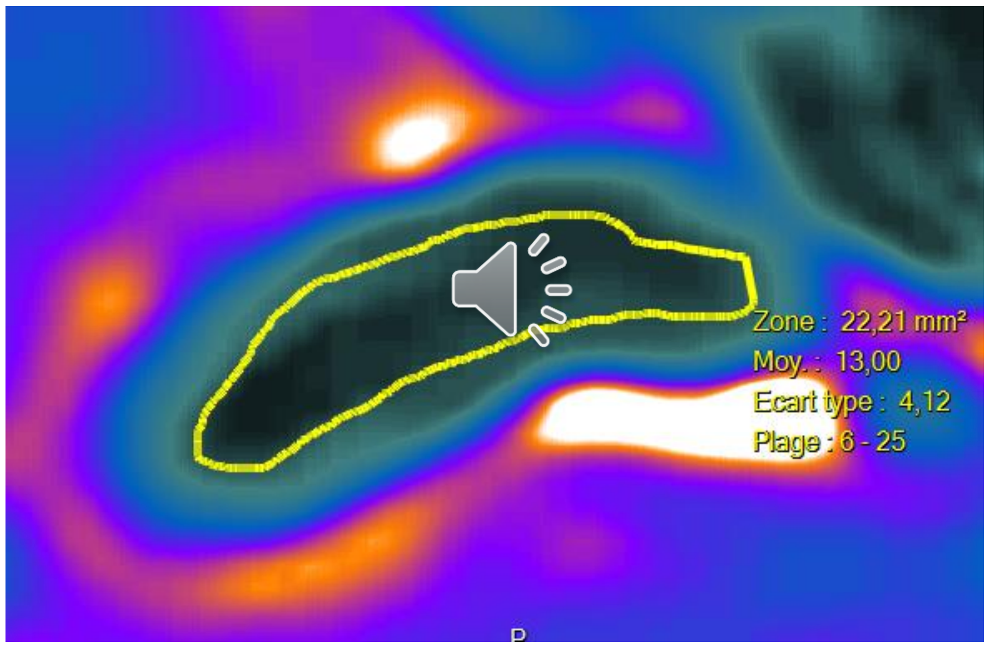
Imagerie des occlusions artérielles à la phase aiguë de l'AVC ischémique



Romain Bourcier (PH - 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 2021

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Conflits d’intérêts

- Collaboration scientifique avec Cerenovus sur l’étude VECTOR

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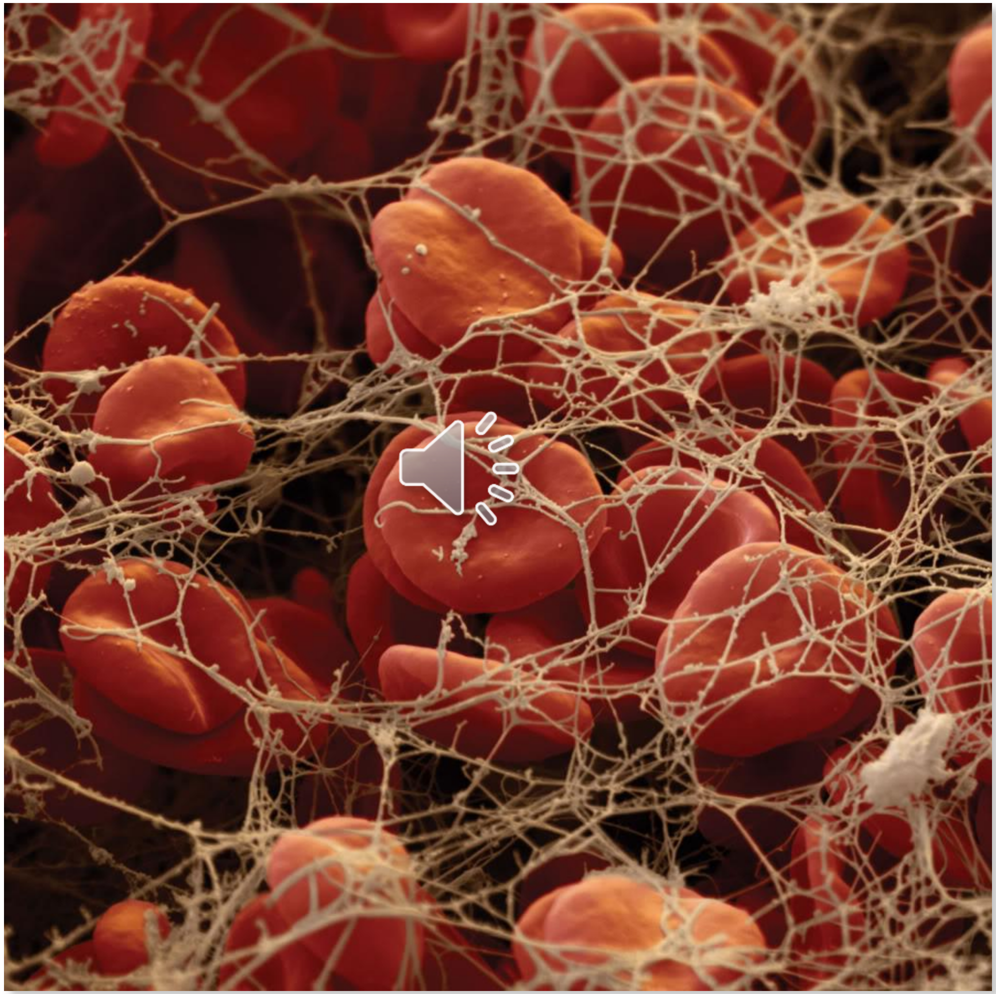
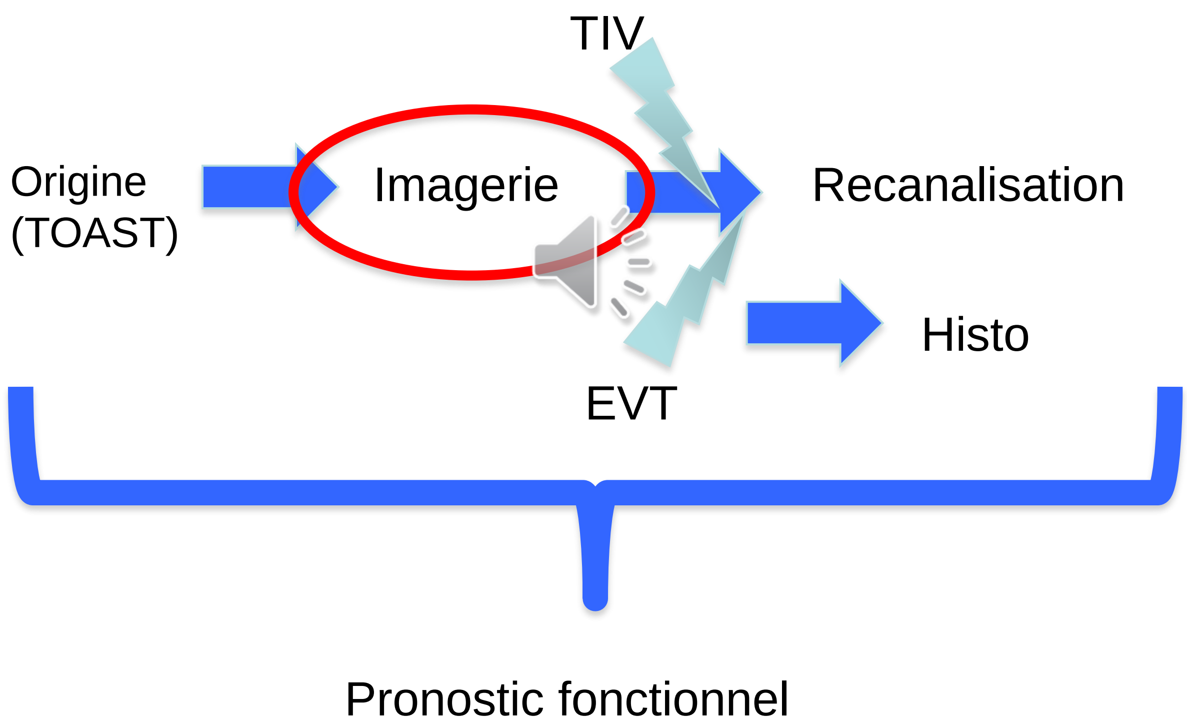
Tout commence par une artère occluse !



Mais à la différence des coronaires …

Le thrombus …


TIV
Origine
(TOAST)
Imagerie
Recanalisation
Histo
EVT
Pronostic fonctionnel

Analyse du thrombus – Pourquoi?

- Thrombus varie selon l'etiologie ?

Analyse du thrombus – Pourquoi?

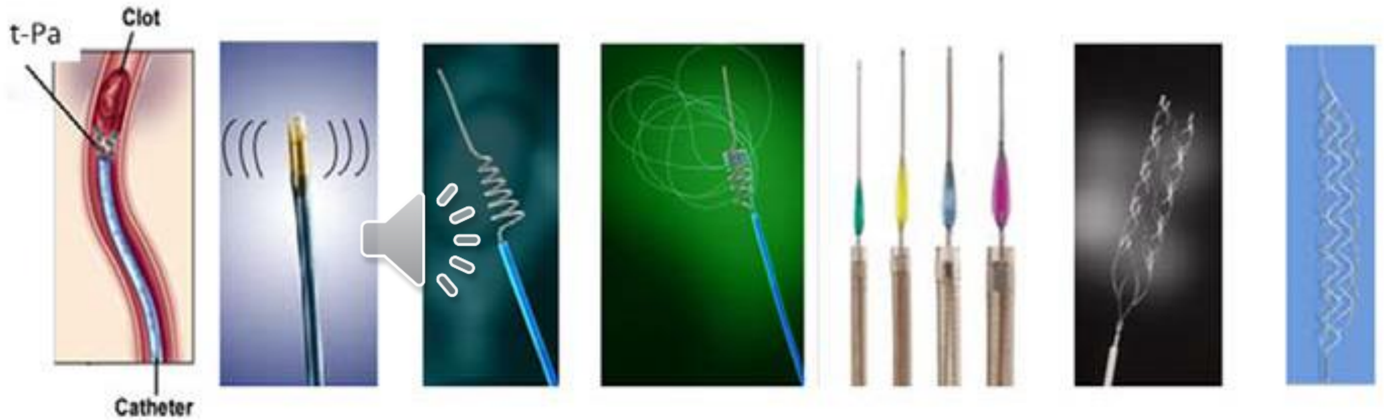
- Etiologie ➔ Prevention secondaire

Analyse du thrombus – Pourquoi?

- Etiologie → Prevention secondaire
- Recanalisation dépend du thrombus

Alternatives aux EVT « classiques » ?

