


Ecole de la **Thrombectomie**



Clermont-Ferrand

CHU - Faculté de médecine

**Du 5 au 7
février 2020**



THROMBECTOMIE I :

LE STENT

- Franchir le caillot / déployer le stent
- Naviguer en sécurité ? les reflexes
- Quel micro KT, quel guide, quelle branche ?
- Quel stent pour quel caillot ? autres dispositifs...

Stent retriever = outil de référence pour thrombectomies

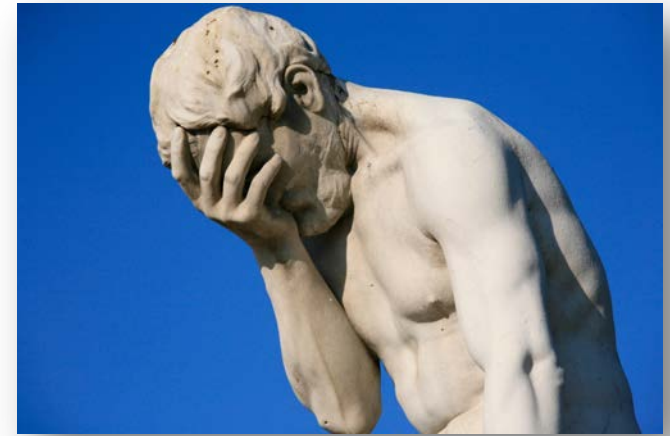
Dispositif le plus souvent utilisé dans les RCT publiées à partir de 2015

Utilisable seul ou en combinaison avec cathéter d'aspiration

Nombreux stents retriever différents...

Déception en 2013...

3 études TIV vs TM → mise en question de l'efficacité de la TM



	IMS III (N=629)	SYNTHESIS (N=362)	MR RESCUE (N=118)
Primary Intervention:	MERCI	IA-tPA and clot fragmentation	MERCI
LVO (ICA, M1):	33%	34%	81%
Successful recanalization (TICI 2b/3):	44%	Not reported [?]	27%
Good clinical outcome (mRS 0-2):	43%	42%	13%
Symptomatic ICH:	6%	6%	5%
Death (90 days):	19%	8%	19%

...MAIS :

→ Devices d'anciennes générations

→ Pas toujours des LVO...



2015



The NEW ENGLAND
JOURNAL of MEDICINE

Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke
Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke

A Randomized Trial of Intraarterial Treatment for Acute Ischemic Stroke

Endovascular Therapy for Ischemic Stroke with Perfusion-Imaging Selection

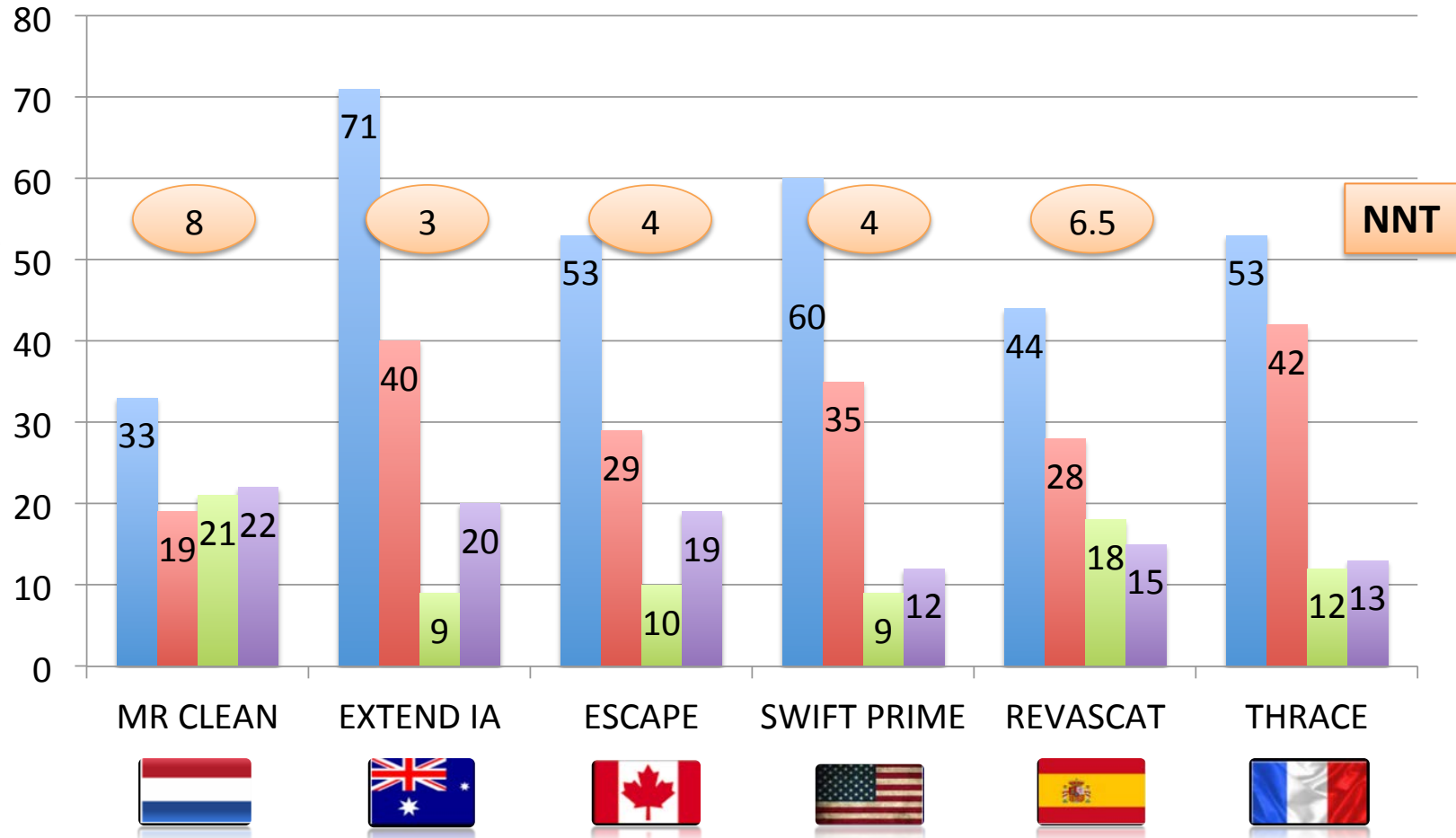
Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke



+



■ mRS 0-2 à 3 mois (thrombectomie) ■ mRS 0-2 à 3 mois (médical)
■ Mortalité à 3 mois (thrombectomie) ■ Mortalité à 3 mois (médical)



Thrombectomy after intravenous thrombolysis is the new standard of care in acute stroke with large vessel occlusion

Benjamin Gory^{1,2,3} and Francis Turjman^{1,2,3}

Interventional Neuroradiology
2015, Vol. 21(6) 691-693

Table 1 – Characteristics of patients at baseline and in groups receiving endovascular treatment and their controls in six selected randomized controlled trials.

