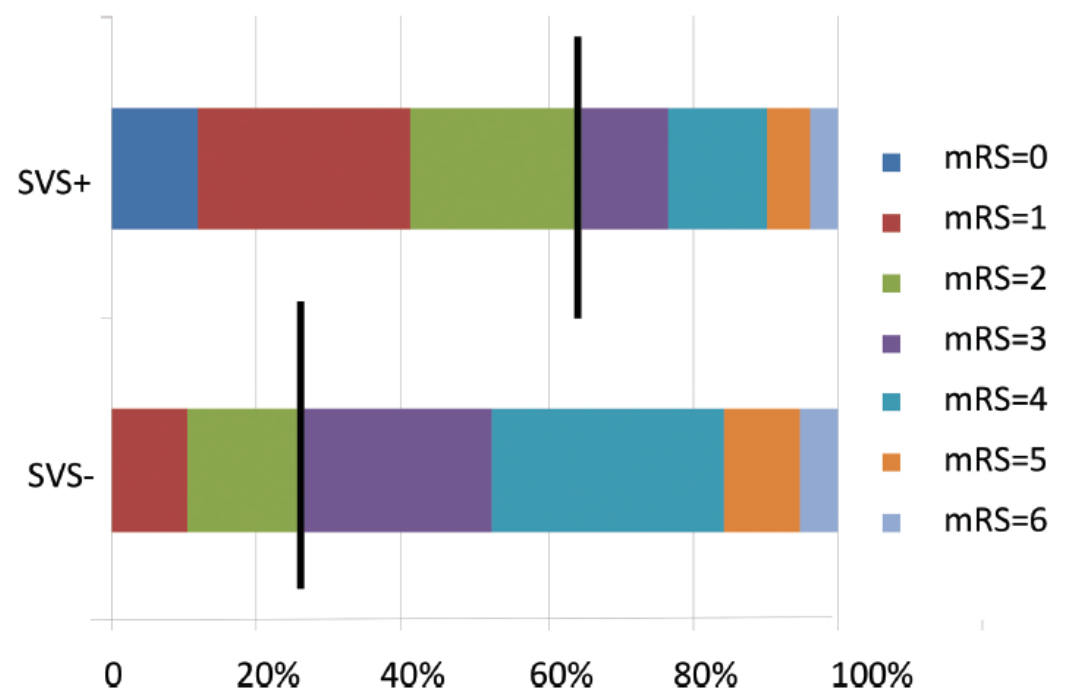
CONCLUSION: Presence of the susceptibility sign proximal to MCA bifurcation provides fast and accurate detection of acute proximal MCA or ICA thrombotic occlusion.

© RSNA, 2004

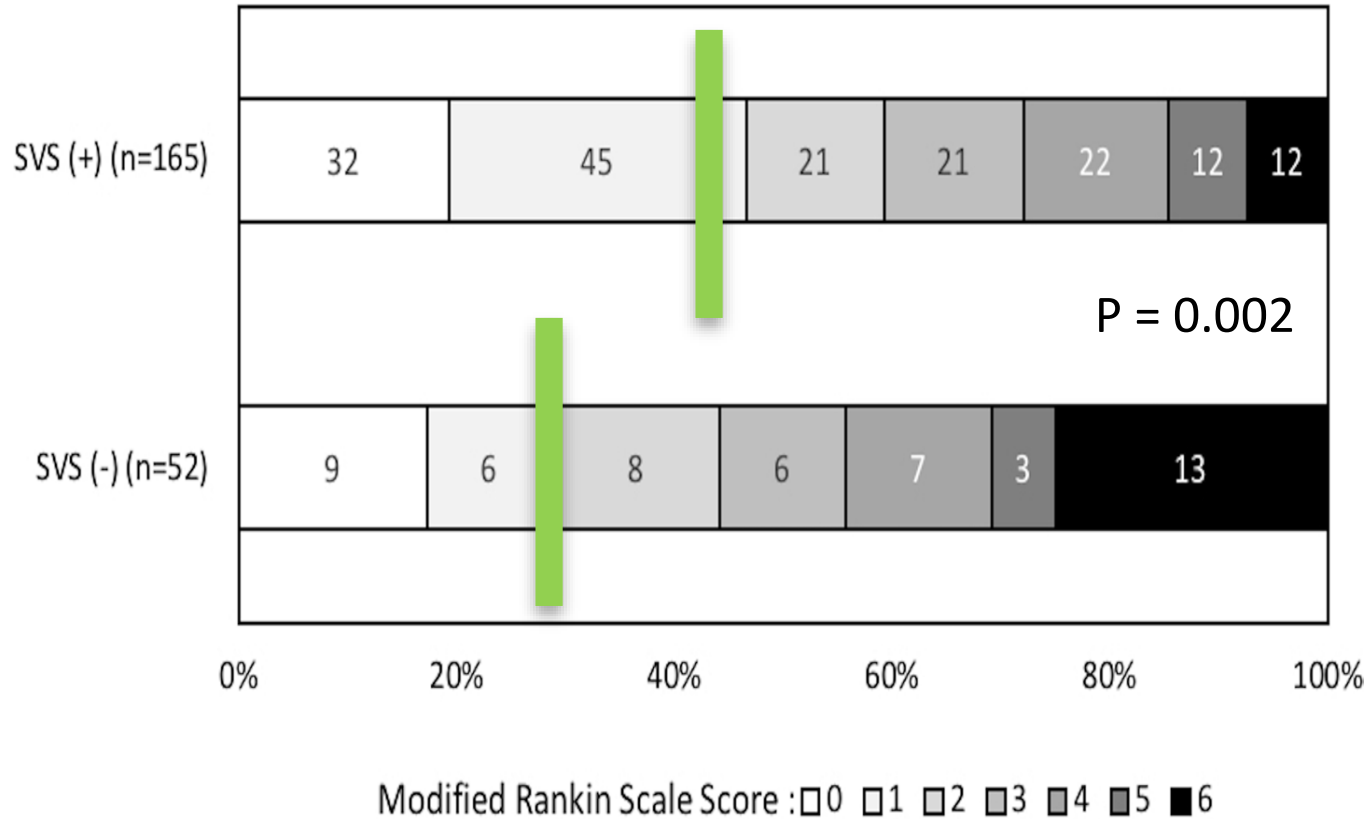




	Univariate			Multivariate		
	OR	95% CI	P Value	OR	95% CI	P Value
Age	0.9	0.9-1.01	.25	0.9	0.9-1.01	.13
Sex	1.4	0.5-3.6	.48			
Initial NIHSS (≤ 20 vs > 20)	0.8	0.3-2.1	.66			
ASPECTS (≤ 7 vs > 7)	0.9	0.4-2.4	.89			
Dissection	1.2	0.3-4.7	.77			
ICA occlusion	1.8	0.7-4.7	.22			
IV tPA	0.8	0.3-2.1	.69			
Onset-to-groin puncture			.58			
270 min to 6 hr vs > 360 min	1.7	0.6-5.0				
≤ 270 min vs > 360 min	1.7	0.5-5.7				
SVS+	5	1.6-16.6	.01 ^a	8.7	1.1-69.4	.04 ^a
Lack of spontaneous hyperattenuation on CT	3.6	1.3-9.7	.01 ^a	3.6	0.7-18.9	.013
Day 1 NIHSS (≤ 10 vs > 10)	51.5	11.8-225.1	$<.001^a$	51.9	8.4-320.5	$<.001^a$
TICI ($\geq 2b$ vs $< 2b$)	5.1	1.4-17.9	.01 ^a	7.1	0.4-112.8	.16



Population ASTER et THRACE traitée par SR en première ligne

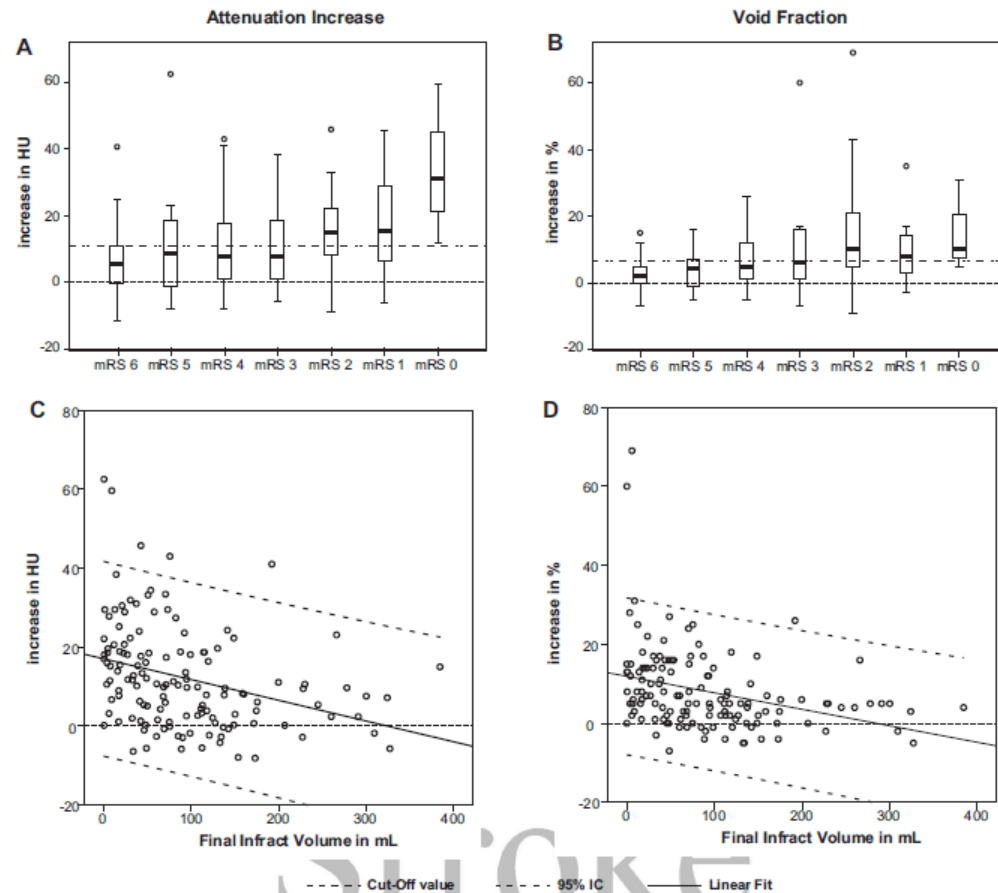


Susceptibility vessel sign on MRI predicts better clinical outcome in patients with anterior circulation acute stroke treated with stent retriever as rst- line strategy JNIS 2018

Apport du NCCT, CTA

Perméabilité du thrombus en CTA associée à :

- * amélioration fonctionnelle
- * meilleure recanalization
- * plus petit infarctus



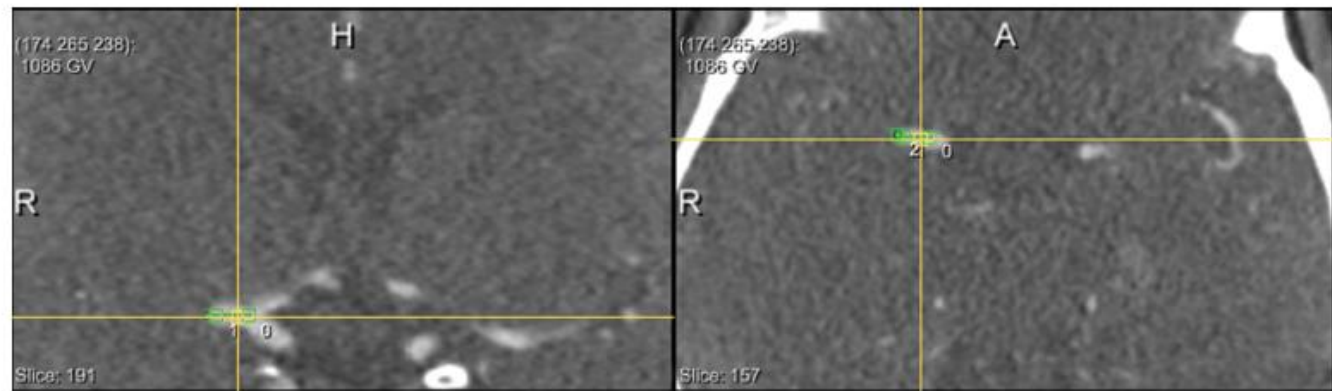


FIG 2. Distance from the ICA-T to the thrombus. Placement of seed points in the vessel from the ICA-T to the thrombus by the observer. Subsequently, the software determined the centerline through the vessel, which represents the distance from the ICA-T to the thrombus. Left: coronal view CTA. Right: axial view CTA.