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



→ Stent 4 ème génération ?

Analyse du thrombus – Pourquoi?

- Etiologie ➔ Prevention secondaire
- Recanalisation liée au pronostic clinique

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TICI 2b = “bonne” recanalisation?

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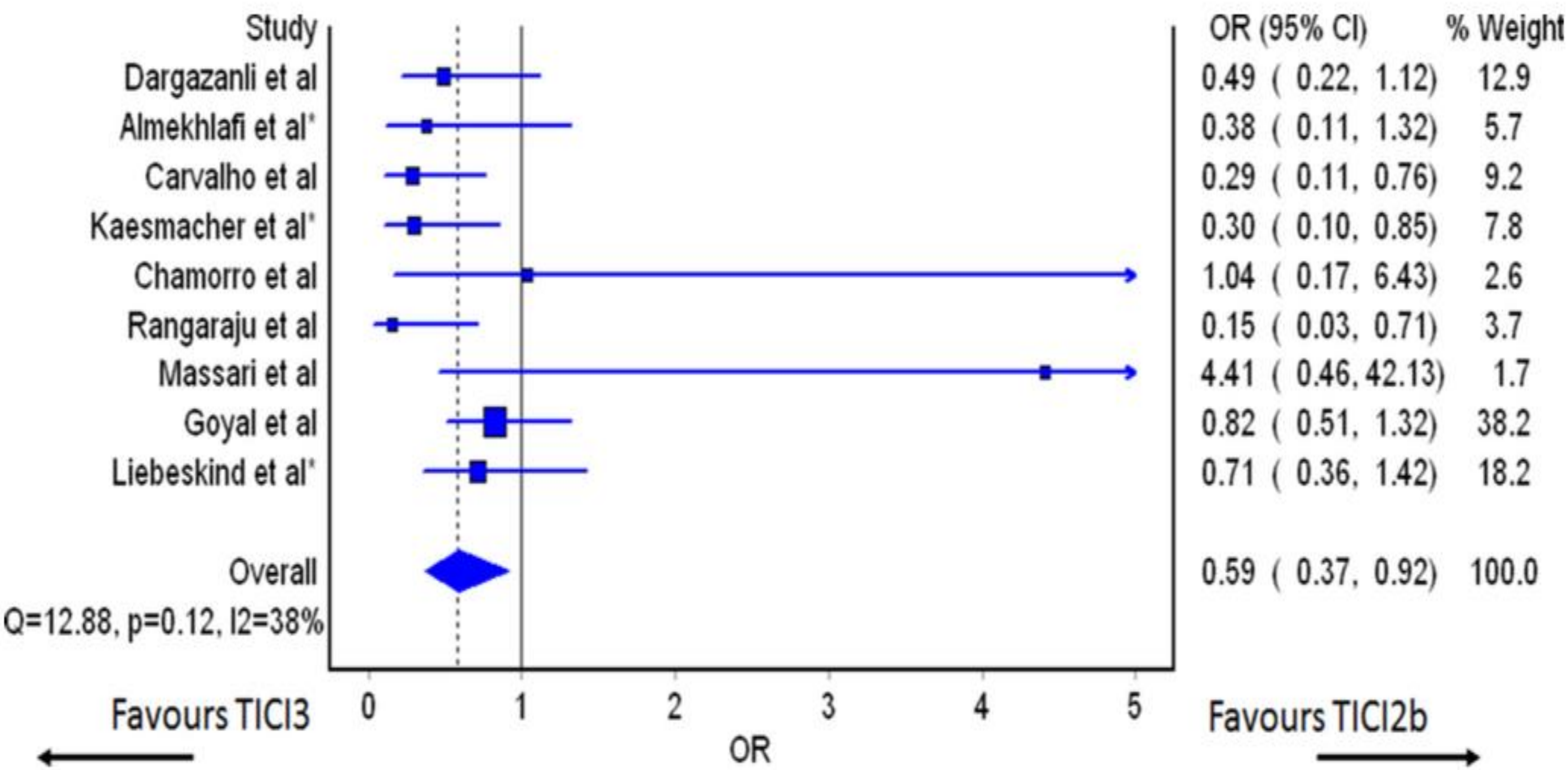
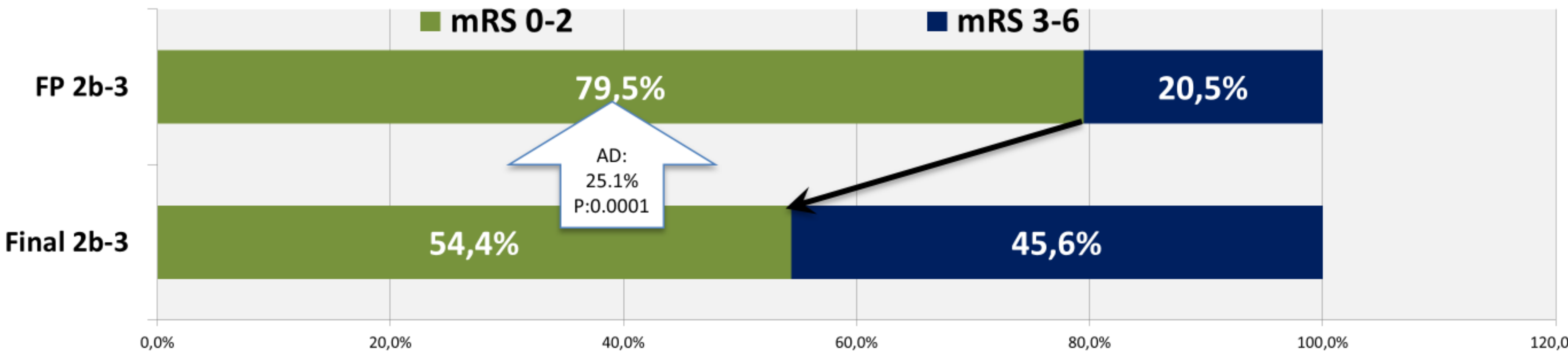
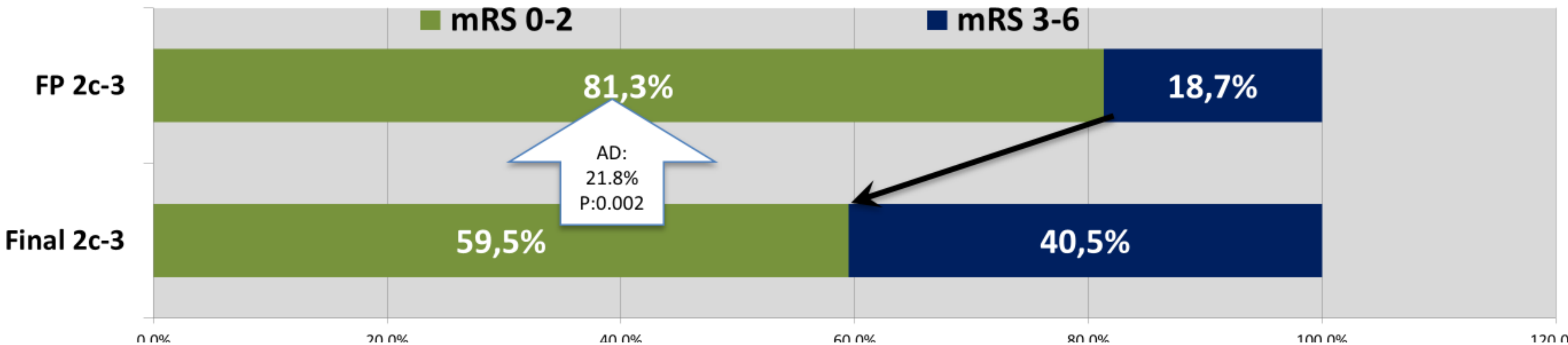


Systematic review and meta-analysis on outcome differences among patients with TICI2b versus TICI3 reperfusions: success revisited - Johannes Kaesmacher, et al. JNNP 2018

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

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Résultats angiographiques du traitement endovasculaire aujourd'hui

~ 90 % de TICI 2**b**/3 final

MAIS

~ 50 % de TICI 2**c**/3 en ≤ **3 passes**

ET

~ 25 % 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…*

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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; Venkatakrishna 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