Trial, Date, Countries (number of centers)	Number of patients and main selection criteria	Endovascular treatment group				Patients treated with retrievers among patients with thrombectomy, No. (%)	Control group		
		No. of patients ^a	Stroke locations, No. (%)	IV tPA, No. (%)	Thrombectomy, No. (%)		No. of patients ^a	Stroke locations, No. (%)	IV tPA, No. (%)
THRACE, 2016 France (26)	n = 414 - Age: 18-80 - < 5 h from onset - NIHSS: 10-25	204	ICA: 24/204 (11.8) M1 MCA: 176/204 (86.3) M2 MCA: 0/204 (0) BA: 2/204 (1.0)	204 (100)	145 (71.1)	Stent retriever: 116 (80.0)	208	ICA: 39/208 (18.8) M1 MCA: 164/208 (78.8) M2 MCA: 2/208 (1.0) BA: 2/208 (1.0)	208 (100)
ESCAPE, 2015 Canada, USA, South Korea, Republic of Ireland, UK (22)	n = 315 - Age ≥ 18 - < 12 h from onset - NIHSS: no restriction	165	ICA: 45/163 (27.6) M1 MCA or all M2s: 111/163 (68.1) Single M2 MCA: 6/163 (3.7)	120 (72.7)	151 (91.5)	Stent retriever: 130 (86.1) Solitaire FR: 100 (66.2)	150	ICA: 39/147 (26.5) M1 MCA or all M2s: 105/147 (71.4) Single M2 MCA: 3/147 (2.0)	118 (78.7)
REVASCAT, 2015 Spain (4)	n = 206 - Age: 18-85 - < 8 h from onset - NIHSS ≥ 6	103	ICA: 26/102 (25.5) M1 MCA: 66/102 (64.7) M2 MCA: 10/102 (9.8)	70 (68.0)	98 (95.1)	Solitaire FR: 88 (89.8)	103	ICA: 28/101 (27.7) M1 MCA: 65/101 (64.4) M2 MCA: 8/101 (7.9)	80 (77.7)
EXTEND IA, 2015 Australia, New Zealand (10)	n = 70 - Age ≥ 18 - < 6 h from onset - NIHSS: no restriction	35	- ICA: 11/35 (31.4) - M1 MCA: 20/35 (57.1) - M2 MCA: 4/35 (11.4)	35 (100)	27 (77.1)	Solitaire FR: 27 (100)	35	ICA: 11/35 (31.4) M1 MCA: 18/35 (51.4) M2 MCA: 6/35 (17.1)	35 (100)
MR CLEAN, 2015 Netherlands (16)	n = 500 - Age ≥ 18 - < 6 h from onset - NIHSS ≥ 6	233	- ICA: 60/233 (25.8) - M1 MCA: 154/233 (66.1) - M2 MCA: 18/233 (7.7) - A1 or A2 ACA: 1/233 (0.4)	203 (87.1)	195 (83.7)	Stent retriever: 190 (97.4)	267	ICA: 78/266 (29.3) M1 MCA: 165/266 (62.0) M2 MCA: 21/266 (7.9) A1 or A2 ACA: 2/266 (0.8)	242 (90.6)
SWIFT PRIME, 2015 USA, France, Germany, Spain, Switzerland, Denmark, Austria (39)	n = 196 - Age: 18-80 - < 6 h from onset - NIHSS: 8-29	98	ICA: 17/93 (18.3) M1 MCA: 62/93 (66.6) M2 MCA: 13/93 (14.0)	98 (100)	87/98 (88.8)	Solitaire FR or Solitaire 2: 87 (100)	98	ICA: 15/94 (16.0) M1 MCA: 72/94 (76.6) M2 MCA: 6/94 (6.4)	98 (100)

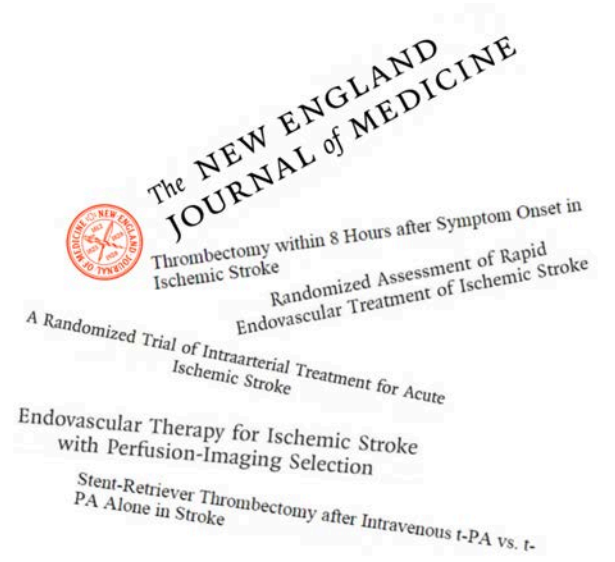
Stent retriever thrombectomy for acute ischemic stroke: A systematic review and meta-analysis of randomized controlled trials, including THRACE

M. Barral^{a,1}, S. Boudour^{b,1}, M. Viprey^{a,c}, C. Giroudon^c, G. Aulagner^b, A.-M. Schott^{a,c}, F. Turjman^{d,e}, X. Armoiry^{b,f}, B. Gory^{g,h,i,*}, *Rev Neurol (Paris)*. 2018 May;174(5):319-326.