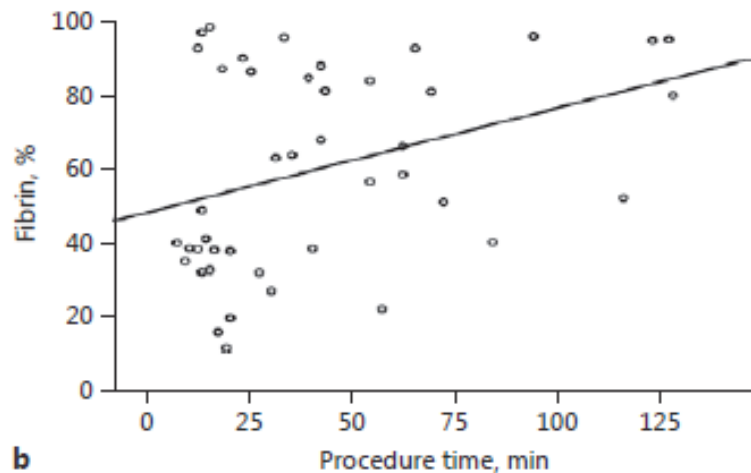
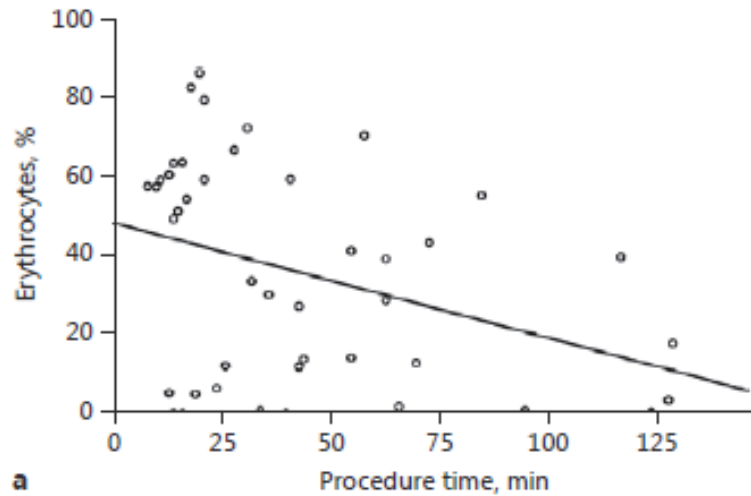
Table 2: Baseline characteristics of the full MR CLEAN subgroups included in this study stratified by treatment

	IAT (n = 78)	Control (n = 121)
Mean age (yr)	63 (range, 43–87)	66 (range, 31–93)
Male sex (%)	67 (52/78)	56 (72/121)
Median NIHSS	17 (IQR, 13–21)	19 (IQR, 14–23)
Median ASPECTS	9 (IQR, 8–10)	9 (IQR, 8–10)
Diabetes mellitus (%)	9 (7/78)	12 (14/121)
Atrial fibrillation (%)	22 (17/78)	31 (37/121)
Previous stroke (%)	14 (11/78)	7 (9/121)
Median thrombus length (mm) (n = 186)	16.2 (IQR, 11.6–22.0) (range, 4.8–39.5)	15.2 (IQR, 10.3–22.3) (range, 4.8–39.5)
Median thrombus volume (mm ³) (n = 186)	69.3 (IQR, 51.7–111.9) (range, 6.1–329.0)	70.9 (IQR, 43.8–115.5) (range, 11.4–456.7)
Median distance to thrombus (mm)	6.8 (IQR, 0.0–12.8) (range, 0.0–38.2)	6.4 (IQR, 0.0–13.5) (range, 0.0–38.2)
T-occlusion (%)	26 (20/78)	21 (26/121)
Median density thrombus NCCT (HU)	49.0 (IQR, 45.2–55.2) (range, 33.1–67.8)	48.9 (IQR, 44.1–55.4) (range, 33.1–67.8)
Median relative density thrombus NCCT (%)	137.4 (IQR, 116.0–151.4) (range, 84.8–213.0)	131.2 (IQR, 117.7–151.7) (range, 65.8–274.4)
Median density thrombus CTA (HU)	61.2 (IQR, 53.3–68.7) (range, 38.5–134.3)	61.9 (IQR, 52.5–75.1) (range, 38.5–134.3)
Median relative density thrombus CTA (%)	29.6 (IQR, 23.2–37.9) (range, 12.2–94.7)	29.8 (IQR, 20.5–43.9) (range, 12.5–88.7)
Median thrombus attenuation increase (HU)	12.3 (IQR, 0.74–19.6) (range, –9.9–80.0)	11.2 (IQR, –0.9–28.5) (range, –9.9–80.0)
Median thrombus void fraction (%)	5.8 (IQR, 0.99–12.3) (range, –8.9–61.8)	6.1 (IQR, –0.47–16.8) (range, –8.9–61.8)

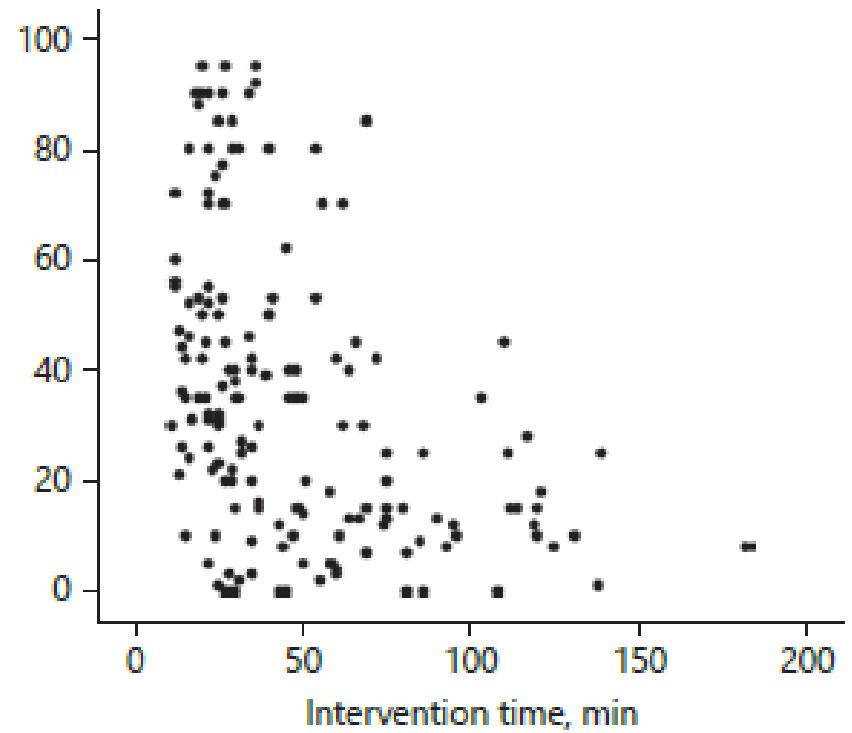
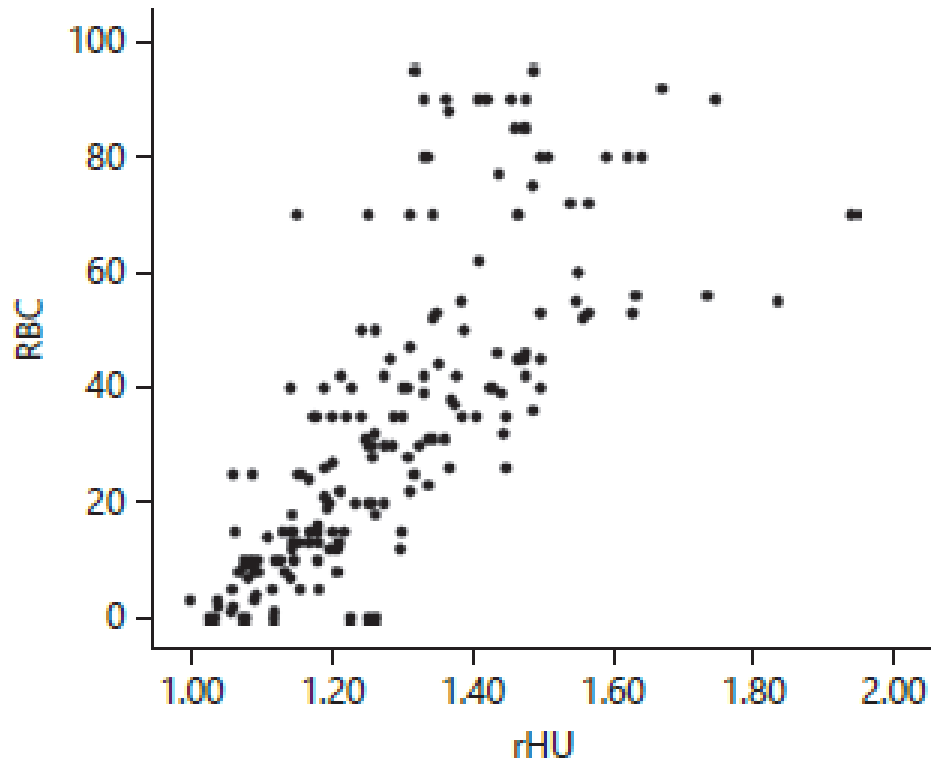
Longueur > 18 mm et perméabilité du thrombus lié au mRS en univarié.

Densité relative du thrombus = facteur indépendant associé OR 1.21 per 10% (95% CI, 1.02–1.43; P".029).

Pas de modification du "TTT-effect" en lien avec les caractéristiques du thrombus



- 43 patients
- Hyperdensité des thrombi riches en érythrocytes plus que riches en fibrine
- Thrombi érythrocytaires
 - Nb passes réduits
 - Temps de procédure plus courts



168 patients (93,4%) recanalisation complète

association entre moins de fibrine ($p < 0,001$), plus de GR ($p < 0,001$) et Hyperdensité au CT ($p < 0,001$)

Durées d'intervention plus longues ($p \leq 0,001$) quand GR diminue ($p \leq 0,001$).

ASTER trial 1

- A comparé, un traitement de première ligne par :
 - * contact aspiration (CA)
- versus
- * stent retriever (SR).

Pas de différence en terme de reperfusion .

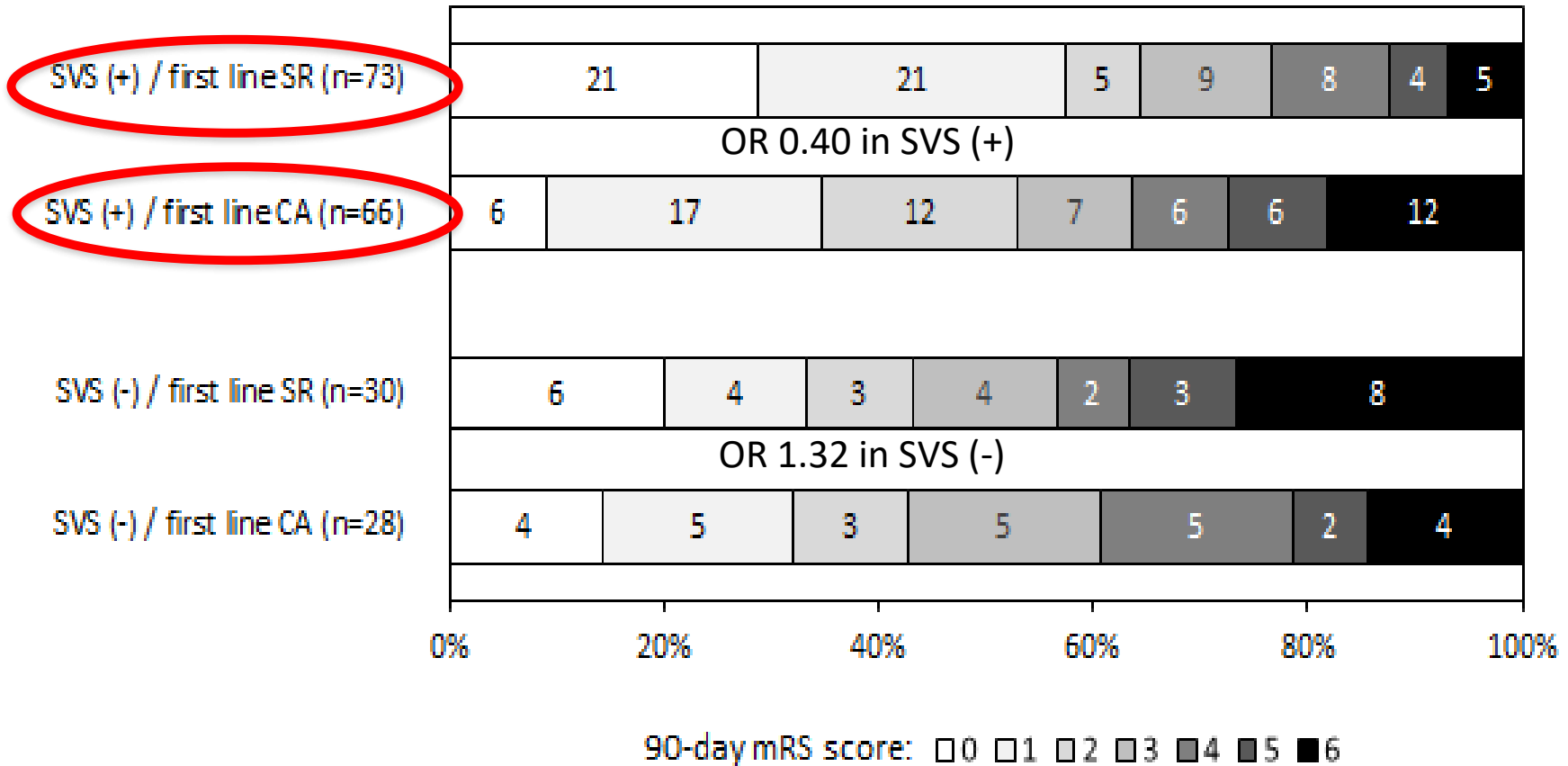
Mais, si on considère le thrombus?