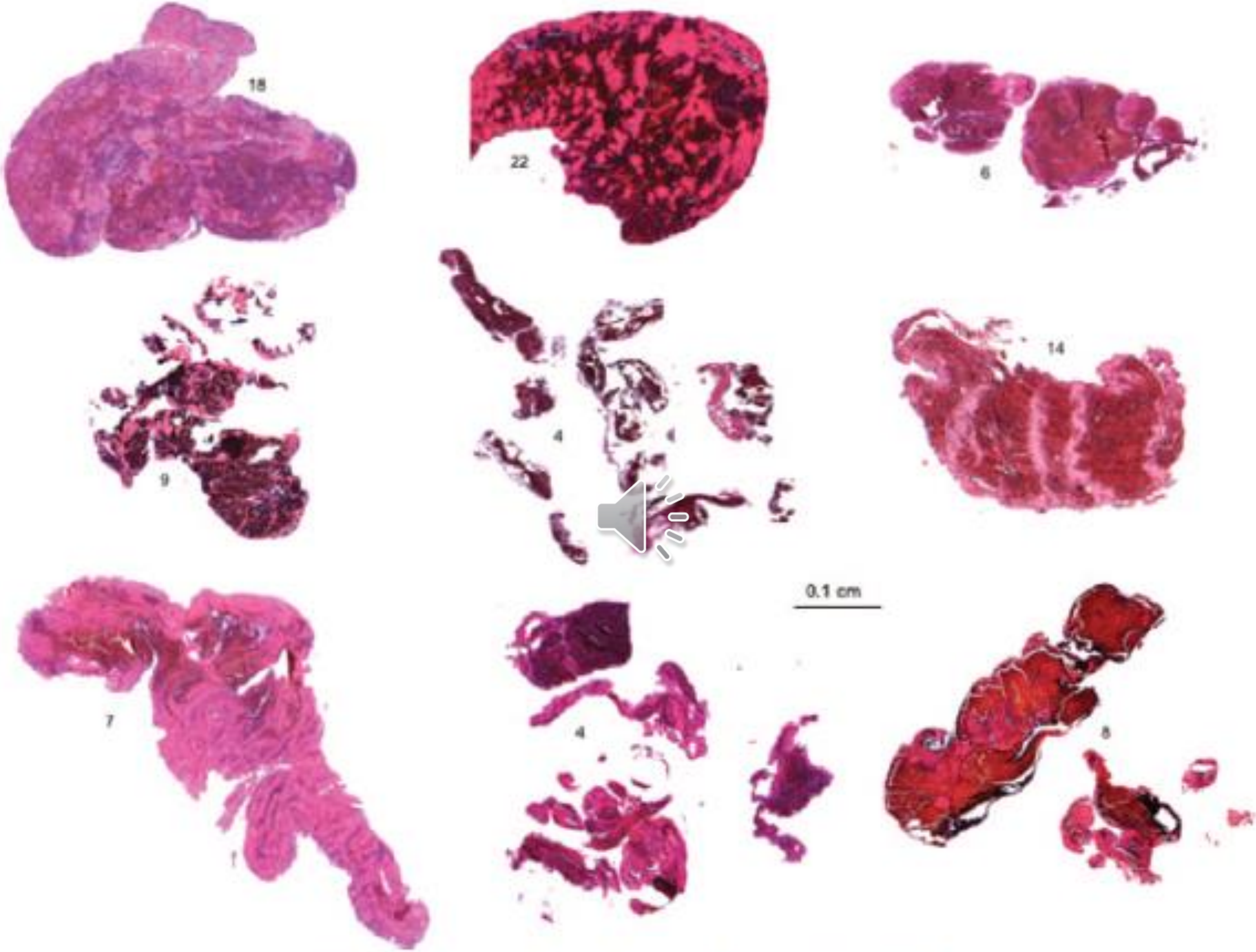
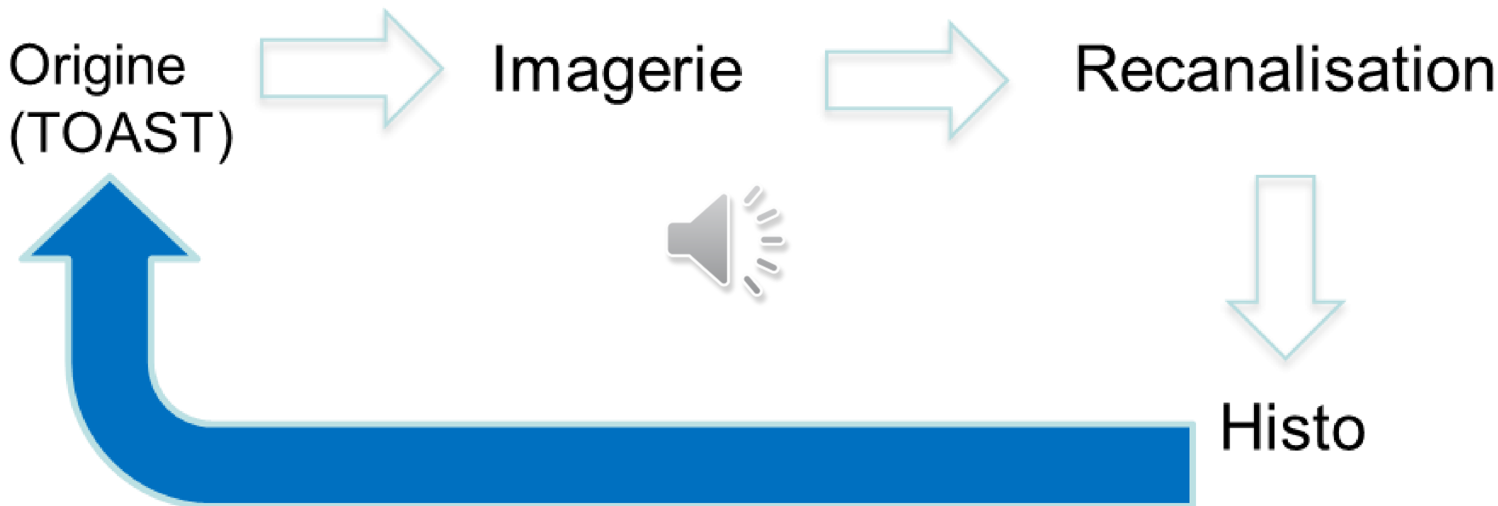


Figure 3. Hematoxylin and eosin–stained sections of 9 thrombi.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Recanalisation
Histo

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Etiologie et Histologie

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

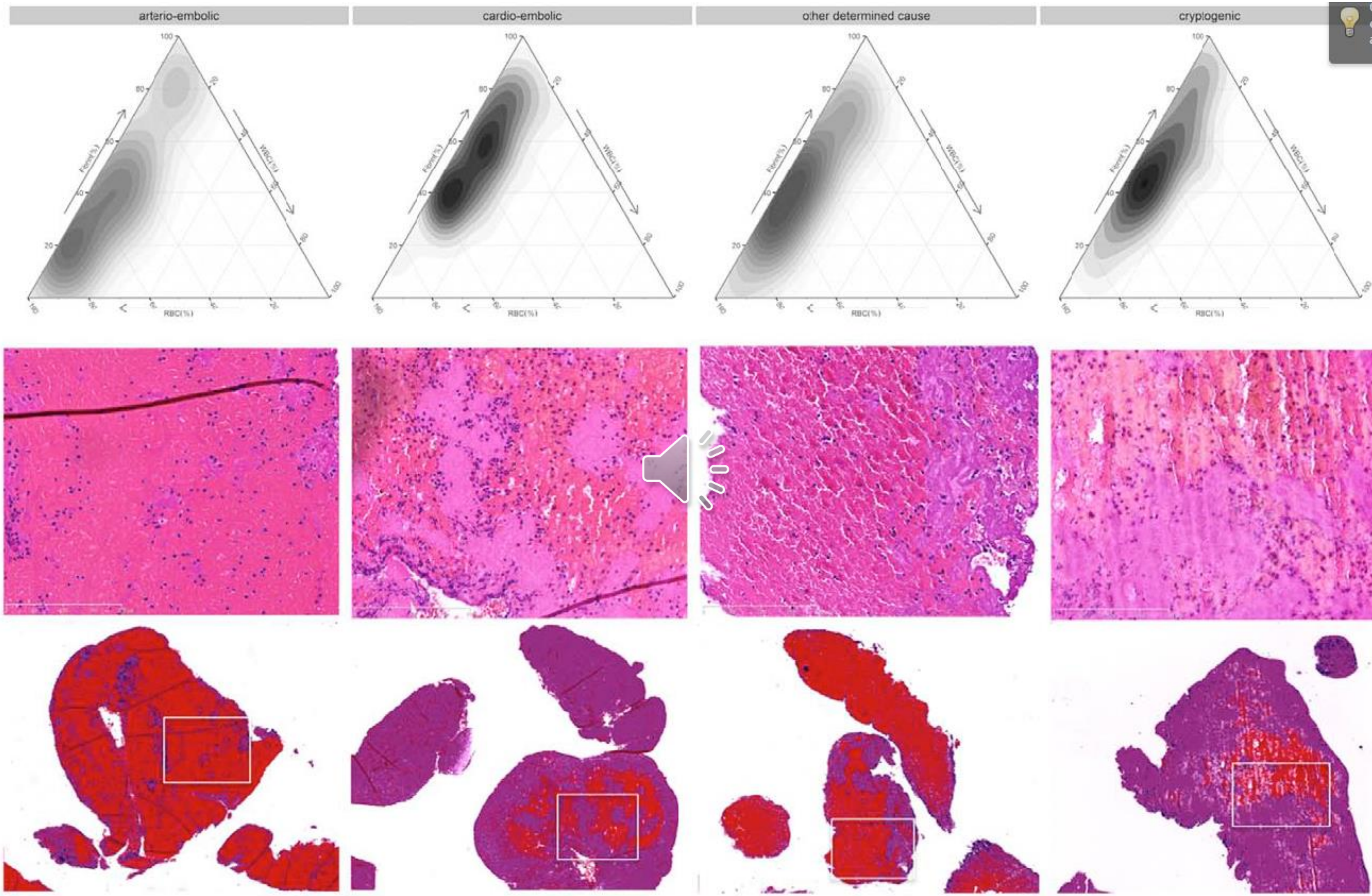
Background and Purpose—Ischemic stroke of undetermined cause is a major health issue because of its high frequency and clinical relevance. Histopathologic analysis of human thrombi, retrieved from stroke patients with large-vessel occlusion during mechanical thrombectomy, may provide information about 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.

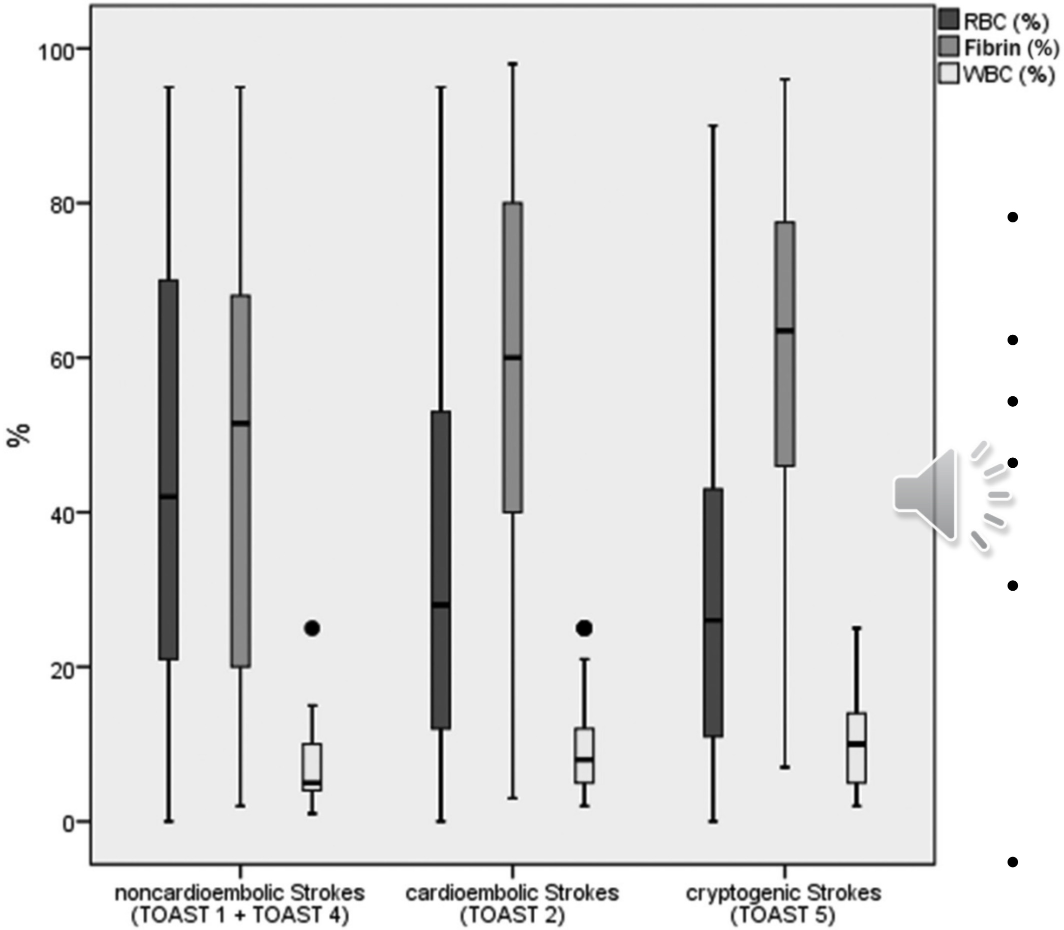
Results—The composition of thrombi from cardioembolic and noncardioembolic stroke patients differed significantly for all main thrombus components. Cardioembolic thrombi had higher proportions of fibrin/platelets (P=0.009), less erythrocytes (P=0.003), and more leucocytes (P=0.035) than noncardioembolic 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.**)

Key Words: blood cells ■ histology ■ pathology ■ stroke ■ thrombosis



arterio-embolic
cardio-embolic
other determined cause
cryptogenic
Fibrin(%)
WBC(%)
RBC(%)



- 187 patients

- 77 patients cardioemboliques
- 46 patients non cardio-embolique
- 64 patients cryptogénique

- cardio-emboliques plus élevées de fibrine/plaquettes (P=0,027), moins d'érythrocytes (P=0,005) plus de leucocytes (P=0,026)

- chevauchement cryptogènes et cardio-emboliques

Peter B. Sporns, et Stroke et al. 2017


Origine
(TOAST)
Imagerie
Recanalisation
Histo

Recanalisation EVT et Histologie

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±23% versus 47±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.)