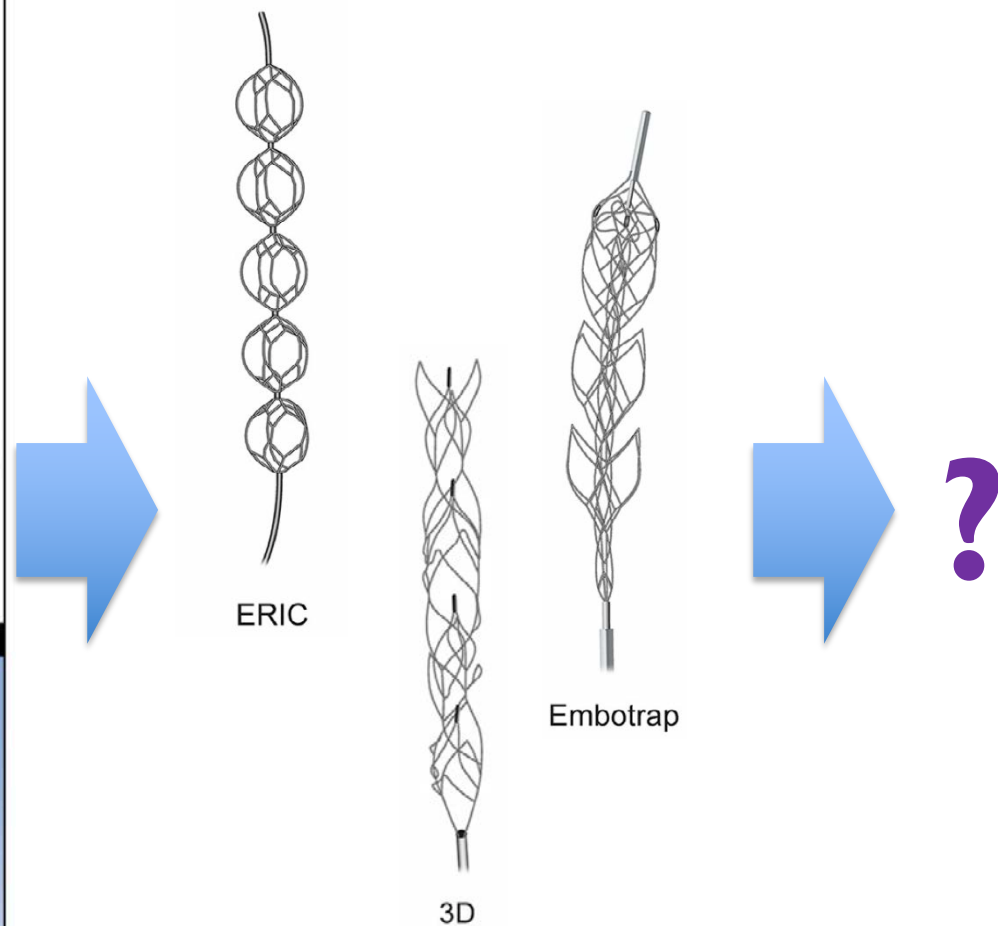
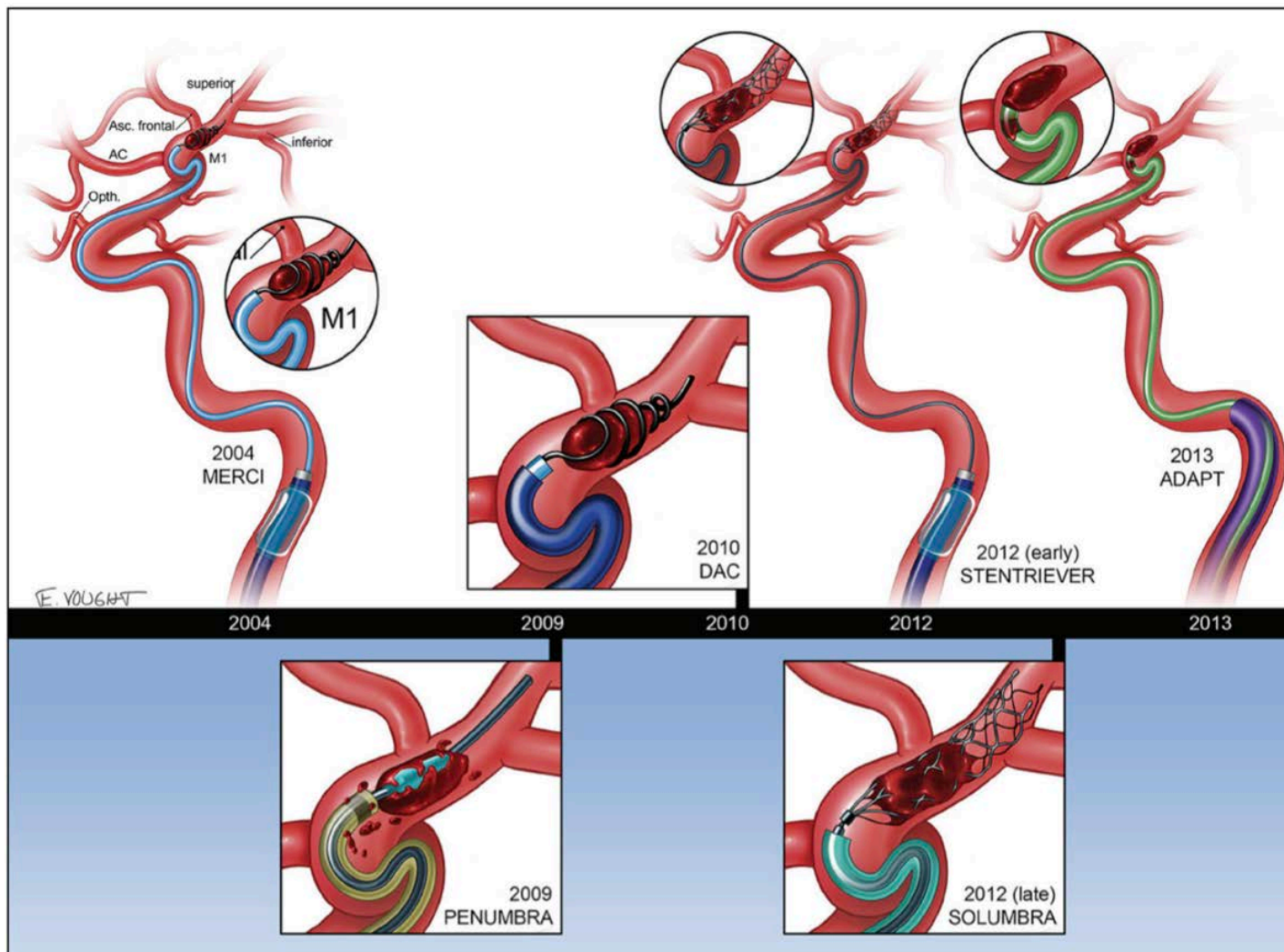
Table. Summary of Data From the 5 Trials

Trial N	NIHSS Range			TICI 2B/3	LSN to Groin Mdn	mRS 0-2 at 90 d		sICH		Device Complications	Mortality	
	CTL	IAT+	r-tPA			CTL	IAT+	CTL	IAT+		CTL	IAT+
MR CLEAN ¹² 500 233/267	18 (14-21)	17 (14-22)	90%	59%	260	19%	33%	6.4%	7.7%	Embol. 13	22%	21%
ESCAPE ¹³ 315 165/150	17 (12-20)	16 (13-20)	76%	72%	200	29%	53%	2.7%	3.6%	Perfor. 1	19%	10%
EXTEND IA ¹⁴ 70 35/35	13 (9-19)	17 (13-20)	100%	86%	210	40%	71%	6%	0%	Perfor. 1 Embol. 2	20%	9%
SWIFT PRIME ¹⁵ 196 98/98	17 (13-19)	17 (13-20)	98%	88%	224	36%	60%	3%	0%	SAH 4	12%	9%
REVASCAT ¹⁶ 206 103/103	17 (12-19)	17 (14-20)	73%	66%	269	28%	44%	1.9%	1.9%	Perfor. 5 Embol. 5	16%	18%

CTL indicates control group; Embol, distal embolization; IAT+, intra-arterial thrombectomy on top of standard treatment including r-tPA; LSN, time (minutes) from last seen normal to groin puncture in IAT+ group; Mdn, median; mRS 0-2 at 90 d, modified Rankin Scale of 0-2 at 90 days after randomization; NIHSS, baseline National Institutes of Health Stroke Scale; Perfor, vessel perforation; r-tPA, patients in trial treated with recombinant tissue-type plasminogen activator; REVASCAT, Randomized Trial of Revascularization With the Solitaire FR Device Versus Best Medical Therapy in the Treatment of Acute Stroke Due to Anterior Circulation Large Vessel Occlusion Presenting Within Eight Hours of Symptom Onset; SAH, subarachnoid hemorrhage; sICH (SITS), symptomatic intracerebral hemorrhage based on safe implementation of treatments in stroke criteria; and TICI 2b/3, patients in IAT+ group achieving thrombolysis in cerebral infarction grade 2b or 3 reperfusion.