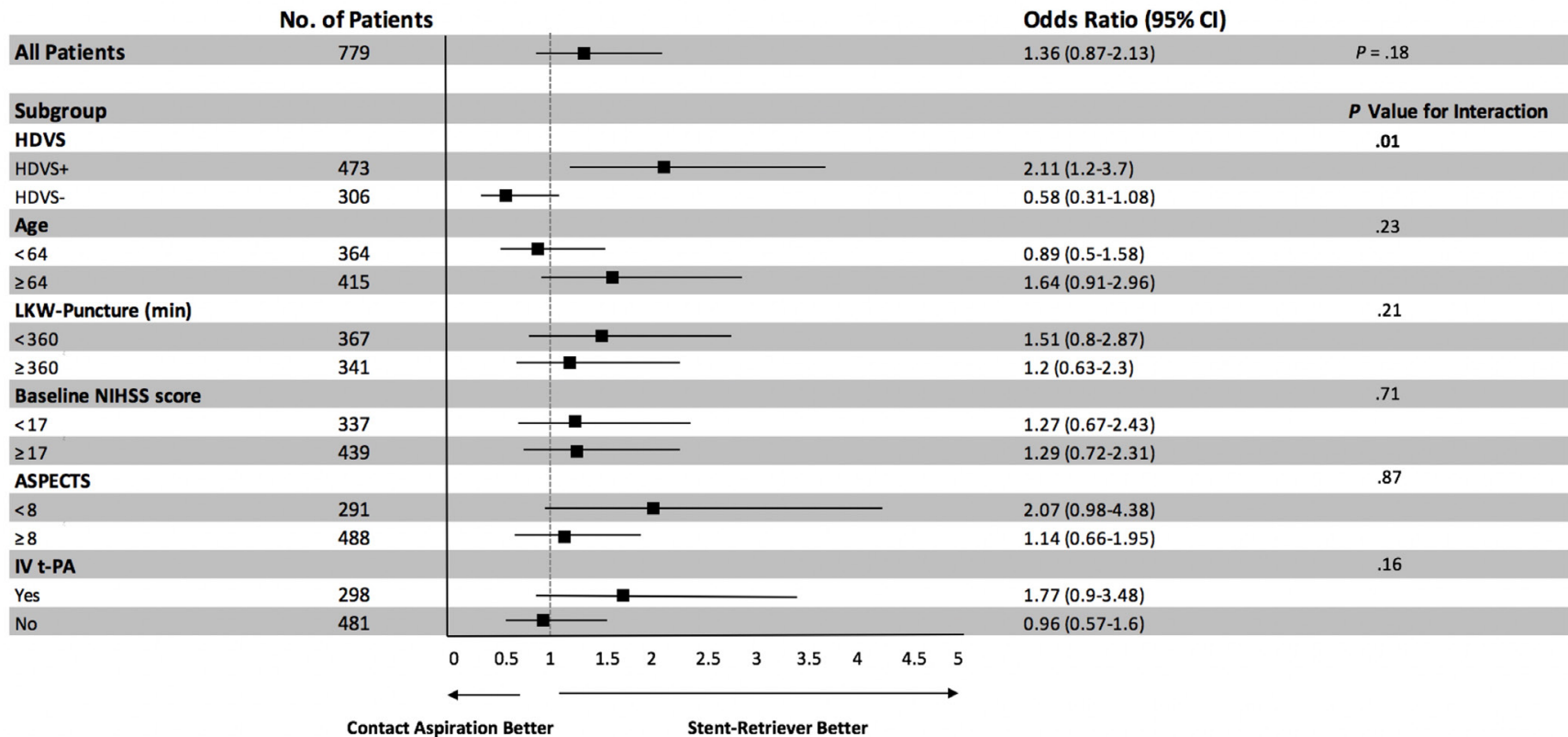
Résultats angiographiques selon le SVS dans chaque bras

Angiographic outcomes	SVS	First-line SR	First-line CA	RR (95%CI)	P	P Het
		(n=106)	(n=96)			
<u>After first-line strategy</u>						
mTICI 2c/3	-	15/31 (48.4)	15/28 (53.6)	1.11 (0.69 to 1.77)	0.66	0.018
	+	44/75 (58.7)	24/68 (35.3)	0.60 (0.50 to 0.71)	<0.001	0.018
mTICI 2b/3	-	20/31 (64.5)	21/28 (75.0)	1.16 (0.69 to 1.93)	0.57	0.018
	+	56/75 (74.7)	38/68 (55.9)	0.75 (0.54 to 1.03)	0.078	0.018
Number of passes > 2	-	12/31 (38.7)	10/28 (35.7)	0.89 (0.43 to 1.81)	0.24	0.032
	+	25/75 (33.3)	36/68 (52.9)	1.61 (1.01 to 2.55)	0.045	0.032
Use of rescue treatment	-	11/31 (35.5)	9/28 (32.1)	0.88 (0.38 to 2.05)	0.77	0.031
	+	13/75 (17.3)	25/68 (36.8)	2.19 (1.15 to 4.14)	0.017	0.031

mRs according to first-line and SVS

CA vs. SR for interaction=0.038).

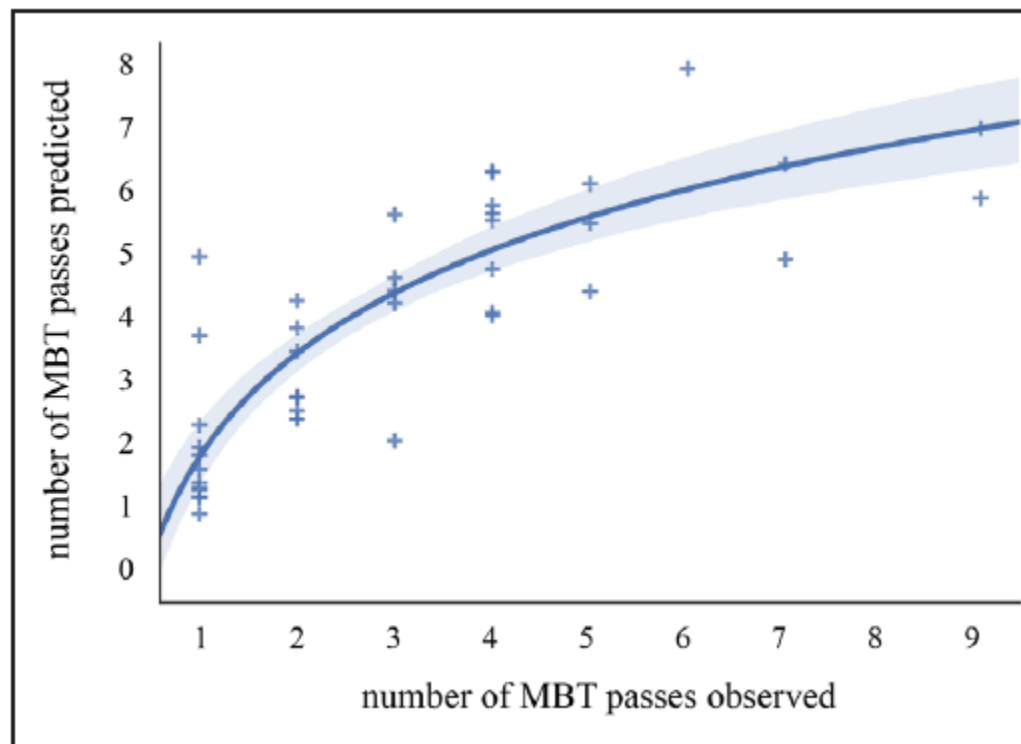




HDVS et FPE dans 473 (60,7%) et 286 (36,7 %) patients, respectivement.
 HDVS modifie l'effet de la thrombectomie sur FPE ($p=0,01$) qd HDVS non-HDVS ayant une meilleure réponse à CA

Table 1. Radiomics Features and Filters

Radiomics Features Class	No. of RFs
First-order statistics	18
Shape based	13
Gray level co-occurrence matrix	23
Gray level run length matrix	16
Gray level size zone matrix	16
Neighboring gray tone difference matrix	5
Gray level dependence matrix	14
Image filters	
Laplacian of gaussian (sigma: 0.5, 1.0, 2.0)	276
Wavelet	736
Square	92
Square root	92
Logarithm	92
Exponential	92



une cohorte de formation (n=109) et cohorte de validation prospective (n=47).

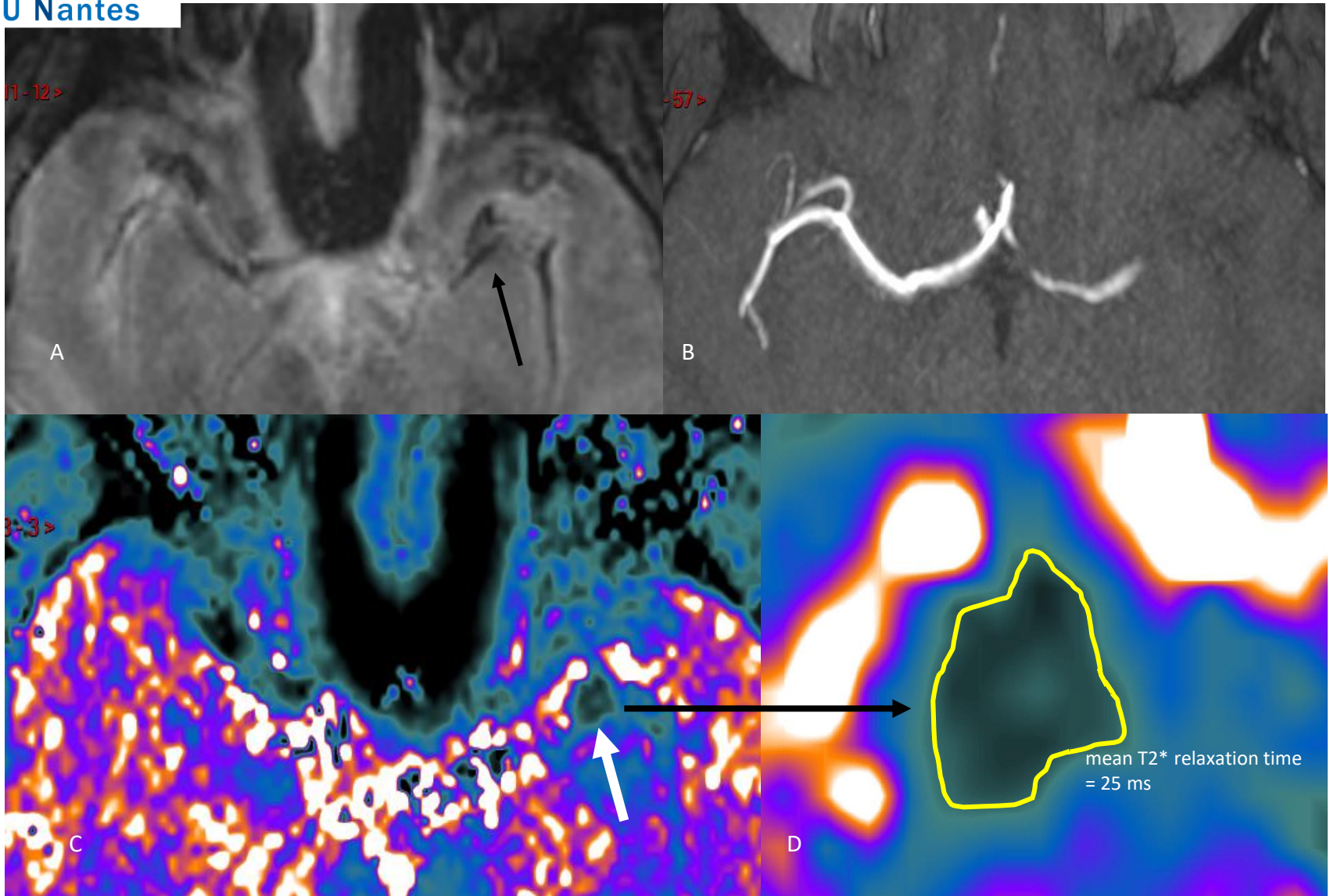
Thrombi segmentés sur CT et calcul automatique de 1485 caractéristiques radiomiques