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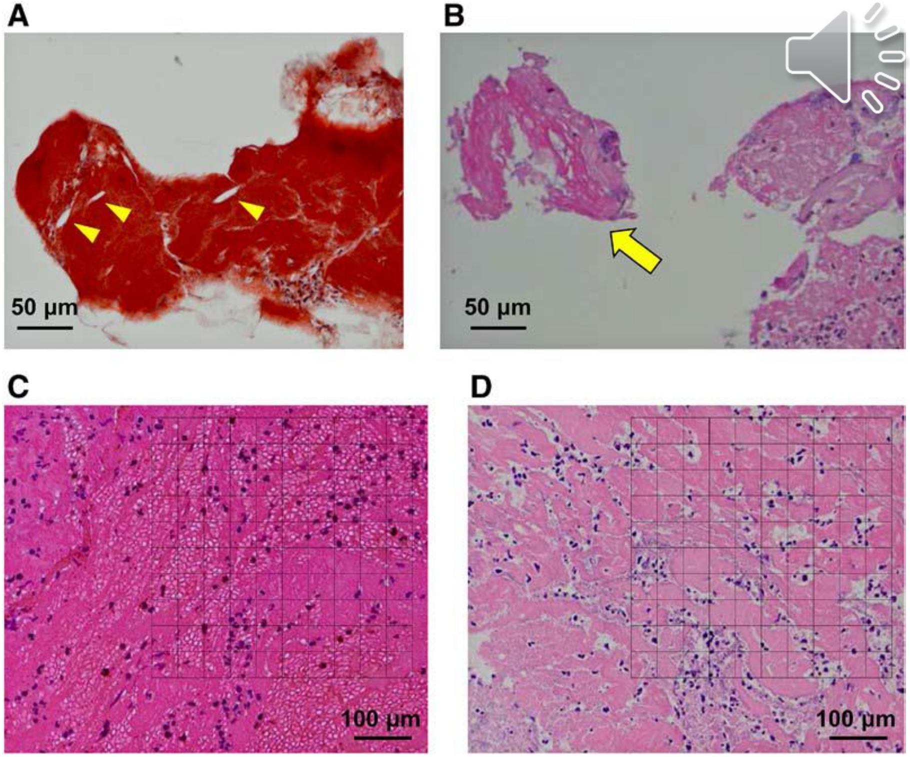
	Overall (n=83)	mTICI 2b–3 (n=58)	mTICI 0–2a (n=25)	*P* Value*
Atheromatous gruel	7 (8)	2 (3)	5 (20)	0.024
Organization	19 (23)	16 (28)	3 (12)	0.159
Ratio of erythrocyte components, mean±SD, %	53±24	57±23	47±24	0.042
Erythrocyte-rich thrombus†	34 (41)	29 (51)	5 (20)	0.014
Ratio of fibrin/platelet components,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



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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

Brinjiki et al. JNIS 2016

NeuroRadiologie
CHU Nantes

Imagerie de l'occlusion

Hyperdense middle cerebral artery: incidence and quantitative significance

T. A. Tomsick [1], T. G. Brott[2], C. P. Olinger [2], W. Barsan [3], J. Spilker [2], R. Eberle [2], 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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Radiology

Alex Rovira, MD
Patricia Orellana, MD
Jose Alvarez-Sabín, MD, PhD
Juan F. Arenillas, MD
Xavier Aymerich, MSc
Elisenda Grivé, MD
Carlos Molina, MD
Antoni Rovira-Gols, MD

Hyperacute Ischemic Stroke: Middle Cerebral Artery Susceptibility Sign at Echo-planar Gradient-Echo MR Imaging[1]

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

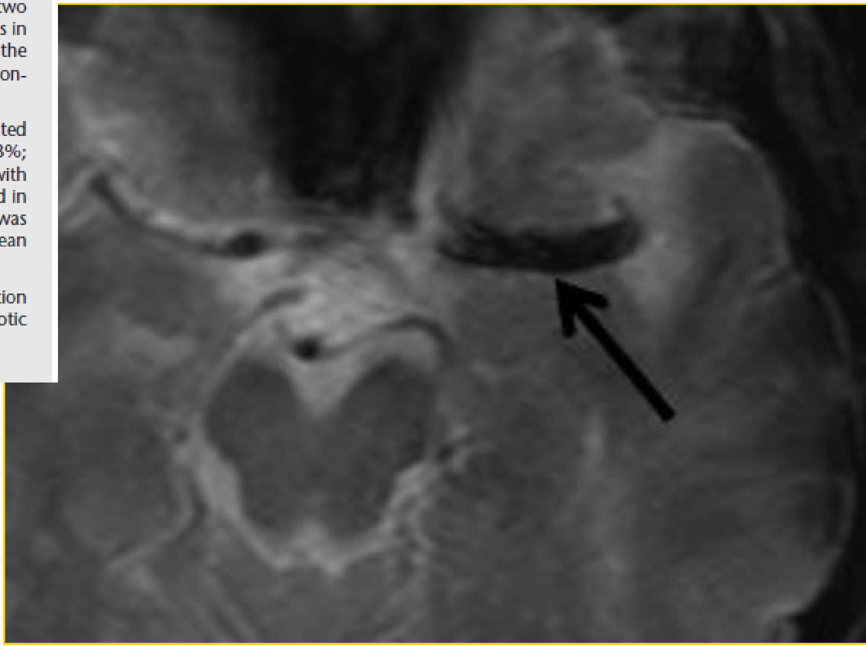
[1] From the Department of Radiology, Magnetic Resonance Unit (A.R., P.O., X.A., E.G., A.R.G.) and Department of Neurology, Cerebrovascular Unit (J.A.S., J.F.A., C.M.), Hospital Universitari Vall d'Hebron, Passeig Vall d'Hebron 119–129, 08035 Barcelona, Spain. Received February 19, 2003; revision requested

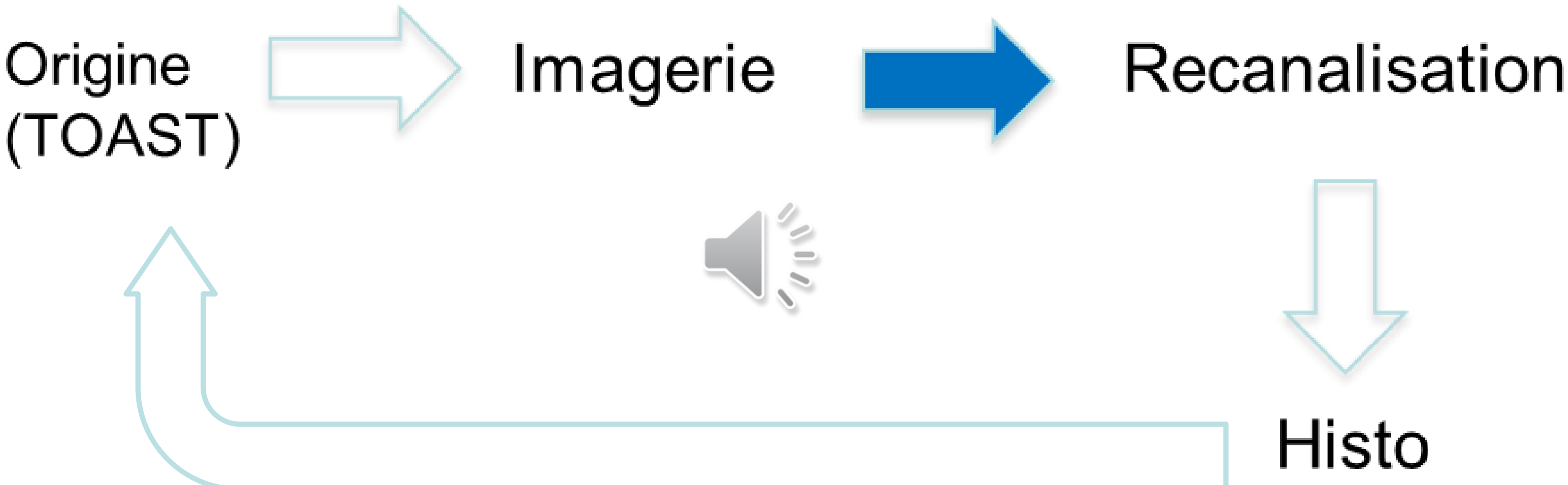
PURPOSE: To evaluate the accuracy of echo-planar T2*-weighted magnetic resonance (MR) sequences in detection of acute middle cerebral artery (MCA) or internal carotid artery (ICA) thrombotic occlusion.

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.