TM → TICI 2B/3 : 59 - 88% (précédentes études : < 41%)
 Bénéfice absolu (mRS 0-2 90d) : 13,5% - 31,4%
 Pas plus de complication hémorragique ou de mortalité



A Direct Aspiration First Pass Technique vs Standard Endovascular Therapy for Acute Stroke: A Systematic Review and Meta-Analysis

Kevin Phan, BSc(Adv), MPhil*
 Adam A. Dmytriw, MD, MSc*
 Ian Teng, MD*

NEUROSURGERY 2018

Mechanical Thrombectomy: Emerging Technologies and Techniques

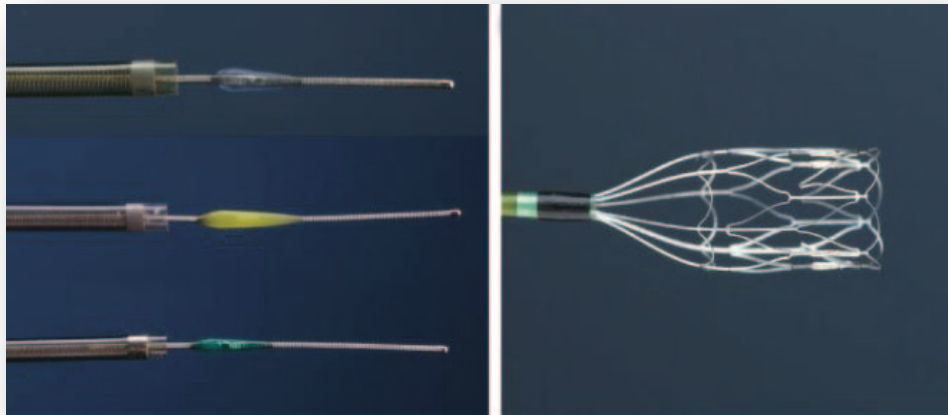
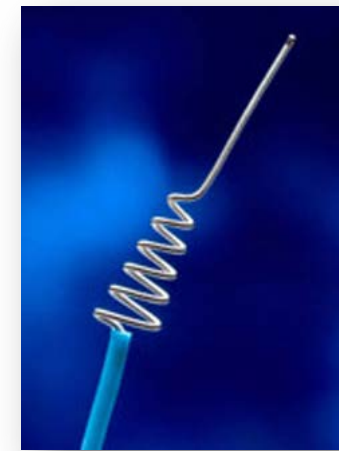
Edgar A. Samaniego, MD, MS,* Jorge A Roa, MD,† Kaustubh Limaye, MD,‡
 J Stroke Cerebrovasc Dis. 2018 Oct;27(10):2555-2571.

Safety and Efficacy of Mechanical Embolectomy in Acute Ischemic Stroke

Results of the MERCI Trial

Wade S. Smith, MD, PhD; Gene Sung, MD; Sidney Starkman, MD; Jeffrey L. Saver, MD

Stroke July 2005



The Penumbra Pivotal Stroke Trial

Safety and Effectiveness of a New Generation of Mechanical Devices for Clot Removal in Intracranial Large Vessel Occlusive Disease

The Penumbra Pivotal Stroke Trial Investigators

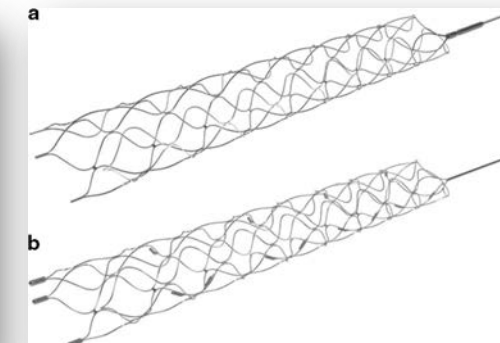
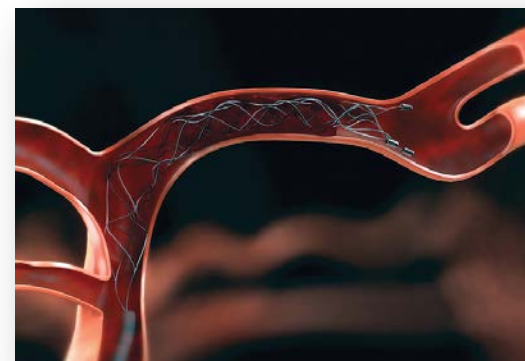
Stroke August 2009

Figure. Penumbra reperfusion catheters and separators (left); thrombus removal ring (right).

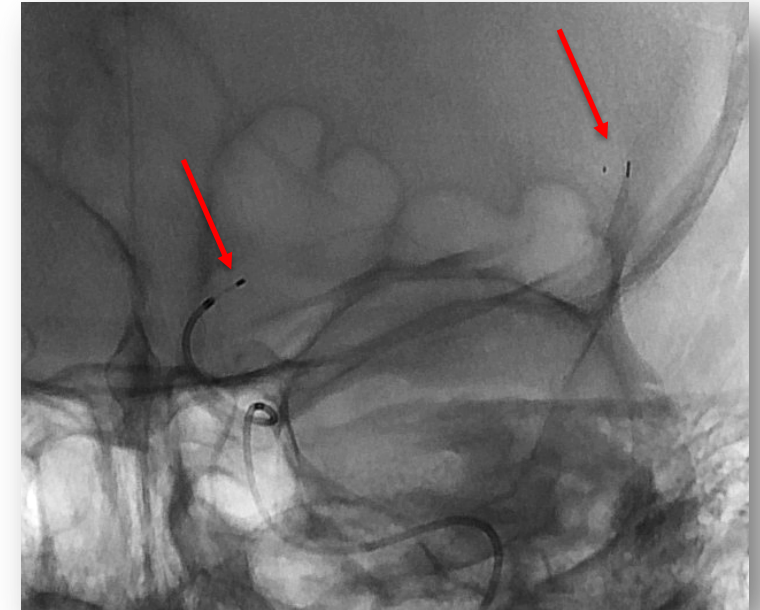
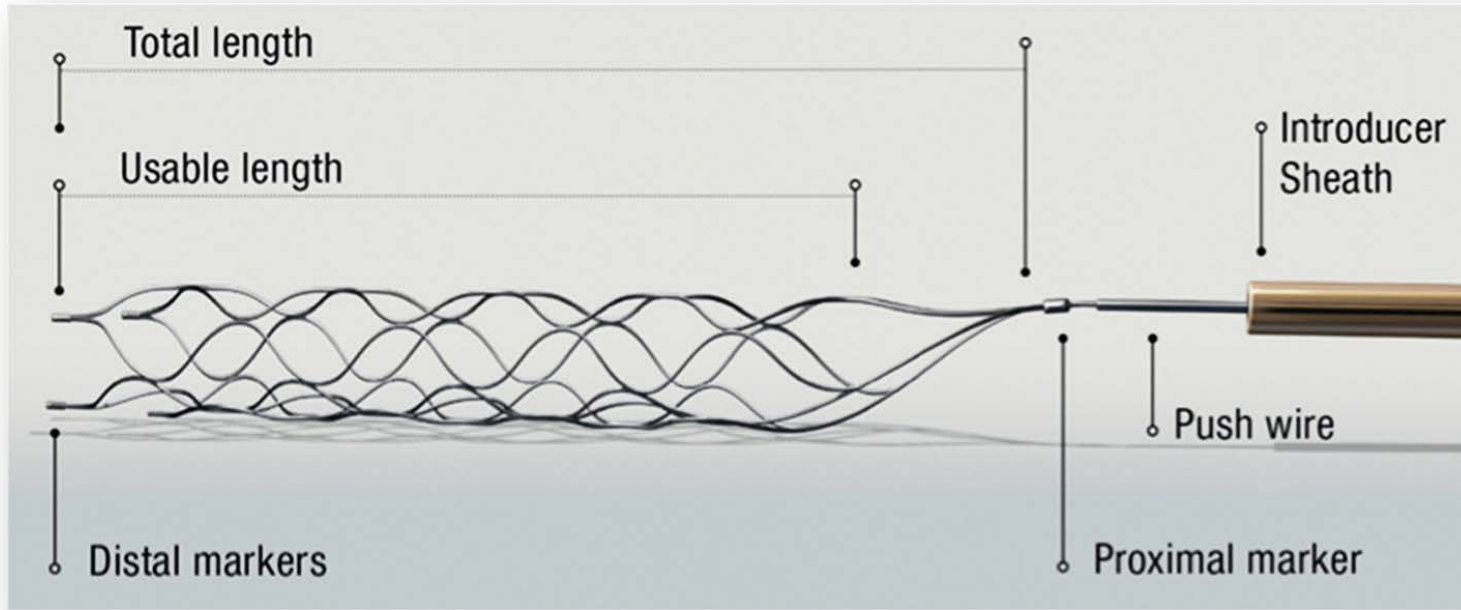
Mechanical Thrombectomy Using the new Solitaire™ Platinum Stent-retriever