2 modèles d'apprentissage développés sur la cohorte de formation pour prédire FPE thromboaspiration et Nb passages

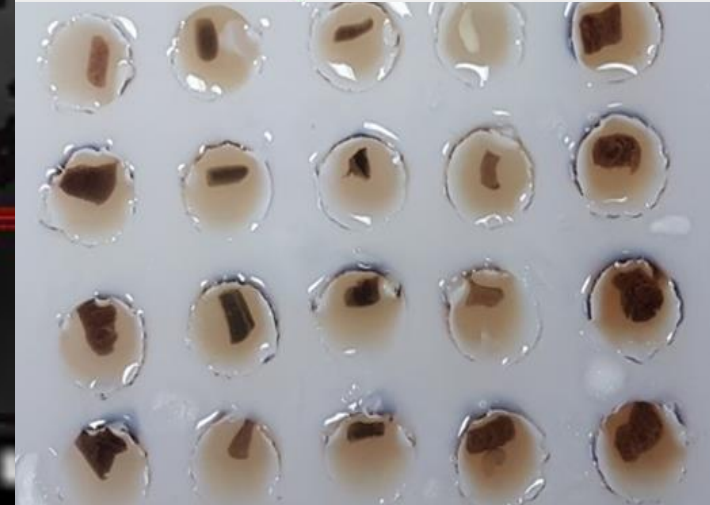
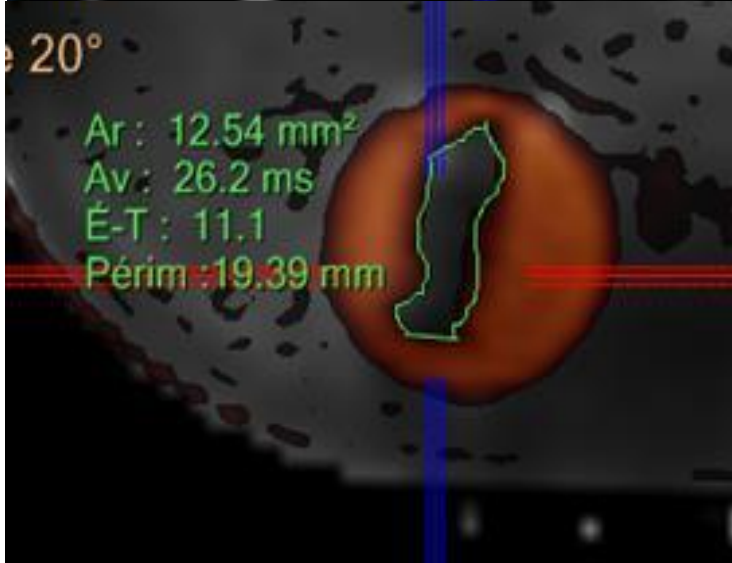
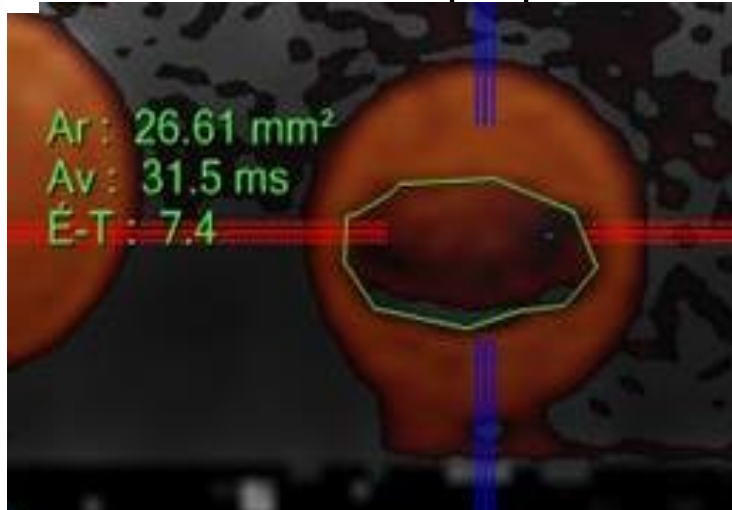
9 caractéristiques radiomiques prédisent FPE - CA

Séquence de quantification

- SVS parfois difficile à déterminer - qualitatif
- Nécessité d'un outil fiable - quantitatif
- Nécessité de séquence courte dans le cadre du stroke

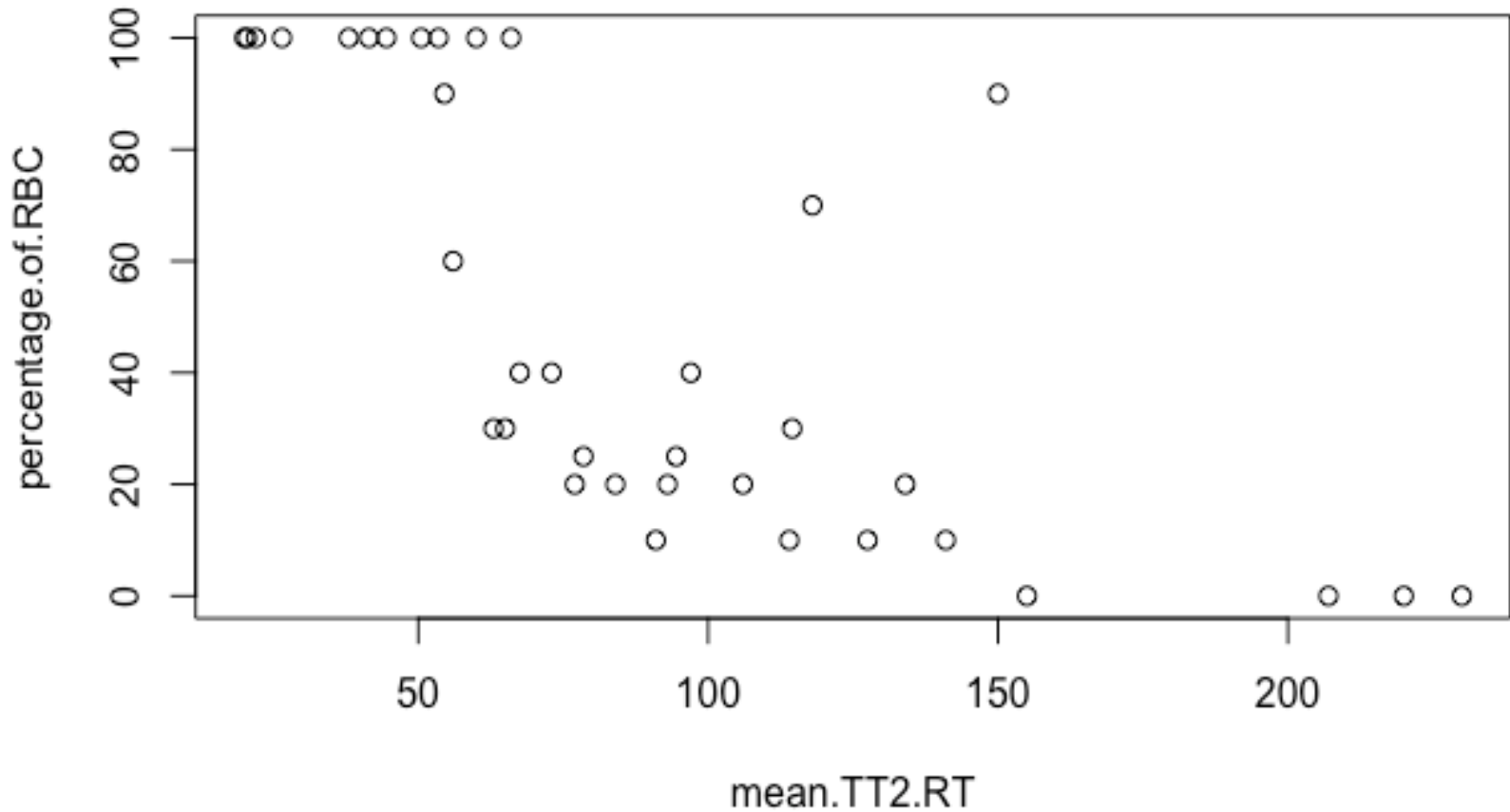


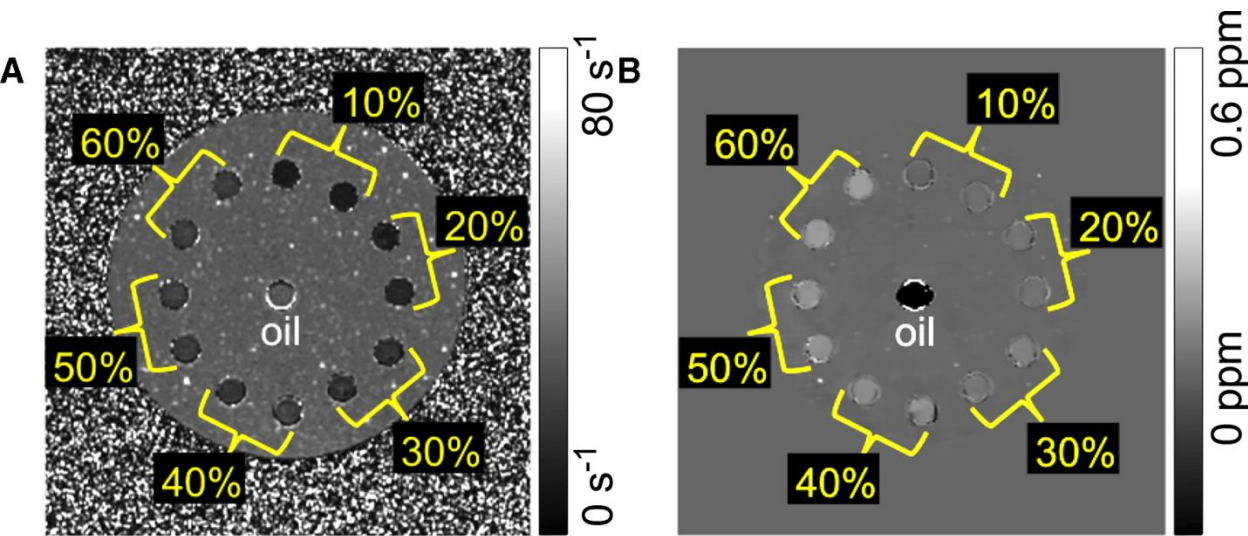
TT2*RT et proportion en GR sur des caillots de synthèse