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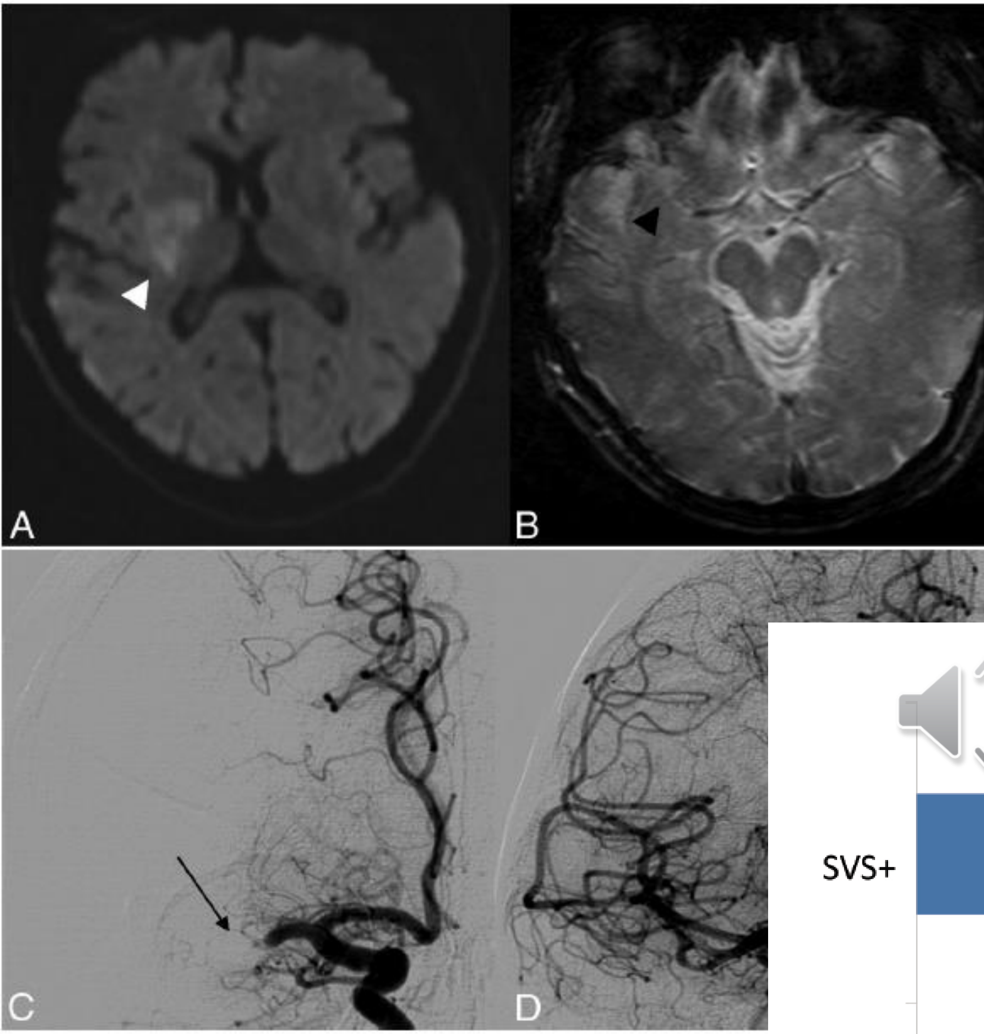
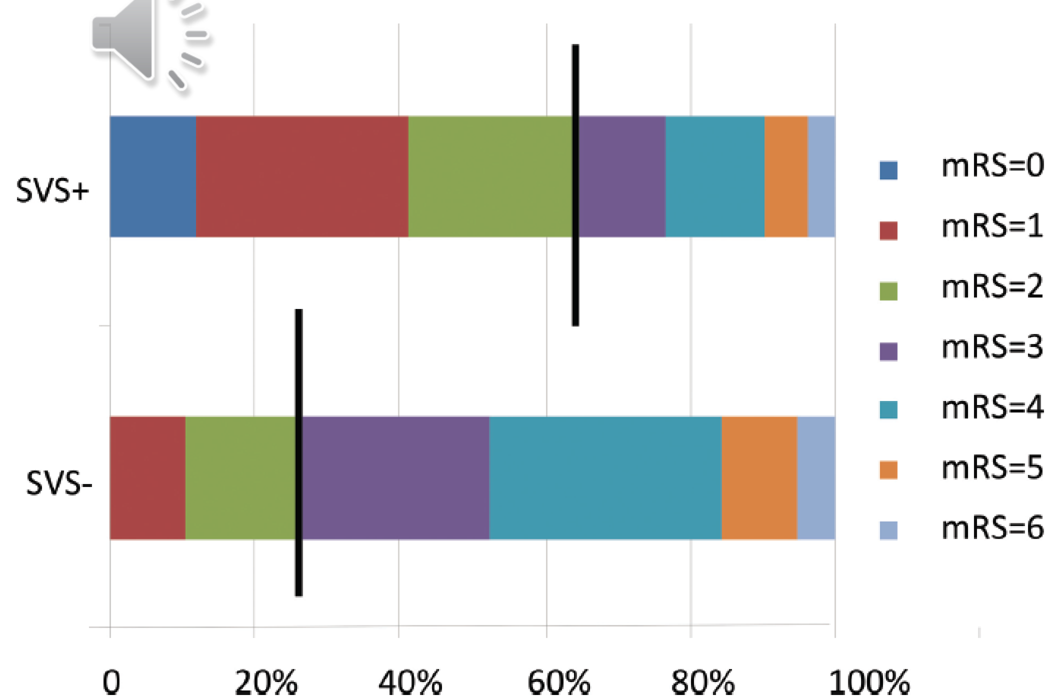
Imagerie
Recanalisation
Histo



	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 (≥2b vs <2b)	5.1	1.4–17.9	.01[a]	7.1	0.4–112.8	.16



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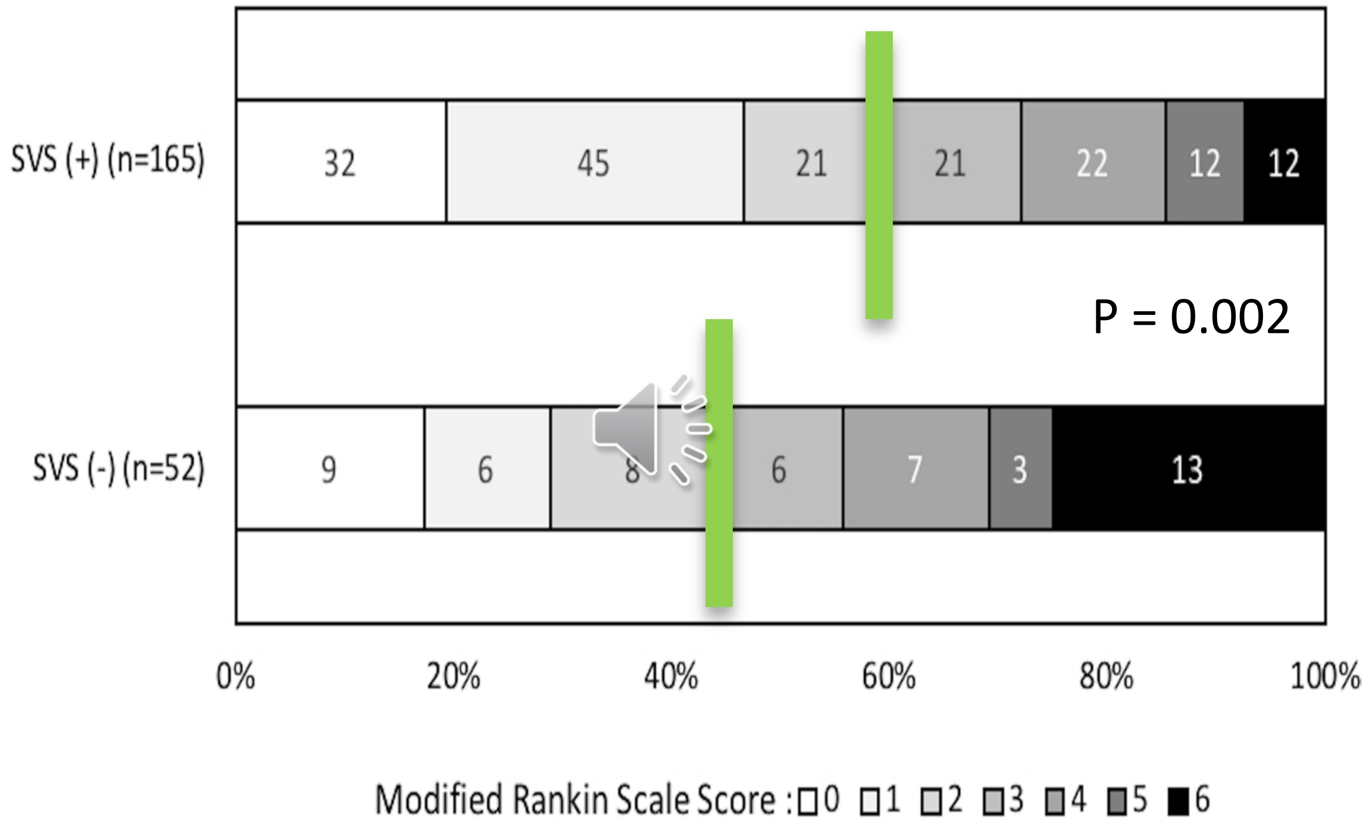
Bourcier et al . AJNR 2015

Population ASTER et THRACE traitée par SR en première ligne

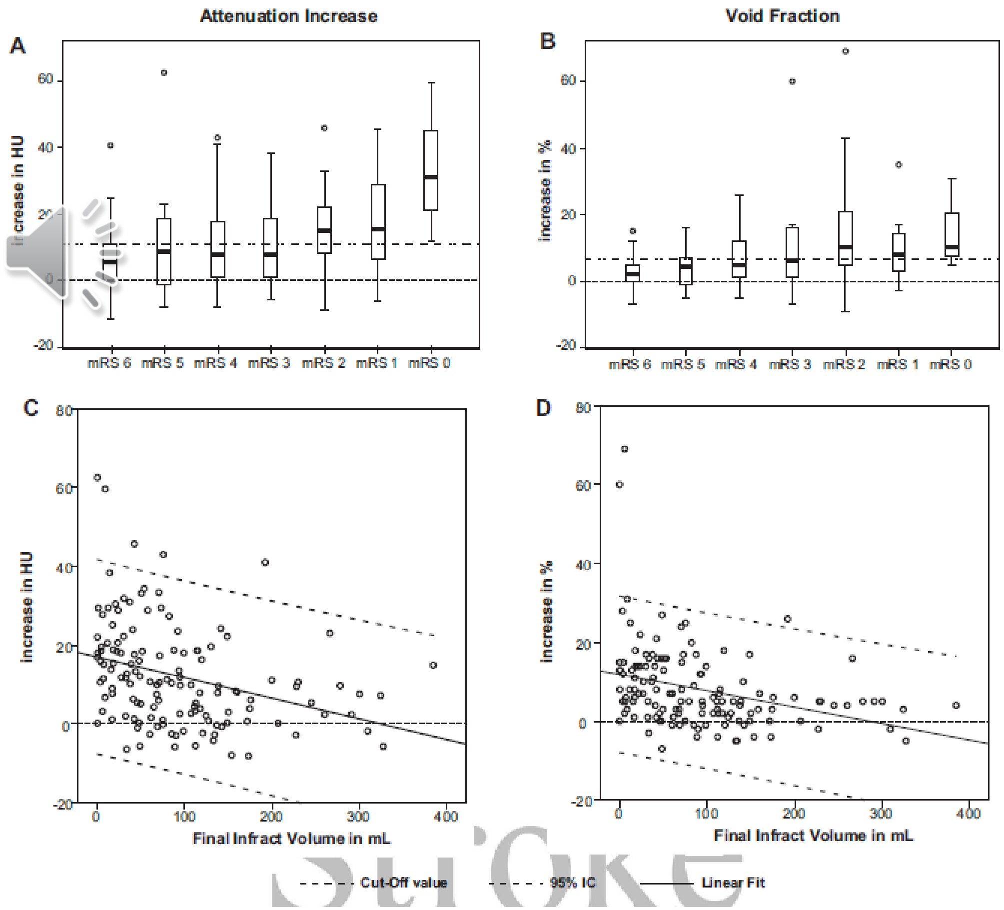


Susceptibility vessel sign on MRI predicts better clinical outcome in patients with anterior circulation acute stroke treated with stent retriever as rst- line strategy JNIS 2018