Johannes Pfaff¹ · Stefan Rohde² · Tobias Engelhorn³ · Arnd Doerfler³ · Martin Bendszus¹ · Markus Alfred Möhlenbruch^{1,4}

Clin Neuroradiol 10 January 2018



ASPECT GENERAL



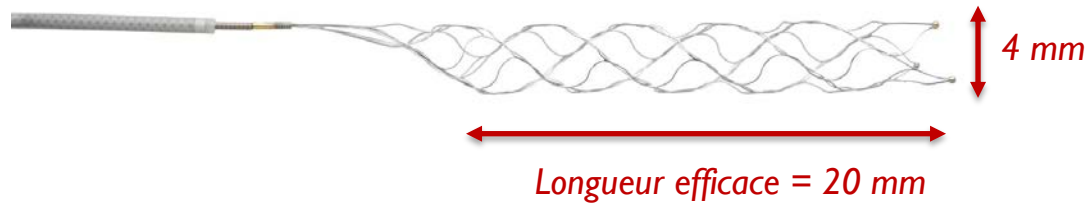
Solitaire FR thrombectomy system: immediate results in 56 consecutive acute ischemic stroke patients

Machi P, et al. *J NeuroIntervent Surg* 2018;**10**:i27–i32.

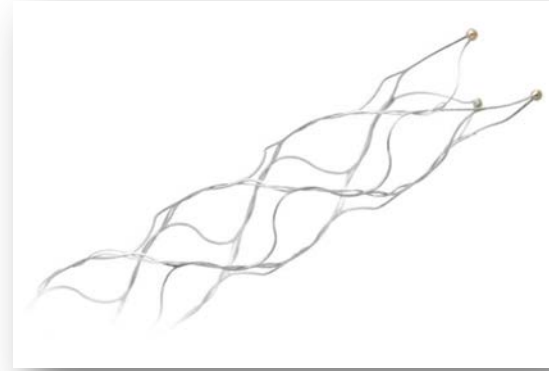
Trevo



Exemple : stent de 4 x 20 mm

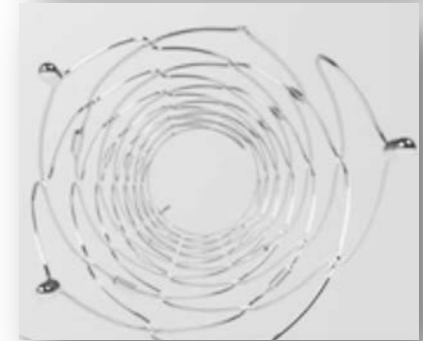


Trevo



Design en overlapping ou non

Solitaire



Disponibles en plusieurs :

- Tailles : en général, diamètre de 3 mm, 4 mm ou 6 mm.
- Longueurs : 20 mm à 40 mm

Compatibilité stent – microcathéter : en règle générale ...

- diamètre < 6 mm : microKT de 21
- diamètre = 6 mm : micro KT de 27

Pour mémoire :

- diamètre ID micro KT = 17, 21 ou 27 ... en inch x 10^{-3} ! (1 inch = 25,4 mm)
- donc e.g. microKT 21 = 0,021 in

MAIS



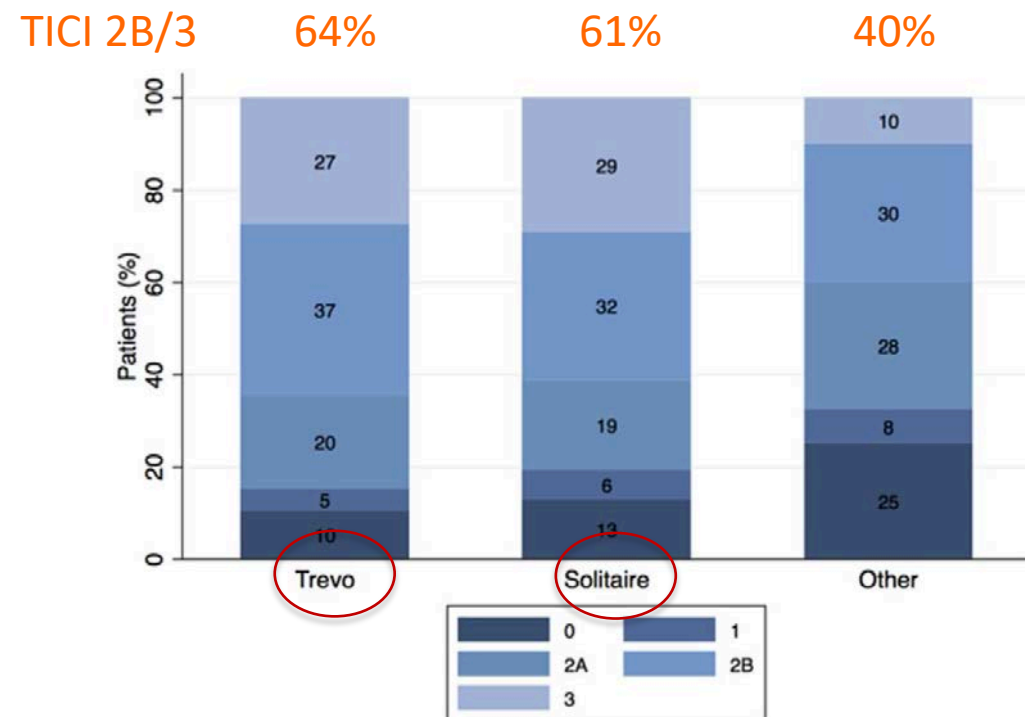
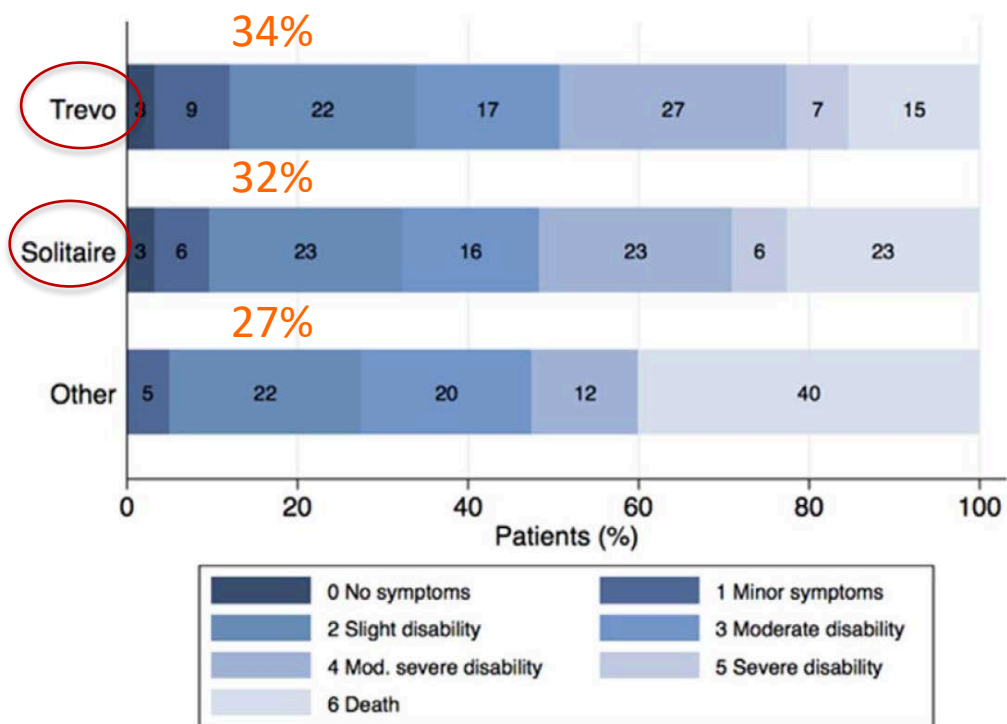
<i>ID microKT</i>	17	21	27
<i>exemples</i>	Echelon 10 Echelon 14 Headway 17	Rapid Transit Rebar 18 Headway 21	Marksman Excelsior XT 27 Headway 27