Correlation entre TT2*RT et proportion en GR

ρ : -0.84, p-value < 0.0001



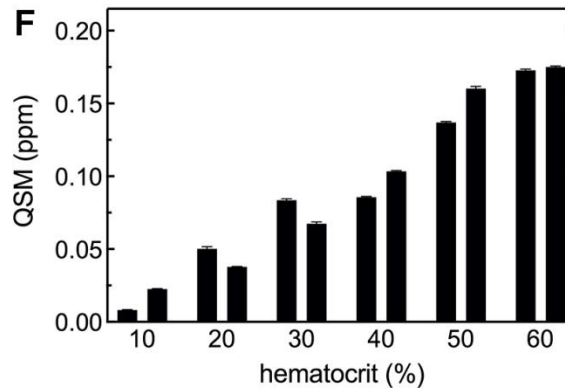
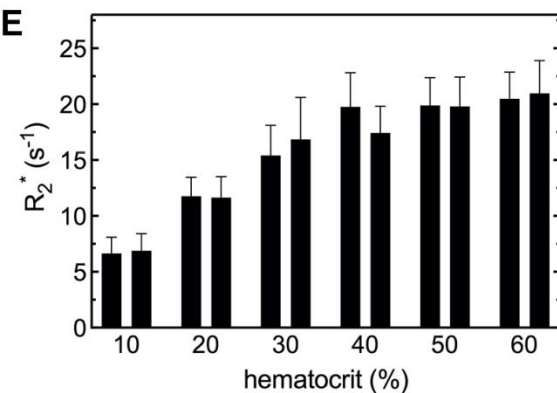
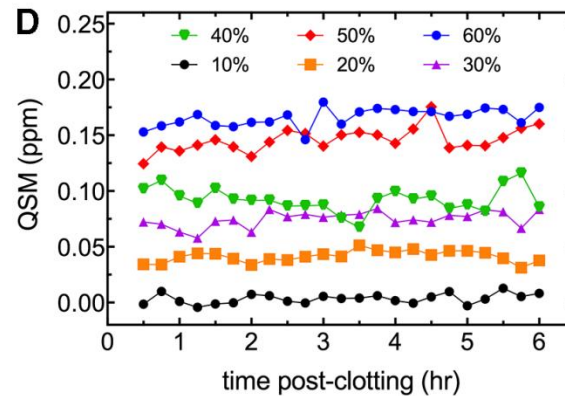
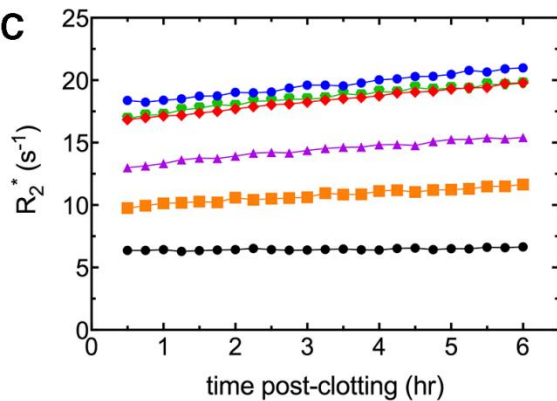


2 caillots scannés à 6 jours d'intervalle

R_2^* et les QSM varient peu au cours des premières 6h la

QSM linéairement corrélé à l'hématocrite

Au-delà de 6 heures R_2^* et le QSM augmenté au fil du temps et l'hématocrite pourrait être estimé à partir de la R_2^*/QSM ratio.



Spencer D Christiansen et al. JNIS 2019

Adaptation du traitement
de reperfusion au type de caillot ?

Negative Susceptibility Vessel Sign and Underlying Intracranial Atherosclerotic Stenosis in Acute Middle Cerebral Artery Occlusion

S.K. Kim, W. Yoon, T.W. Heo, M.S. Park, and H.K. Kang

ABSTRACT

BACKGROUND AND PURPOSE: The role of MR imaging in predicting underlying intracranial atherosclerotic stenosis before endovascular stroke therapy has not been studied. Our aim was to determine the diagnostic value of the negative susceptibility vessel sign on T2*-weighted gradient-echo MR imaging for predicting underlying intracranial atherosclerotic stenosis in patients with acute MCA occlusion.

MATERIALS AND METHODS: Ninety-one consecutive patients with acute stroke because of MCA occlusion underwent gradient-echo MR imaging and MRA before endovascular therapy. The negative susceptibility vessel sign was defined as an absence of a hypointense signal change within the occluded MCA on gradient-echo imaging. Underlying intracranial atherosclerotic stenosis was determined by conventional angiography. The sensitivity, specificity, predictive values, and accuracy of the negative susceptibility vessel sign for predicting the presence of underlying intracranial atherosclerotic stenosis were assessed.

RESULTS: The negative susceptibility vessel sign was identified in 42 (46.1%) of 91 patients, and 18 (19.8%) patients had an underlying intracranial atherosclerotic stenosis responsible for acute ischemic symptoms. The negative susceptibility vessel sign was more frequently observed in patients with intracranial atherosclerotic stenosis than in those without it (100% versus 32.9%, $P < .001$). In the prediction of an underlying intracranial atherosclerotic stenosis, the negative susceptibility vessel sign had 100% sensitivity, 67.1% specificity, 42.9% positive predictive value, 100% negative predictive value, and an accuracy of 73.6%.

CONCLUSIONS: The negative susceptibility vessel sign on gradient-echo MR imaging is a sensitive marker with a high negative predictive value for the presence of an underlying intracranial atherosclerotic stenosis in patients with acute ischemic stroke because of MCA occlusions. The susceptibility vessel sign can be used in decision-making when performing subsequent endovascular revascularization therapy in patients with acute MCA occlusions.

ABBREVIATIONS: GRE = gradient-echo; ICAS = intracranial atherosclerotic stenosis; SBT = stent-based thrombectomy; SVS = susceptibility vessel sign

Table 3: Summary of GRE MRI findings according to occlusion sites

Location	ICAS Group (n = 18)		Non-ICAS Group (n = 73)	
	SVS Absent	SVS Present	SVS Absent	SVS Present
	M1	18	0	20
M2	0	0	4	3
Total (n = 91)	18	0	24	49

Table 2: Comparison between the ICAS group and non-ICAS group

	ICAS Group (n = 18)	Non-ICAS Group (n = 73)	P Value
Age (yr)	63.8 ± 10.4	69.9 ± 11.4	.026
Male sex	11 (61.1%)	41 (56.2%)	NS
Risk factors			
Hypertension	12 (66.7%)	41 (56.2%)	NS
Diabetes mellitus	7 (38.9%)	7 (9.6%)	.002
Coronary artery disease	0 (0%)	5 (6.8%)	NS
Dyslipidemia	12 (66.7%)	17 (23.2%)	<.001
Smoking	3 (16.7%)	22 (30.1%)	NS
Atrial fibrillation	1 (5.6%)	38 (52.1%)	<.001
Congestive heart failure	0 (0%)	2 (2.7%)	NS
History of stroke or TIA	1 (5.6%)	11 (15.1%)	NS
Occlusion sites			
M1 segment	18 (100%)	66 (90.4%)	NS
M2 segment	0 (0%)	7 (9.6%)	NS
IV thrombolysis	7 (38.9%)	47 (64.4%)	NS
Time to procedure (min)	253.8 ± 115.9	250.5 ± 74.2	NS
Procedure time (min)	31.9 ± 9.3	33.6 ± 18.0	NS
Time to revascularization (min)	285.8 ± 117.8	284.3 ± 78.2	NS
Baseline NIHSS score	9.8 ± 3.6	12.7 ± 3.7	.003
m-TICI 2b or 3	18 (100%)	59 (80.8%)	.043
mRS 0–2	14 (77.8%)	35 (47.9%)	.034
Mortality	1 (5.6%)	8 (10.9%)	NS
N-SVS	18 (100%)	24 (32.9%)	<.001

Note:—N-SVS indicates negative susceptibility vessel sign; m-TICI, modified TICI; NS, non-significant.

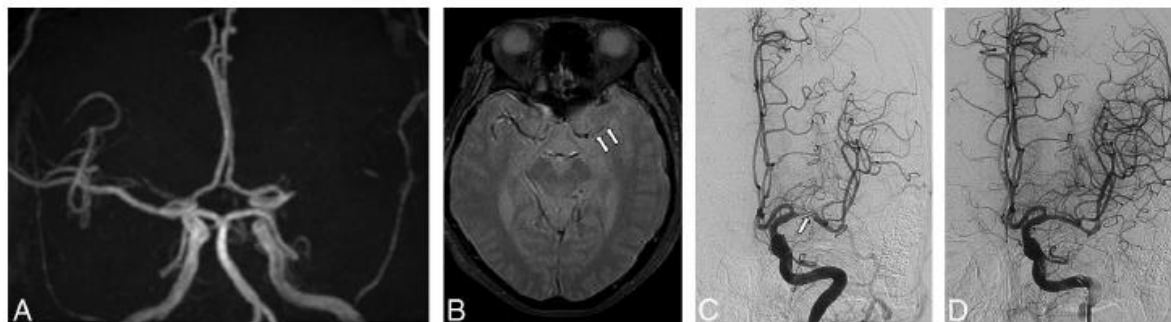
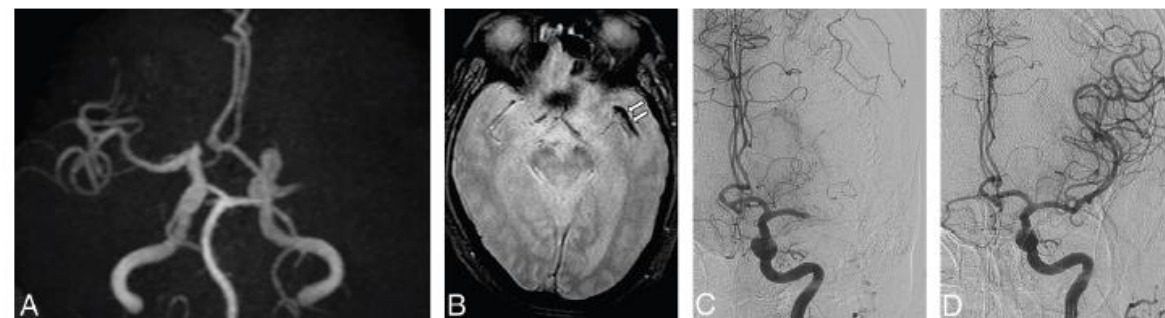
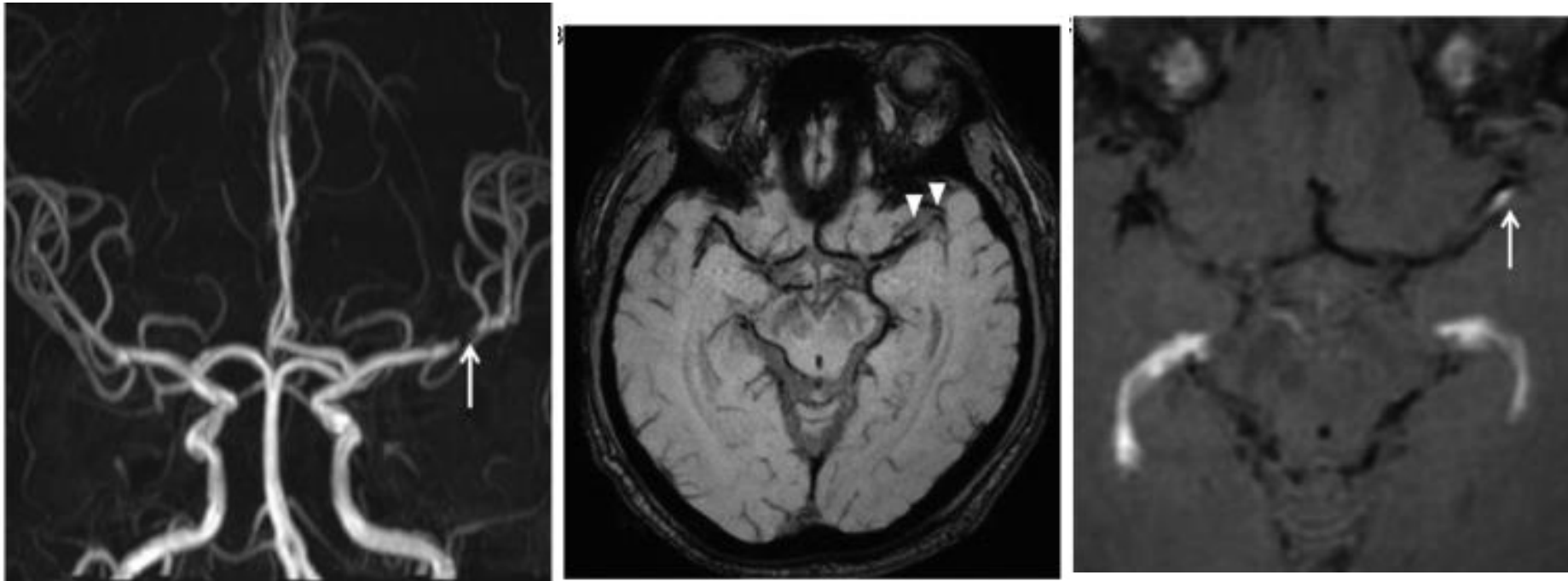