Apport du NCCT, CTA

Perméabilité du thrombus en CTA associée à :

* amélioration fonctionnelle
* meilleure recanalization
* plus petit infarctus



Santos et al. Stroke 2016

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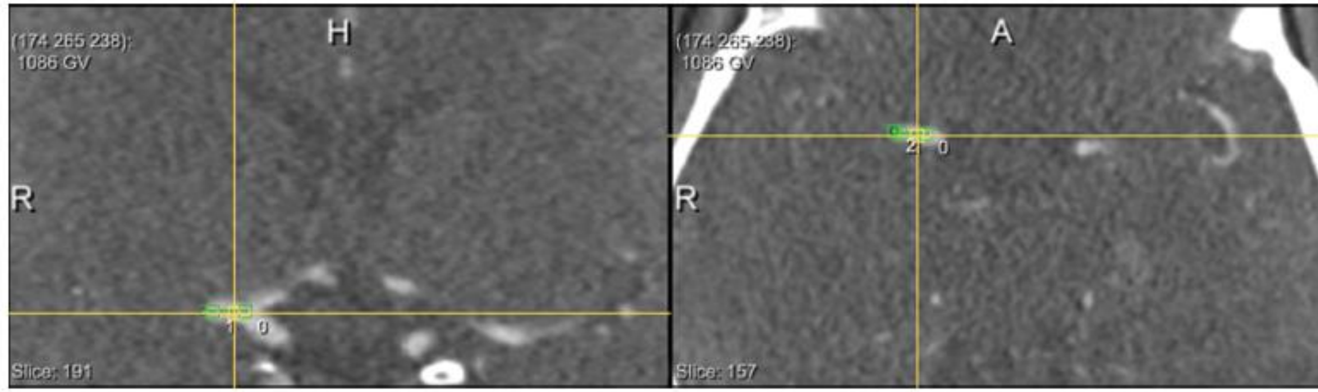


FIG 2. Distance from the ICA-T to the thrombus. Placement of seed points in the vessel from the ICA-T to the thrombus by the observer. Subsequently, the software determined the centerline through the vessel, which represents the distance from the ICA-T to the thrombus. Left: coronal view CTA. Right: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

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

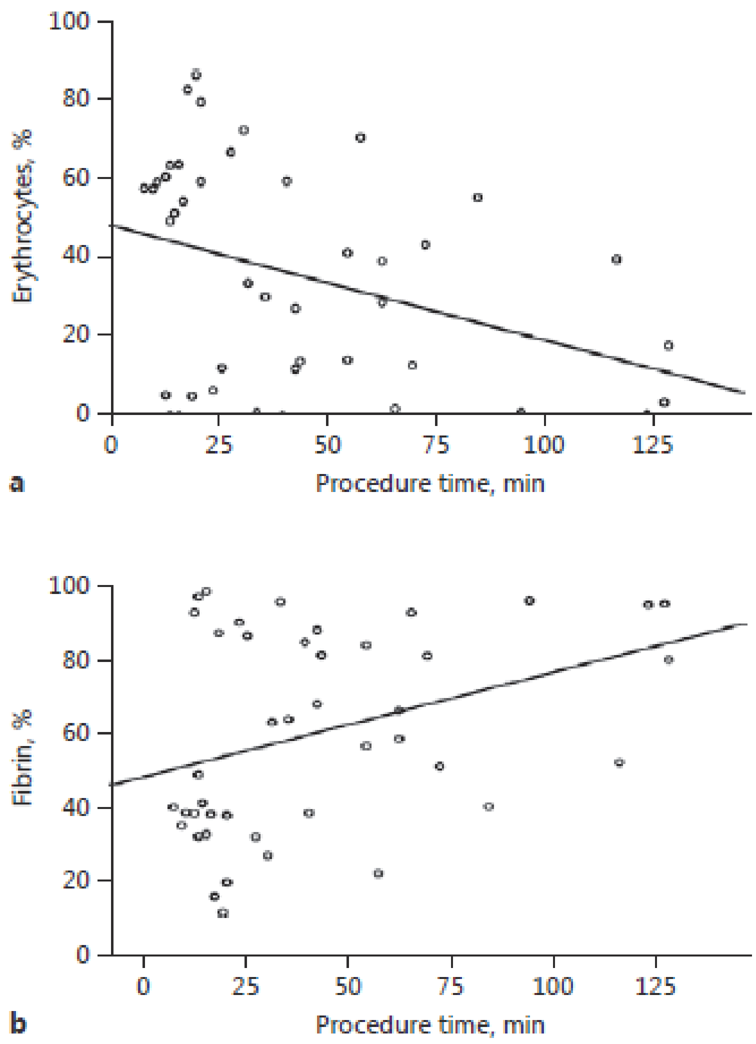
	IAT (*n* = 78)	Control (*n* = 121)
Mean age (yr)	63 (range, 43–87)	66 (range, 31–93)
Male sex (%)	67 (52/78)	56 (72/121)
Median NIHSS	17 (IQR, 13–21)	19 (IQR, 14–23)
Median ASPECTS	9 (IQR, 8–10)	9 (IQR, 8–10)
Diabetes mellitus (%)	9 (7/78)	12 (14/121)
Atrial fibrillation (%)	22 (17/78)	31 (37/121)
Previous 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)

Longeur>18mm 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).

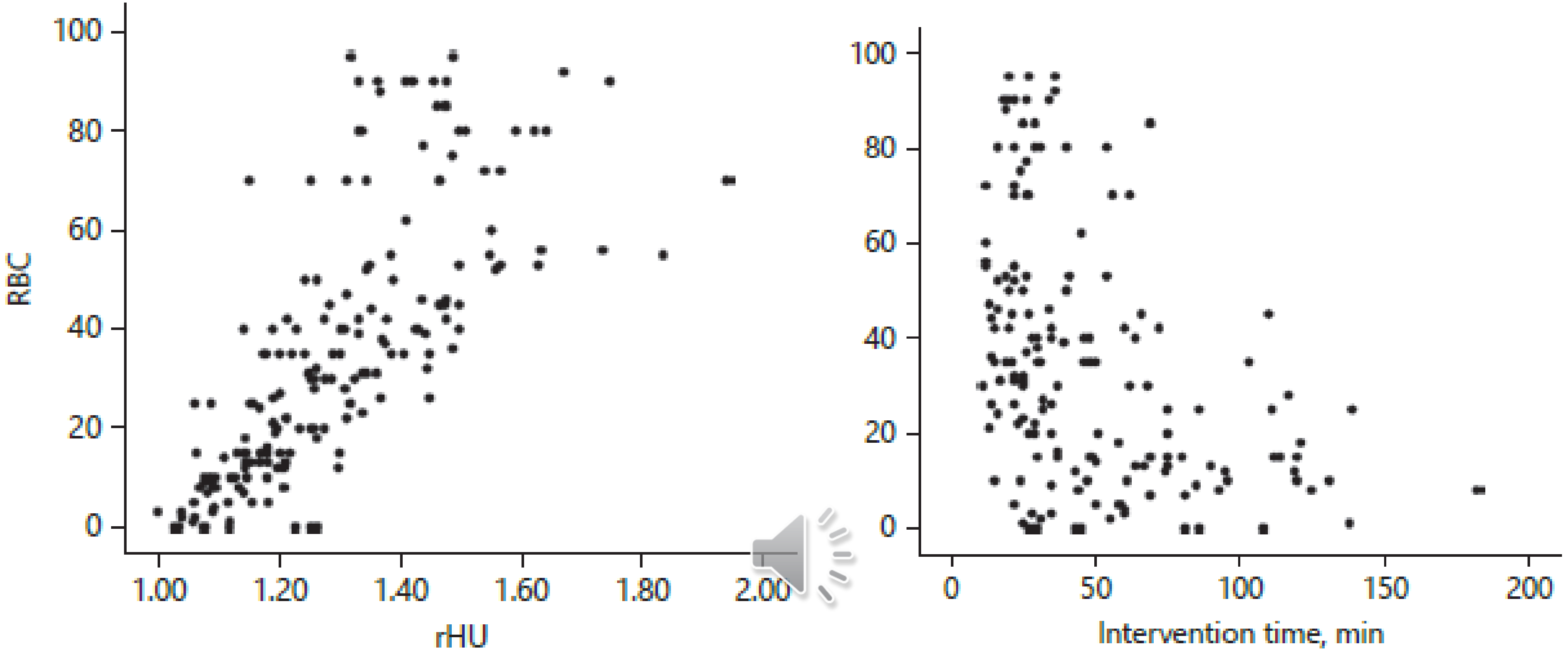
Pas de modification du “TTT-effect” en lien avec les caractéristiques du thrombus

Borst et al. AJNR 2017



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

Kota Maekawa et al .Cerebrovasc. Disease 2018



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 ($p \leq 0.001$).

Sporns et al. Cerebrovasc Dis 2017

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?