Influence of Device Choice on the Effect of Intra-Arterial Treatment for Acute Ischemic Stroke in MR CLEAN (Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands)

Diederik W. Dippel, MD, PhD; Charles B. Majoie, MD, PhD; Yvo B. Roos, MD, PhD;
 Aad van der Lugt, MD, PhD; Robert J. van Oostenbrugge, MD, PhD;
 Wim H. van Zwam, MD, PhD; Hester F. Lingsma, MSc, PhD; Peter J. Koudstaal, MD, PhD;
 Kilian M. Treurniet, MD; Lucie A. van den Berg, MD; Debbie Beumer, MD;
 Puck S. Fransen, MD; Olvert A. Berkhemer, MD; for the MR CLEAN Investigators*

Stroke October 2016

mRS 0-2 at 90d

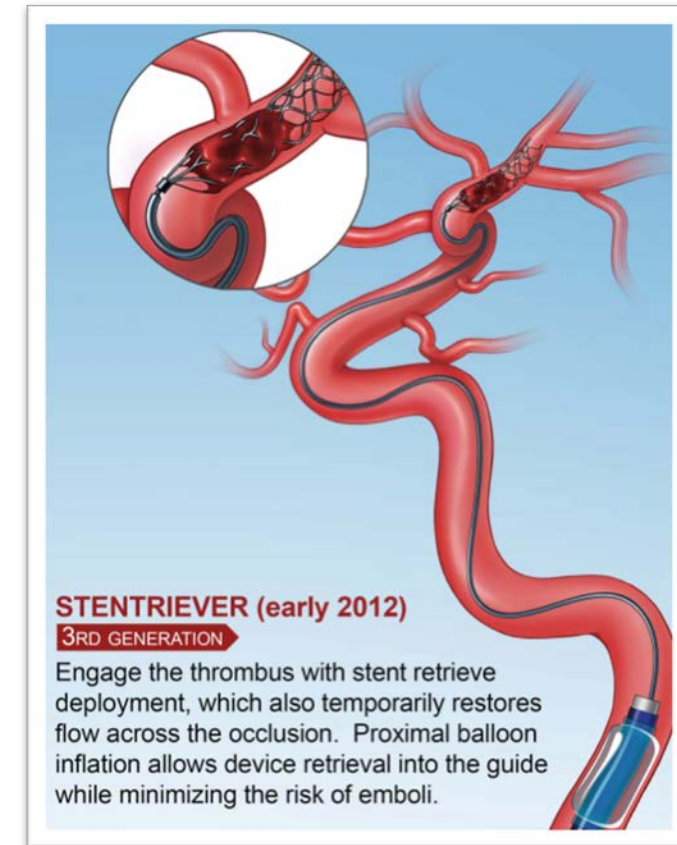


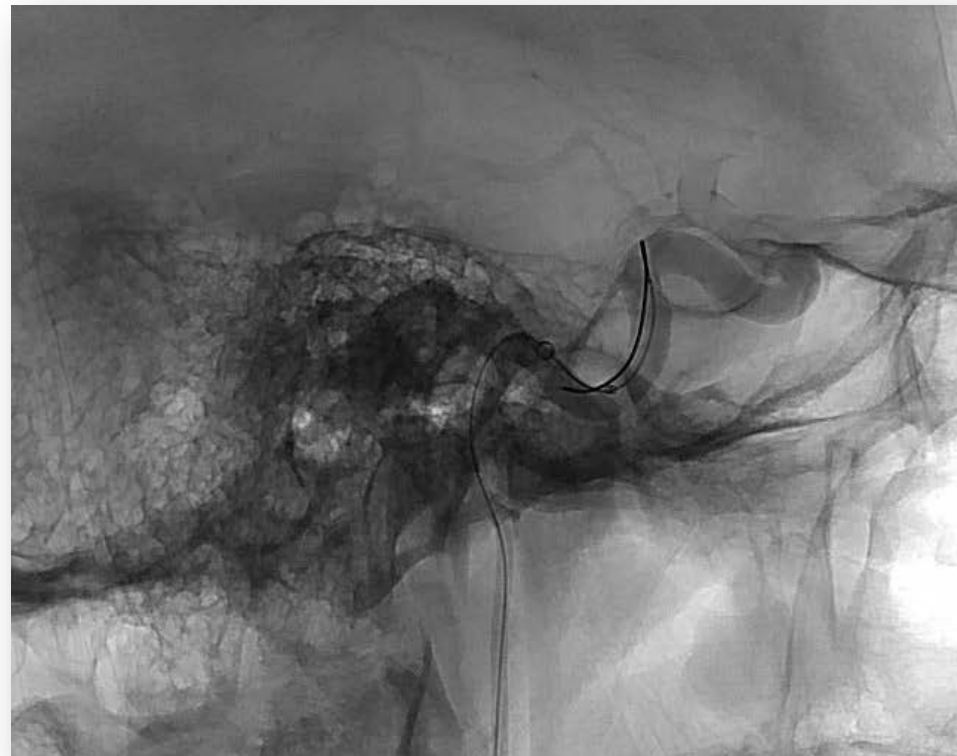
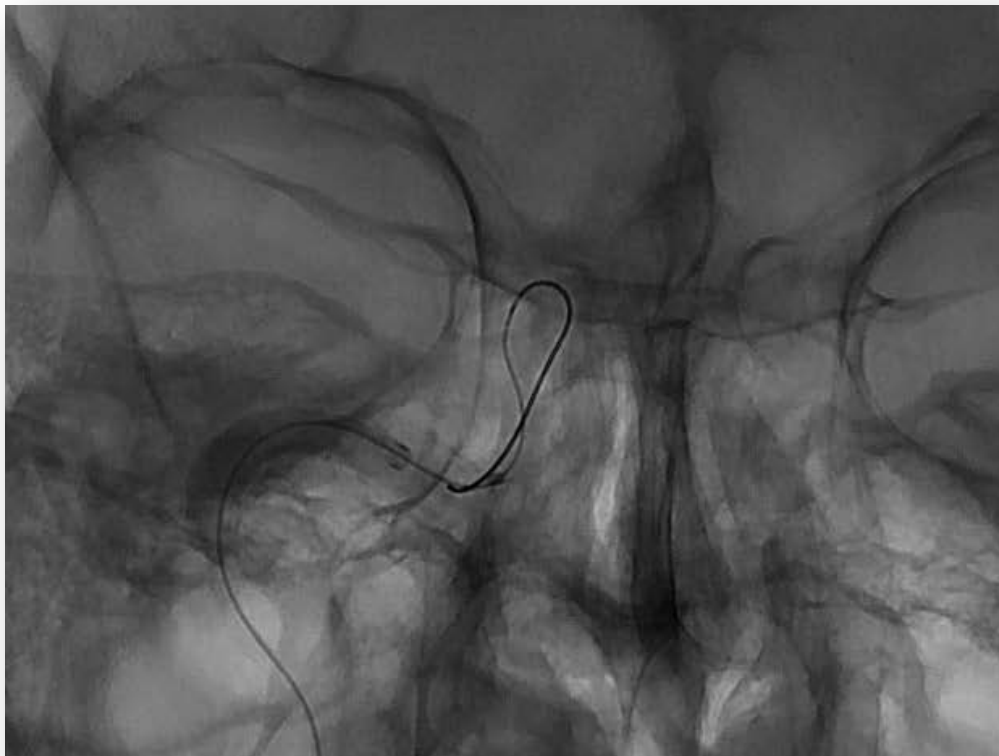
Quel type de stent choisir ?