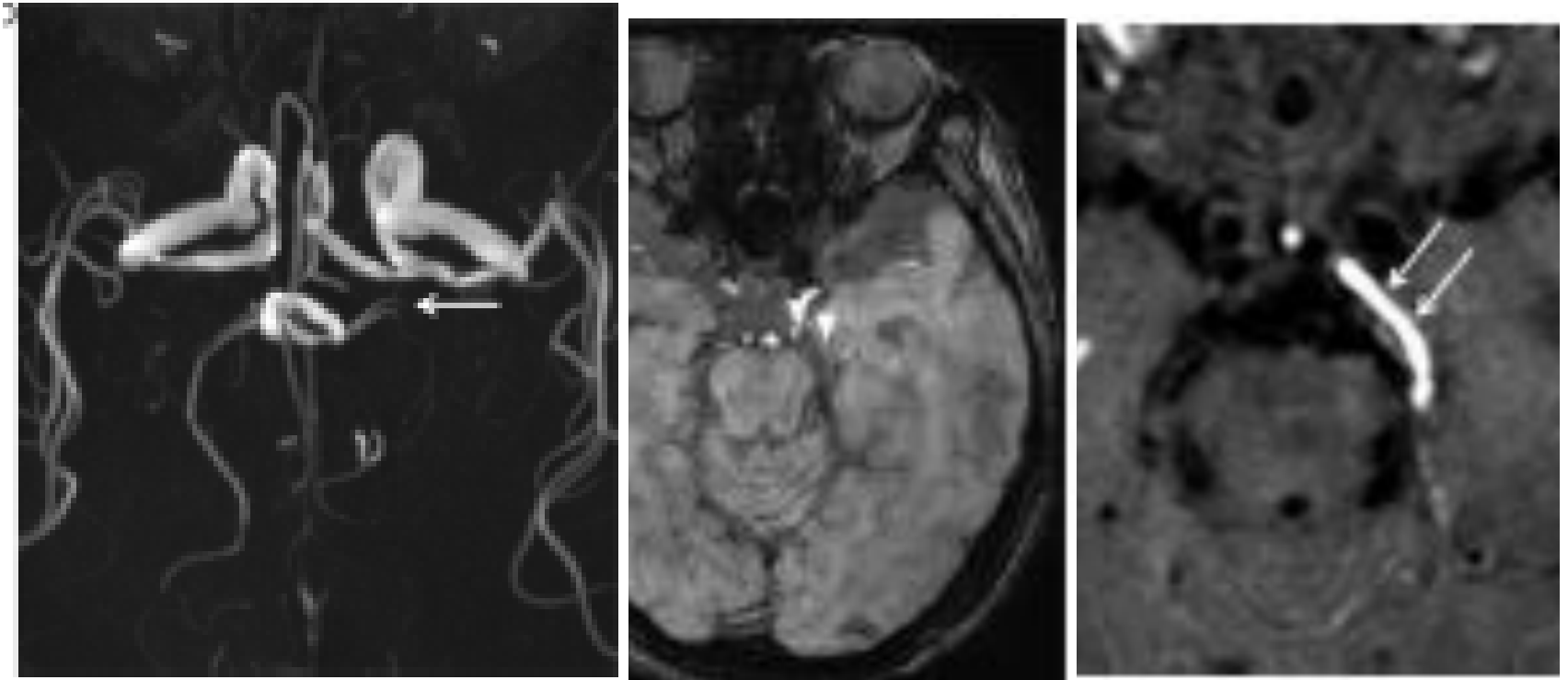
FIG 1. Brain images from a 74-year-old man with acute ischemic stroke and atherosclerotic stenosis in the MCA. **A**, 3D TOF MR angiography shows the occlusion in the proximal M1 segment of the left MCA. **B**, Axial gradient-echo image reveals a negative susceptibility vessel sign (arrows) in the M1 segment of the left MCA. **C**, Angiography after 1 passage of the Solitaire stent identifies a severe stenosis (arrow) in the proximal M1 segment of the left MCA. No thrombi were retrieved with the Solitaire stent. **D**, Angiography after intracranial angioplasty with stent placement shows complete revascularization in the left MCA territory.



Et si pas de SVS ... ?



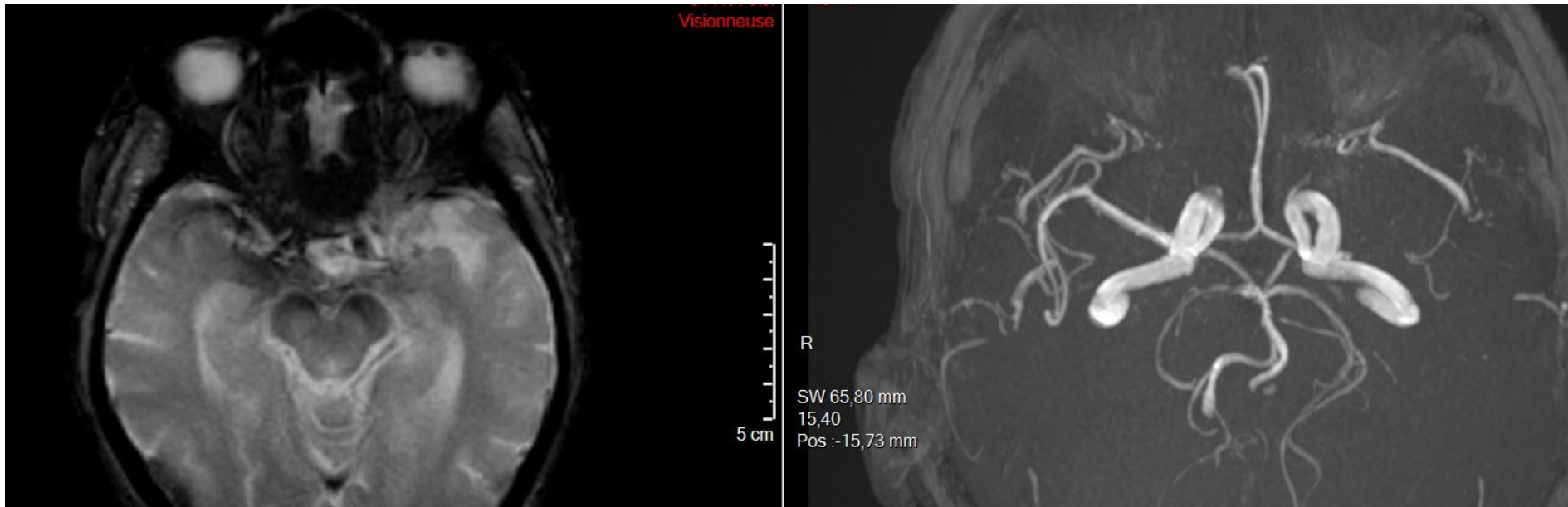
weak intensity, linear or eccentric morphology and focal length pattern = stenose



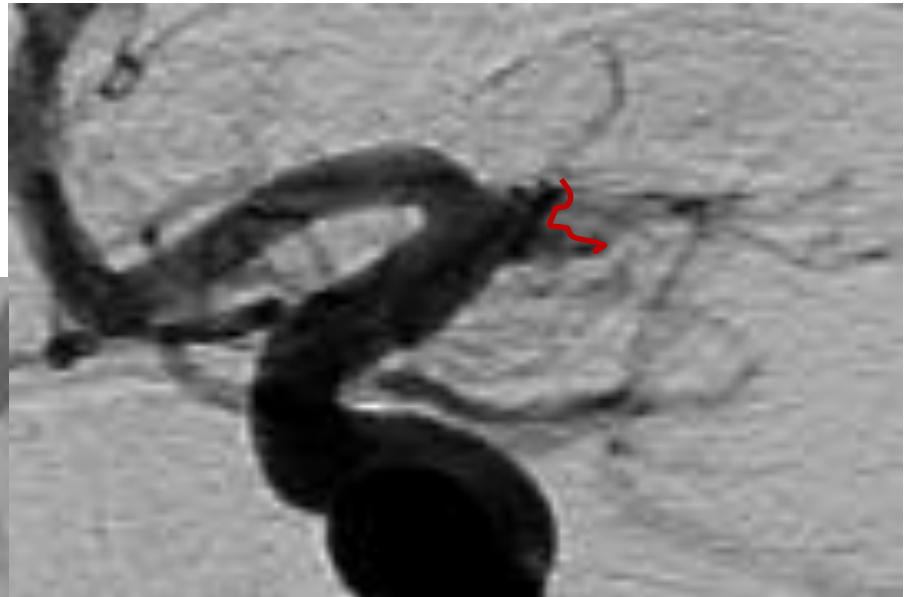
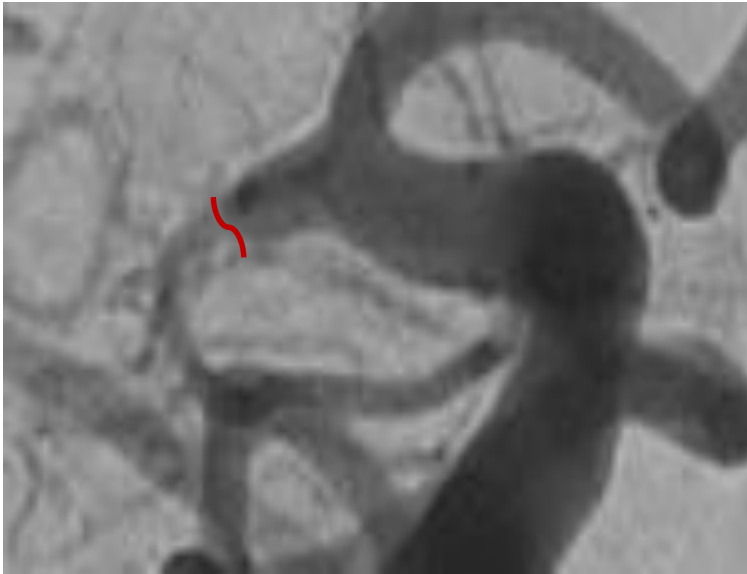
strong intensity, round or concentric morphology and segmental length pattern = occlusion

Sung Hyun Baik et al Eur. J. Radiol. 2018

Pas de SVS ...