Lapergue B et al. The ASTER Randomized Clinical Trial. JAMA. 2017 Aug

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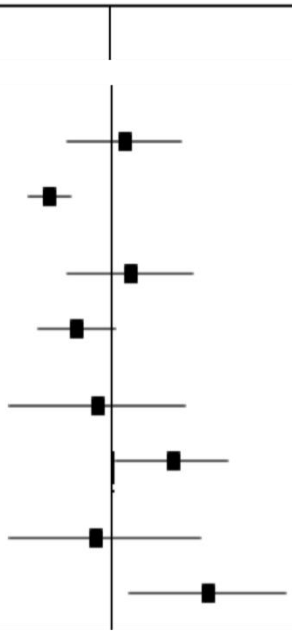
CENTRE HOSPITALIER UNIVERSITAIRE DE NANTES

Résultats angiographiques selon le SVS dans chaque bras

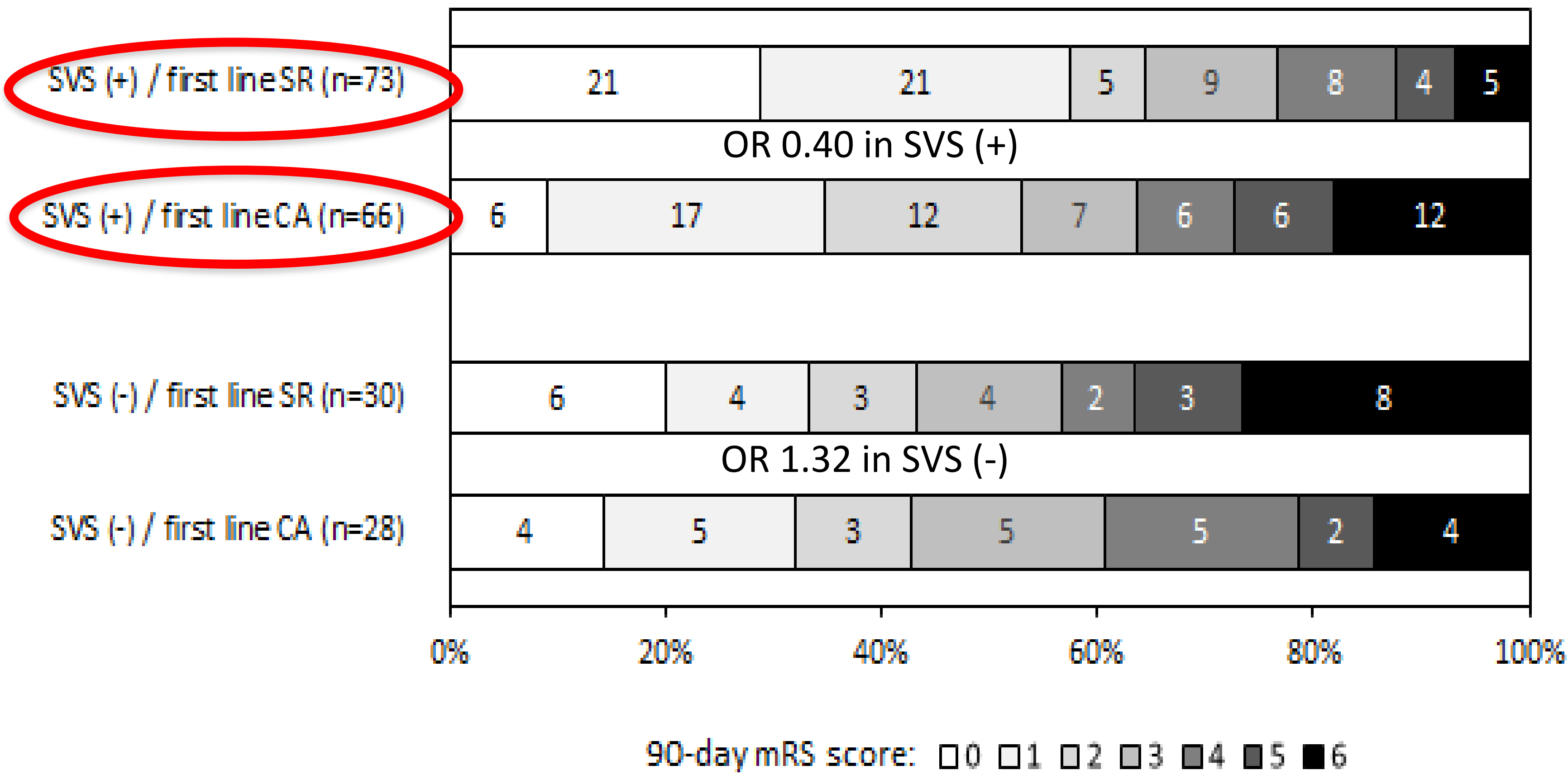
Angiographic outcomes	SVS	First-line SR (n=106)	First-line CA (n=96)	RR (95%CI)	*P*	*P* Het
After first-line strategy						
mTICI 2c/3	-	15/31 (48.4)	15/28 (53.6)	1.11 (0.69 to 1.77)	0.66	0.018
	+	44/75 (58.7)	24/68 (35.3)	0.60 (0.50 to 0.71)	<0.001	
mTICI 2b/3	-	20/31 (64.5)	21/28 (75.0)	1.16 (0.69 to 1.93)	0.57	0.018
	+	56/75 (74.7)	38/68 (55.9)	0.75 (0.54 to 1.03)	0.078	
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	
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	



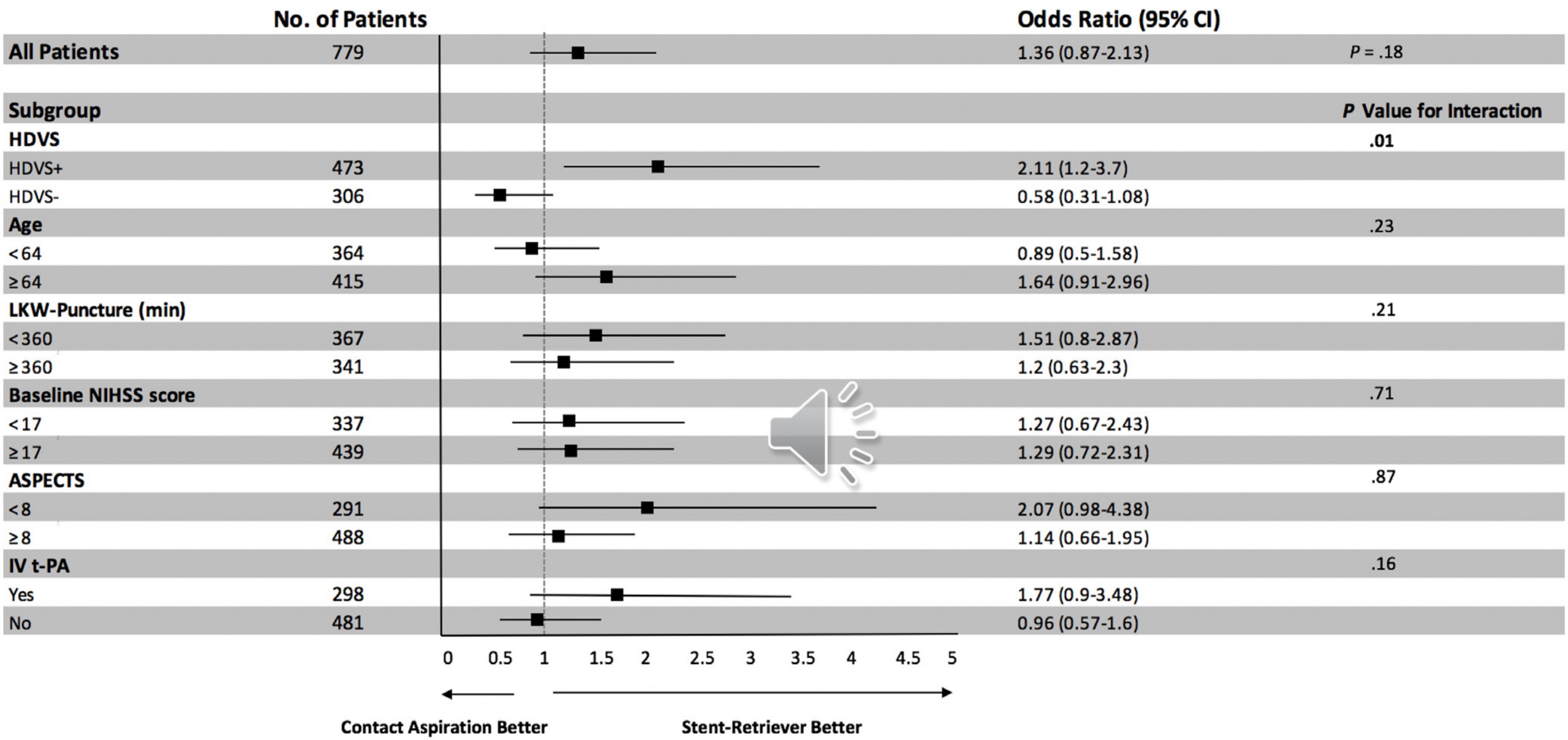
Bourcier et al . ***Journal of Stroke 2018***

mRs according to first-line and SVS

CA vs. SR p for interaction=0.038).



*Bourcier et al . **Journal of Stroke 2018***

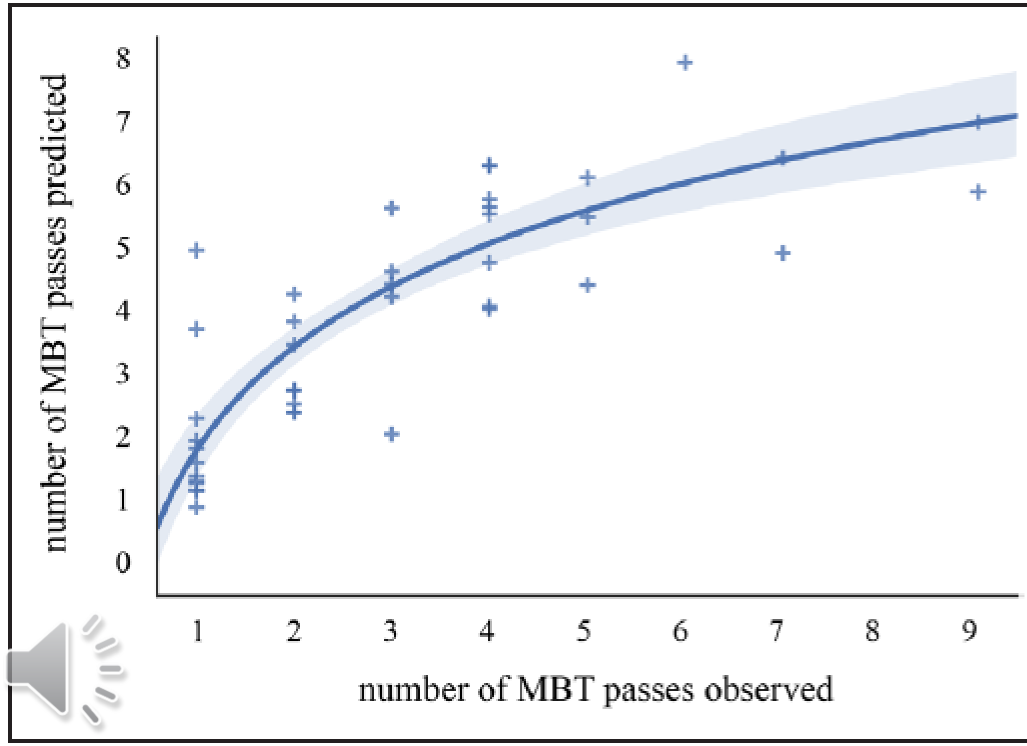


HDVS et FPE dans 473 (60,7%) et 286 (36,7 %) patients, respectivement.
HDVS modifie l'effet de la thrombectomie sur FPE (p=0,01) qd HDVS
non-HDVS ayant une meilleure réponse à CA

Mahmoud H Mohammaden et al. JNIS 2020

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

Jeremy Hofmeister et al. Stroke 2020

Adaptation du traitement de reperfusion au type de caillot ?