→ Pas de différence significative entre les stents Trevo et Solitaire en terme de résultat clinique ou de recanalisation...

NAVIGATION – DEPLOIEMENT DU STENT

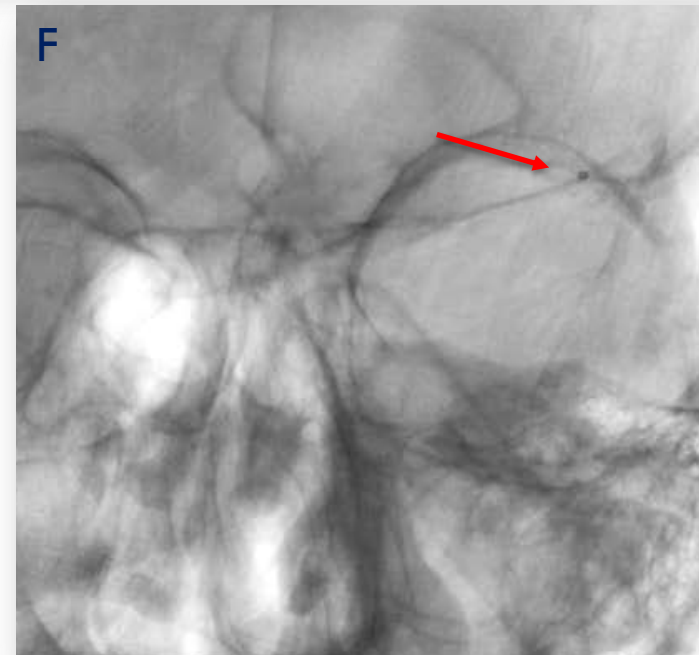
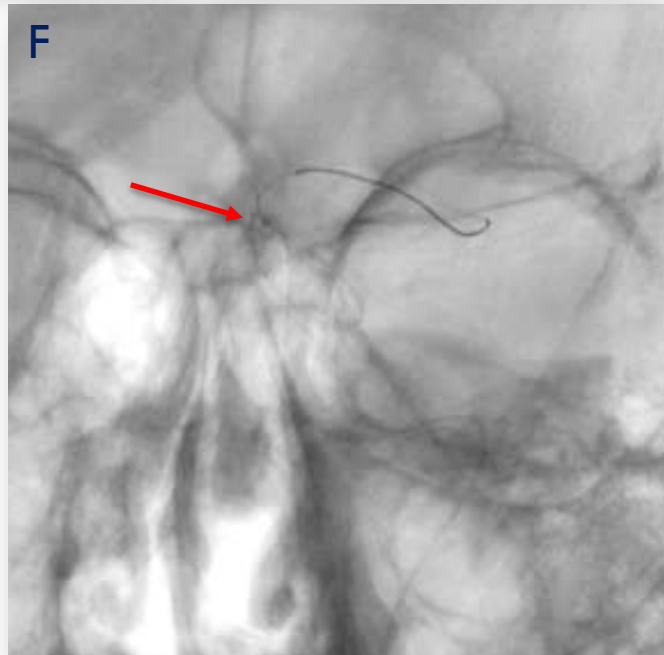
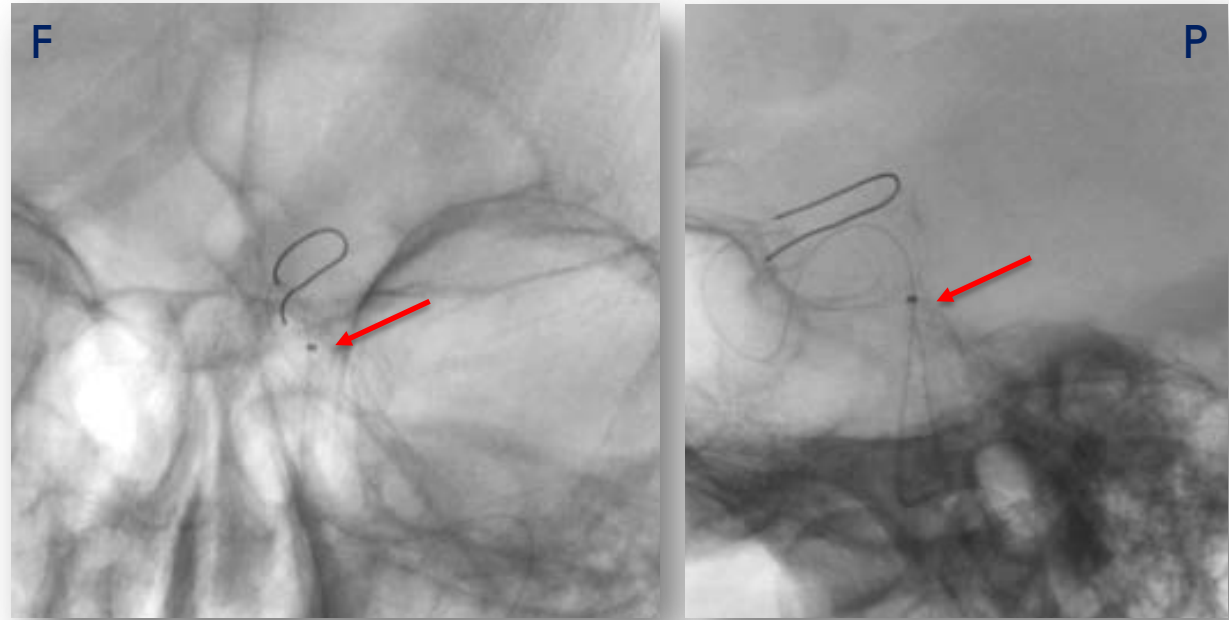
- KT guide à ballon à large lumière
- MicroKT de 21 ou 27 + microguide de 14
- Franchissement du caillot avec microguide, suivi du microKT
- Montée du stent
- Déploiement du stent en regard du caillot
- Attendre quelques minutes après ouverture du stent
- Gonfler le ballon du KT guide
- Retrait du stent sous aspiration dans le KT guide
- Compléter l'aspiration dans le KT guide pour rammener des caillots résiduels