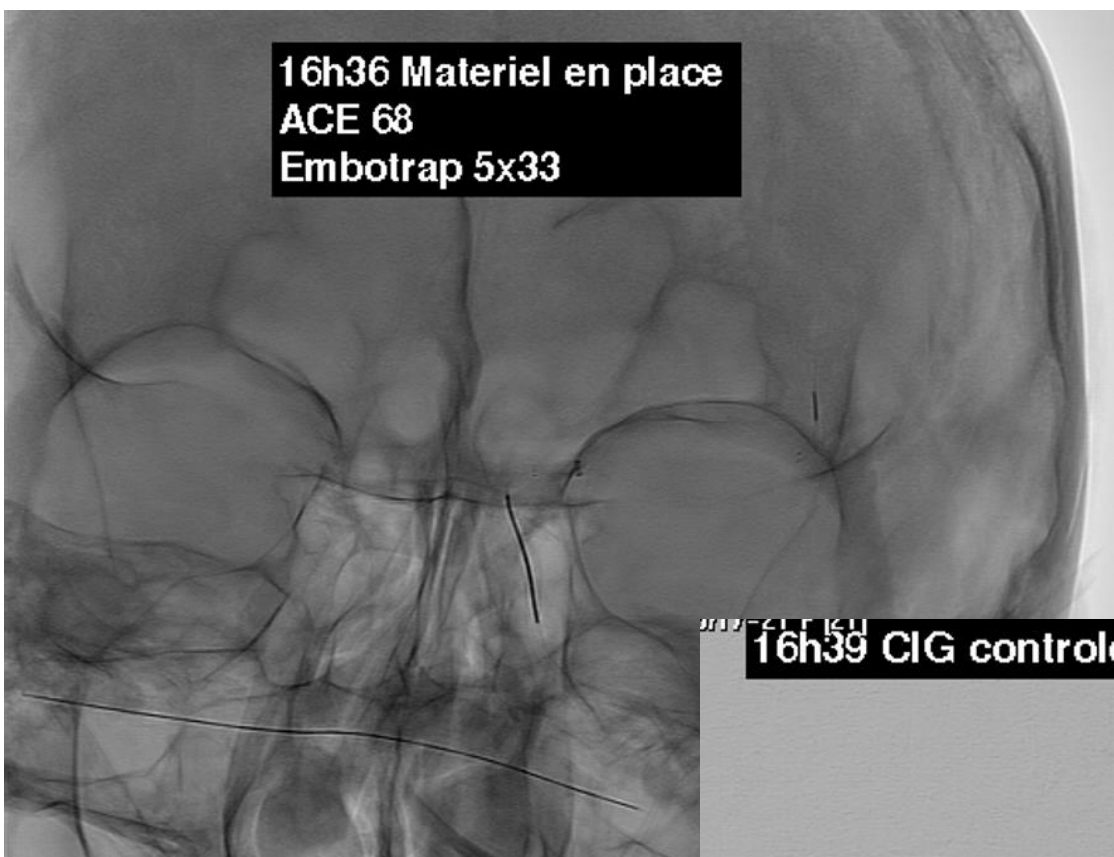
Occlusion Régulière Vs Irrégulière



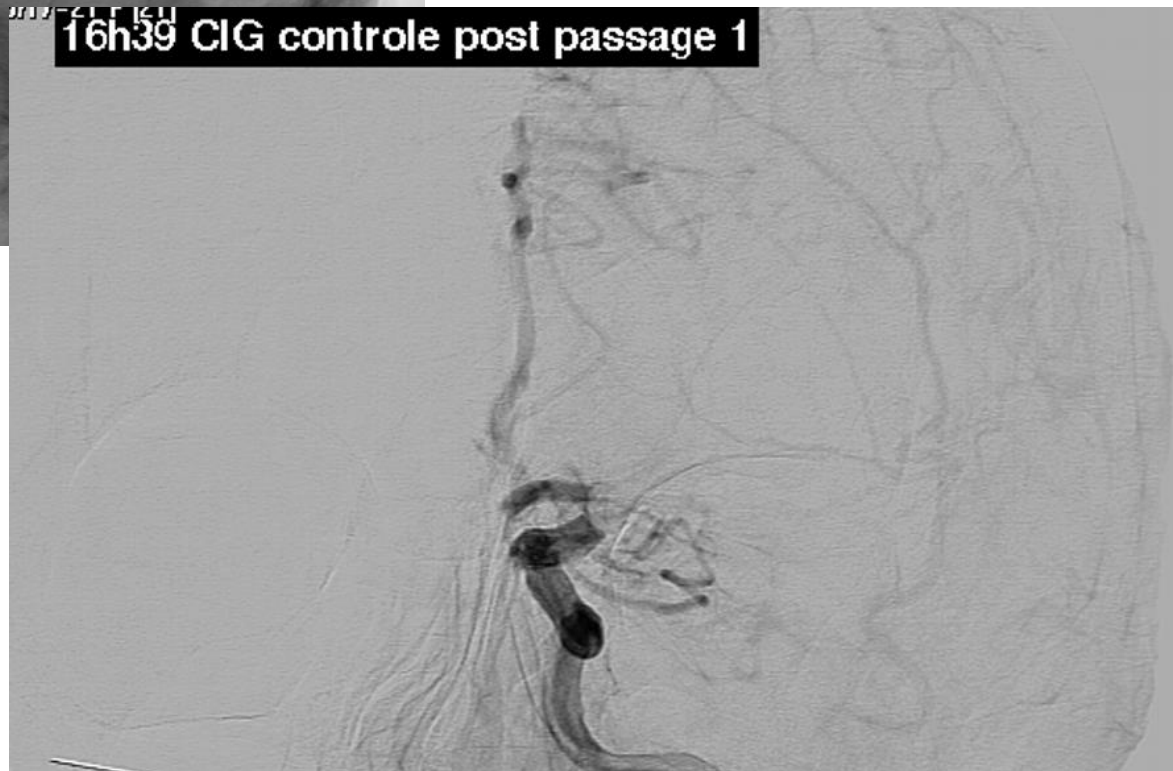
Phénotype de l'occlusion ?



16h36 Matériel en place
ACE 68
Embotrap 5x33



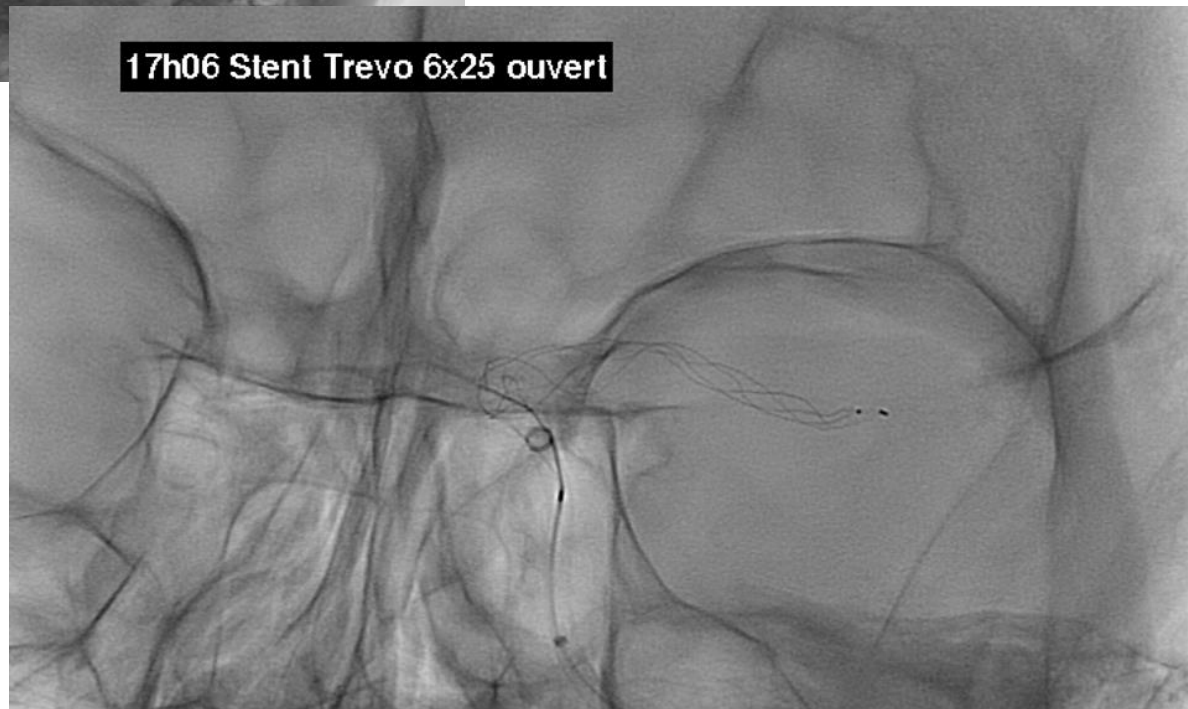
16h39 CIG controle post passage 1



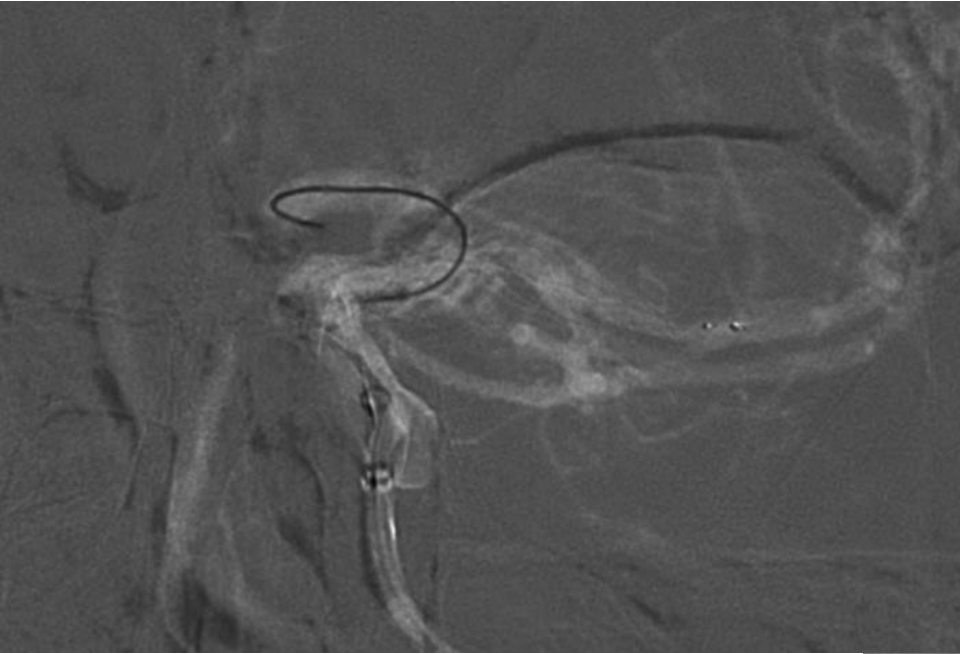
**16h44 Materiel en place
ACE 68
Embotrap 5x33**