NeuroRadiologie
CHU Nantes

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	46
M2	0	0	4	3
Total (n = 91)	18	0	24	49

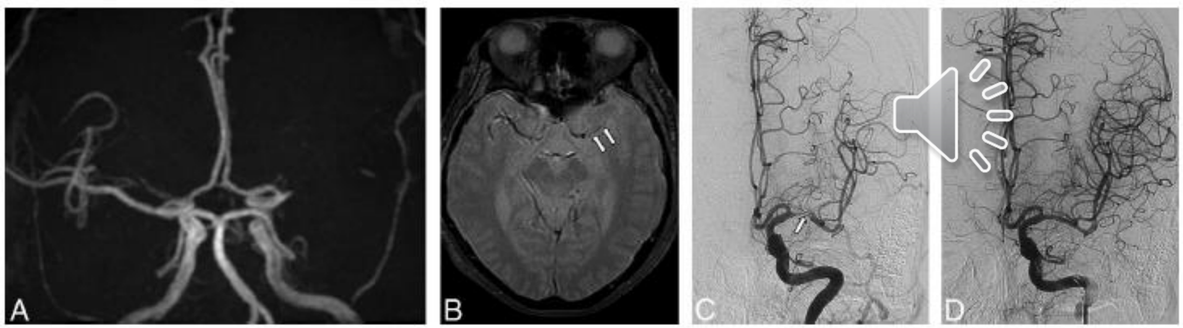


FIG 1. Brain images from a 74-year-old man with acute ischemic stroke and atherosclerotic stenosis in the MCA. *A*, 3D TOF MR angiography shows the occlusion in the proximal M1 segment of the left MCA. *B*, Axial gradient-echo image reveals a negative susceptibility vessel sign (*arrows*) in the M1 segment 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.

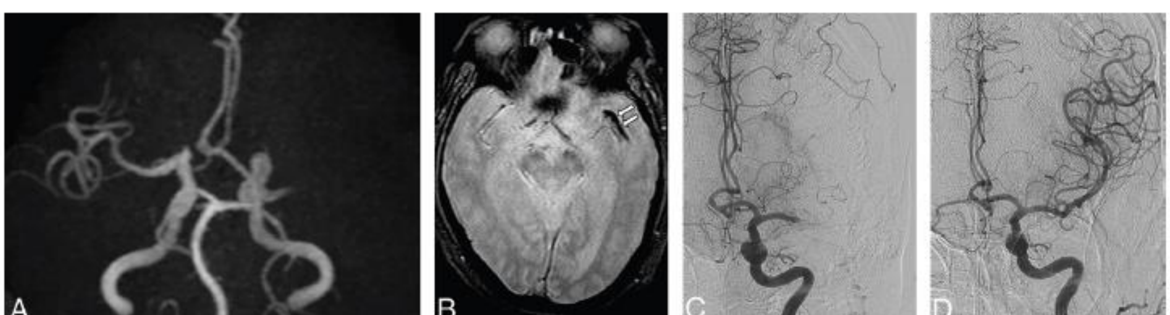
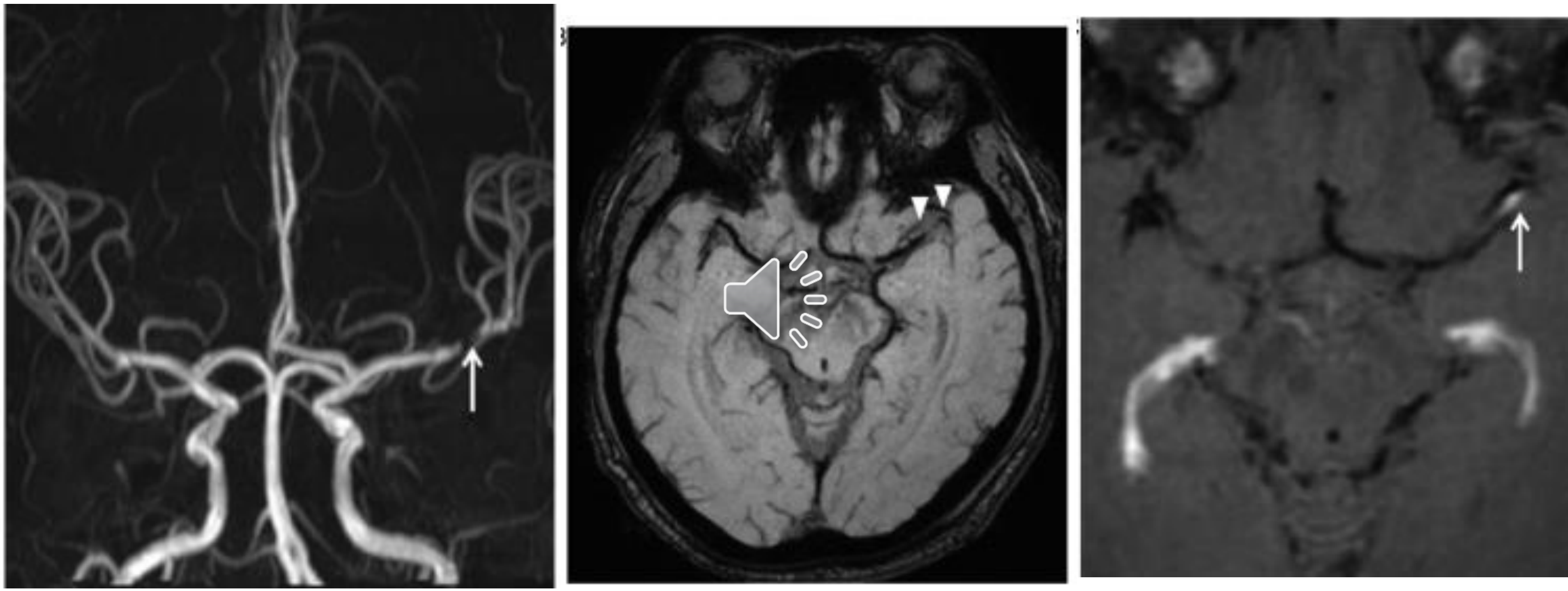


Table 2: Comparison between the ICAS group and non-ICAS group

	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.

Et si pas de SVS ...?



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

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

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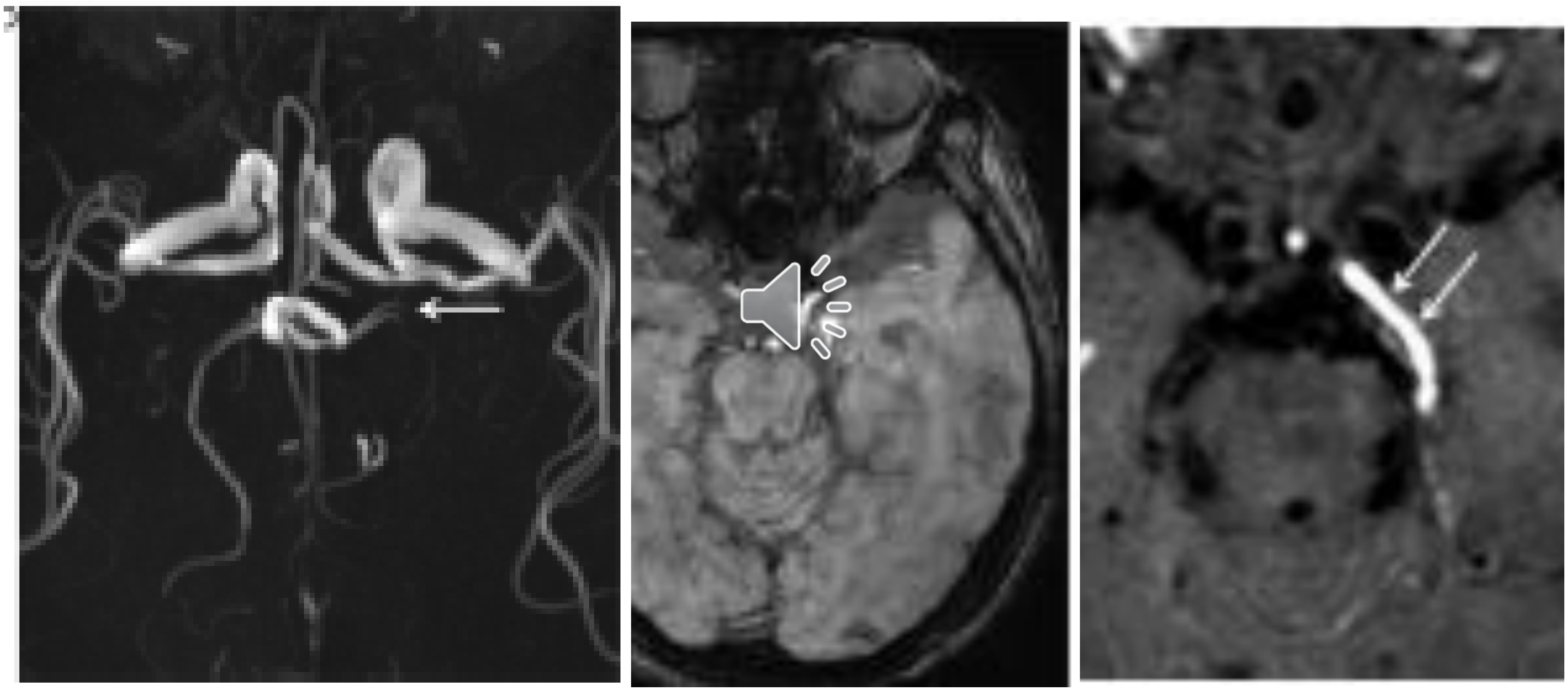

strong intensity, round or concentric morphology and segmental length pattern = occlusion

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

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
  * Prévenir le NRIste …

Devons-nous débuter par une stratégie combinée (SR+CA) en cas d’occlusion SVS + ?

VECTOR

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