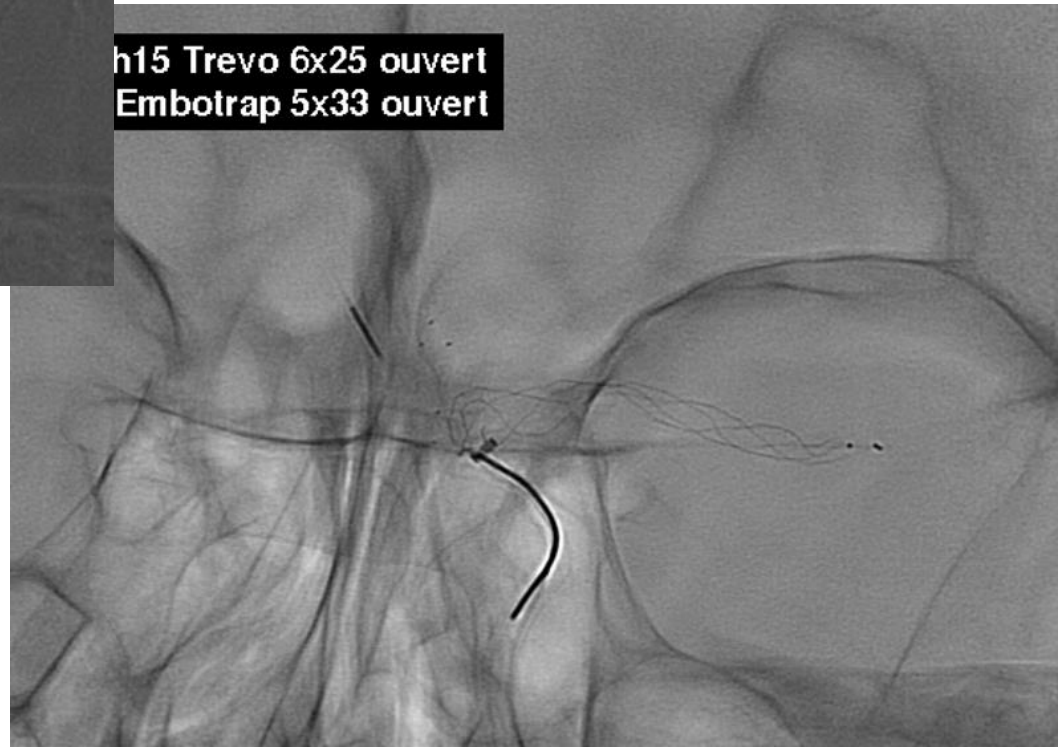
17h06 Stent Trevo 6x25 ouvert



Passage dans le Trevo- Double stent en Y

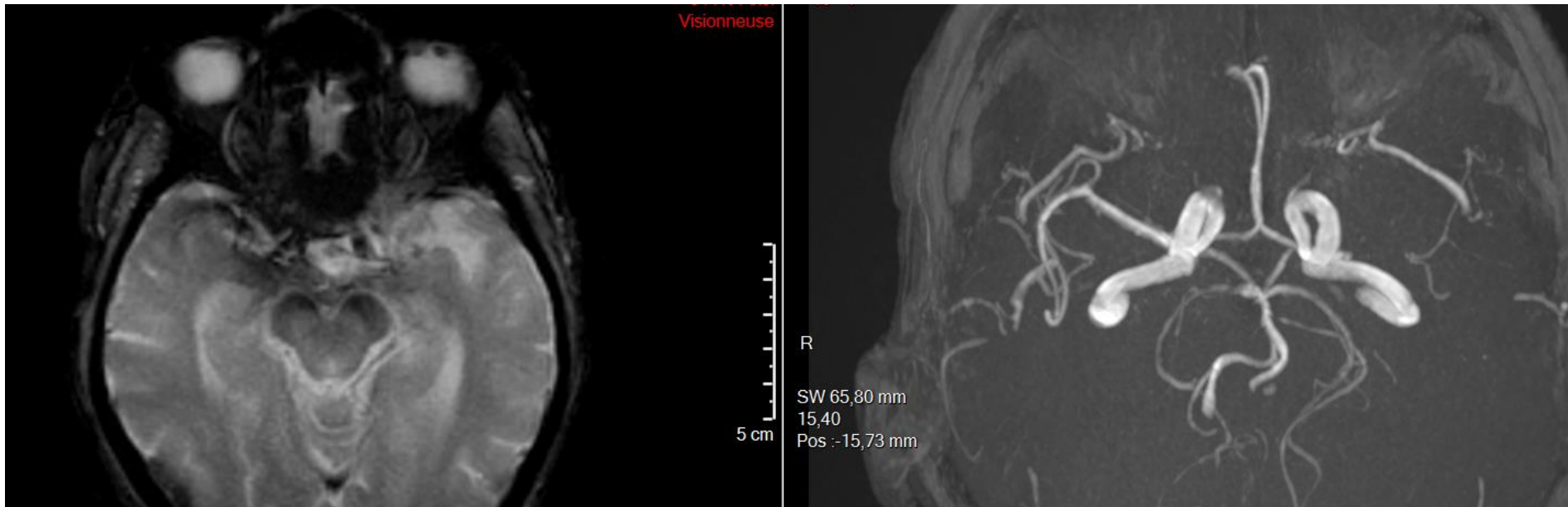


h15 Trevo 6x25 ouvert
Embotrap 5x33 ouvert





Pas de SVS ...





20h16 CIG serie initiale
Merci 9F

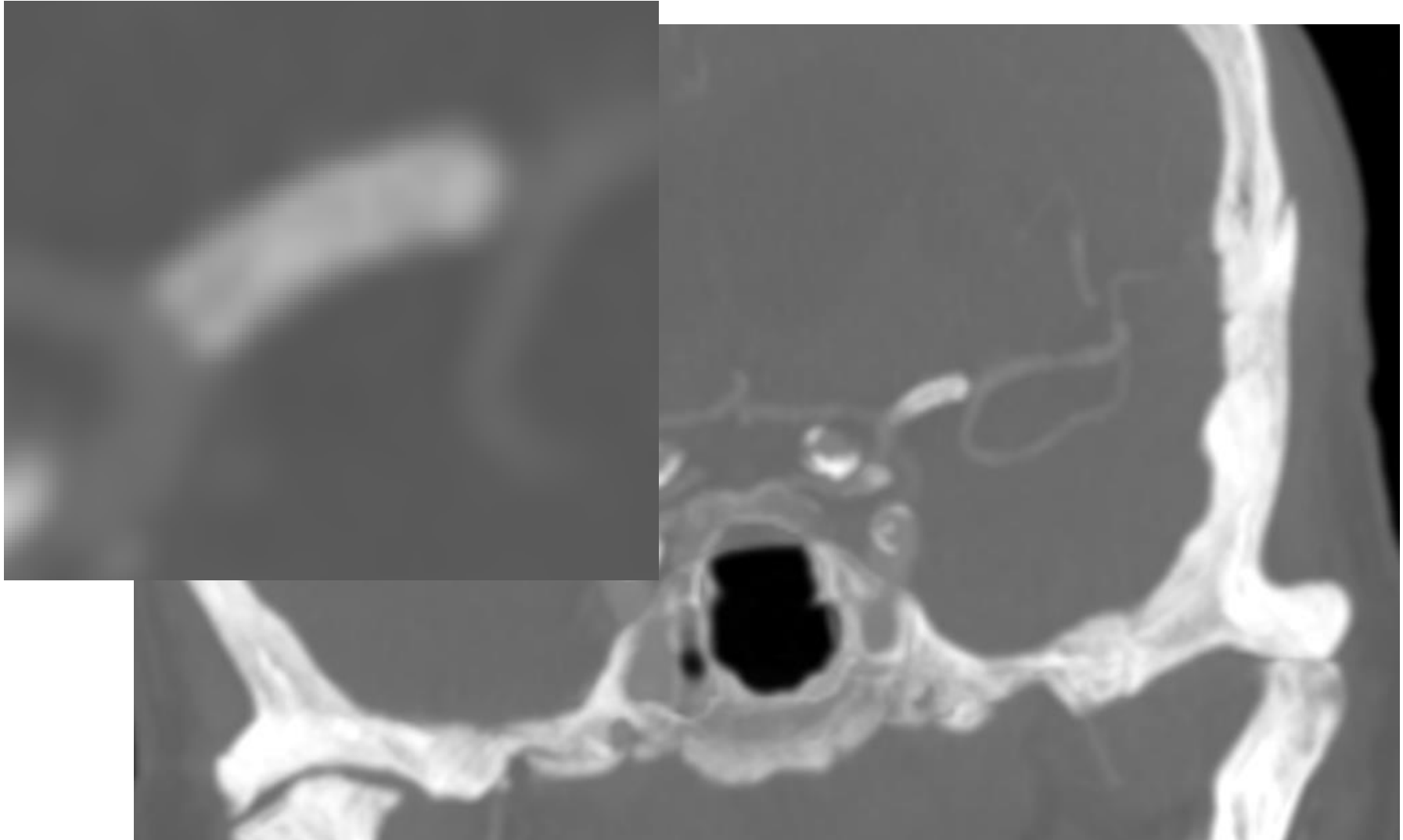


à 5 min





CTA M3



« Caillots blanc »

ICAD

SVS +

« Caucasiens »

« Cai Nimbus, Neva, Double stent ... »

ICAD

CA puis Angioplastie Stent

SVS +

SR+CA

Reste du monde ...

A retenir

- L'IRM et le CT/ CTA, semblent fournir des éléments utiles pour évaluer le thrombus et :
 - Déterminer la cause de l'AVC
 - Optimiser les stratégies endovasculaires

A retenir

- Susceptibility vessel sign (SVS) lié à :
 - Meilleure recanalisation avec stent retrievers (combined SR+CA)
 - Prédominance de globule rouge dans le thrombus.

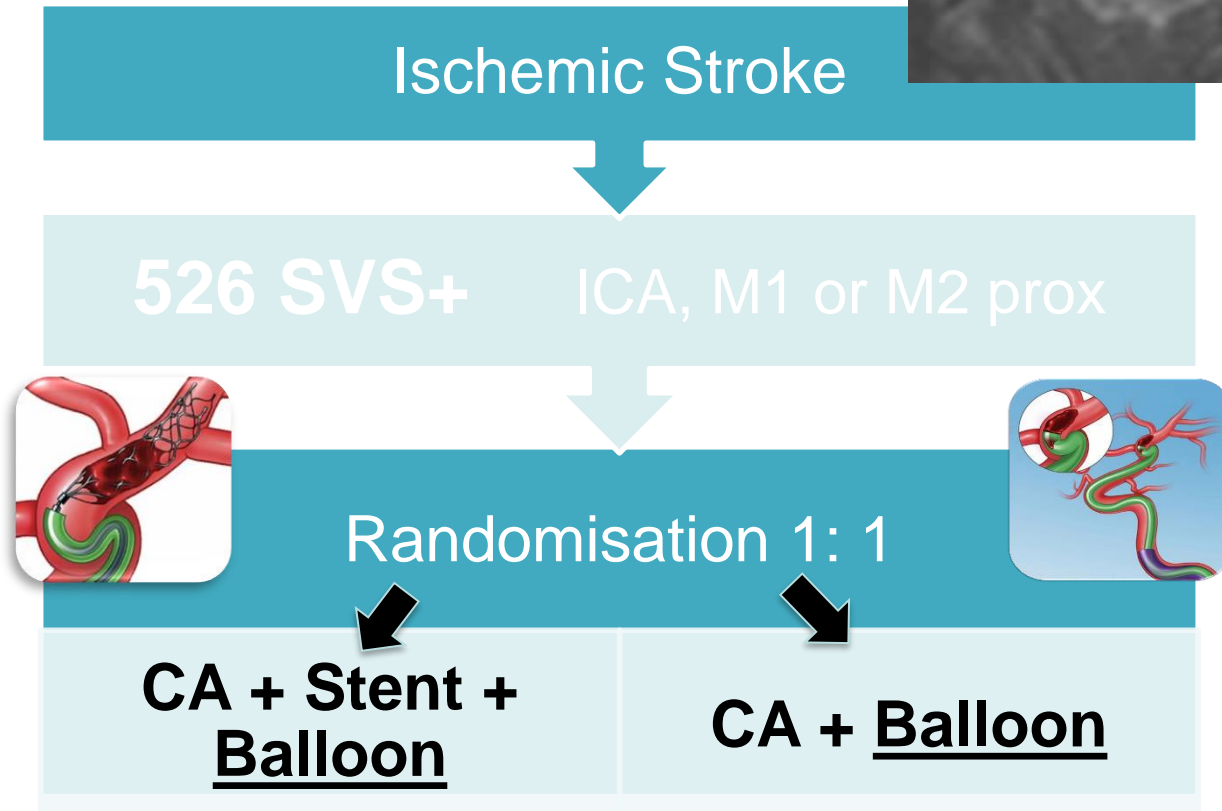
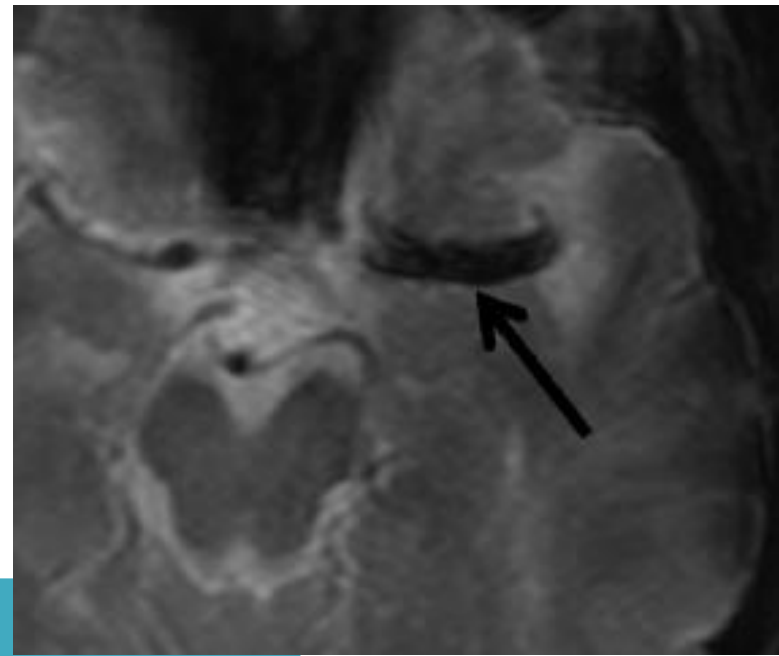
A retenir

- En l'absence de SVS clair :
 - * Vérifier les paramètres de la séquence
 - * Vérifier la présence d'une occlusion
 - * Envisager l'injection
 - * Premier passage avec aspi ?

VECTOR

adaptatiVe Endovascular strategy to the CloT
MRI in large intracranial vessel Occlusion

Multicenter, prospective,
randomized, open-label study with
blinded evaluation (PROBE).



526 inclusions in the VECTOR trial

- 19% General Anesthesia
- 23% ICA occlusions
- 33 % > 80 ans
- 54% IVT - Bridging

Statistical analysis ongoing – Results early 2023⁶⁰



*La belle journée de
l'anévrisme*

15-16 Juin 2023

romain.bourcier@chu-nantes.fr