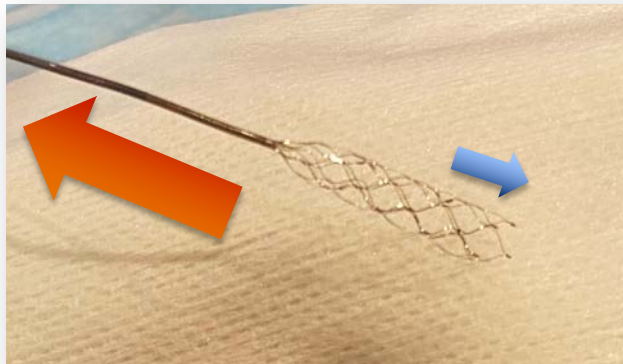
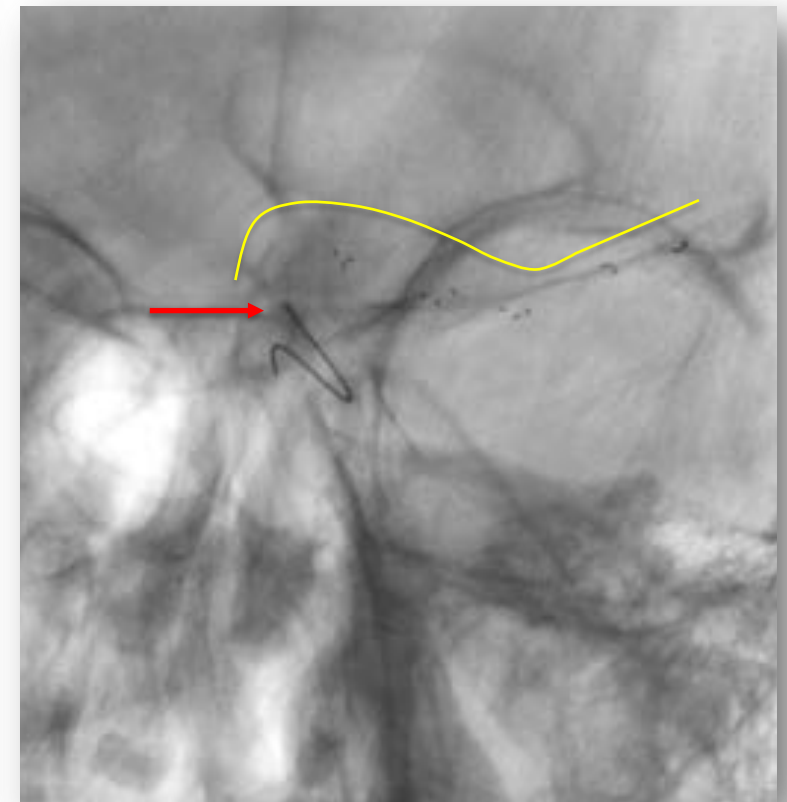
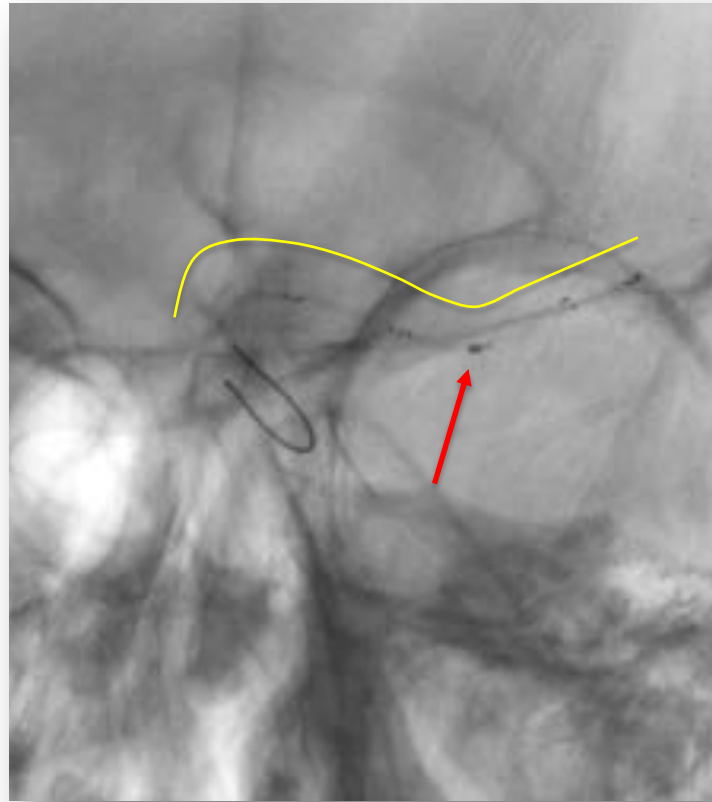
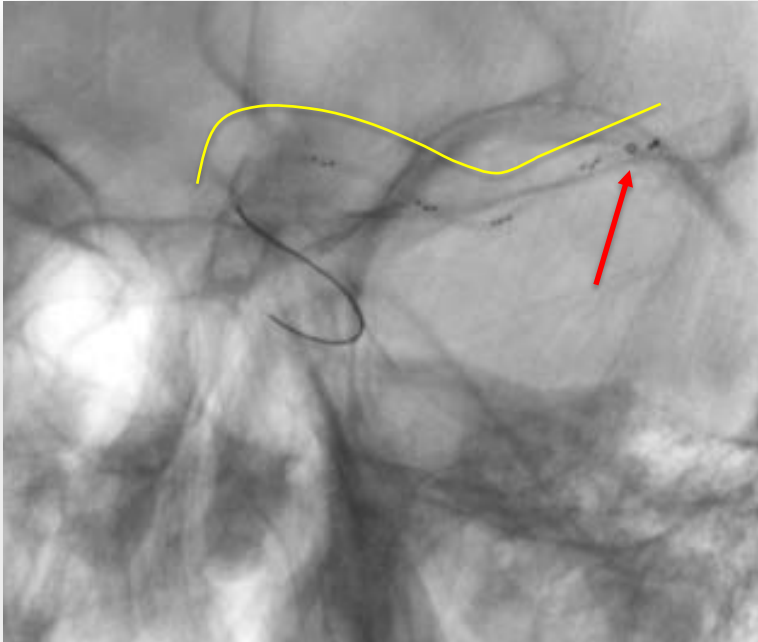


Pré-former le microguide si besoin.
J-shape.

Montée du microguide et microKT



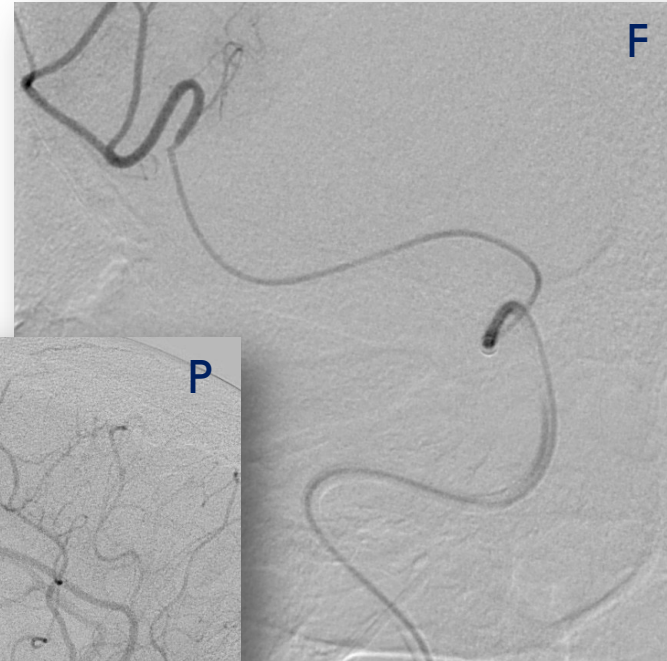
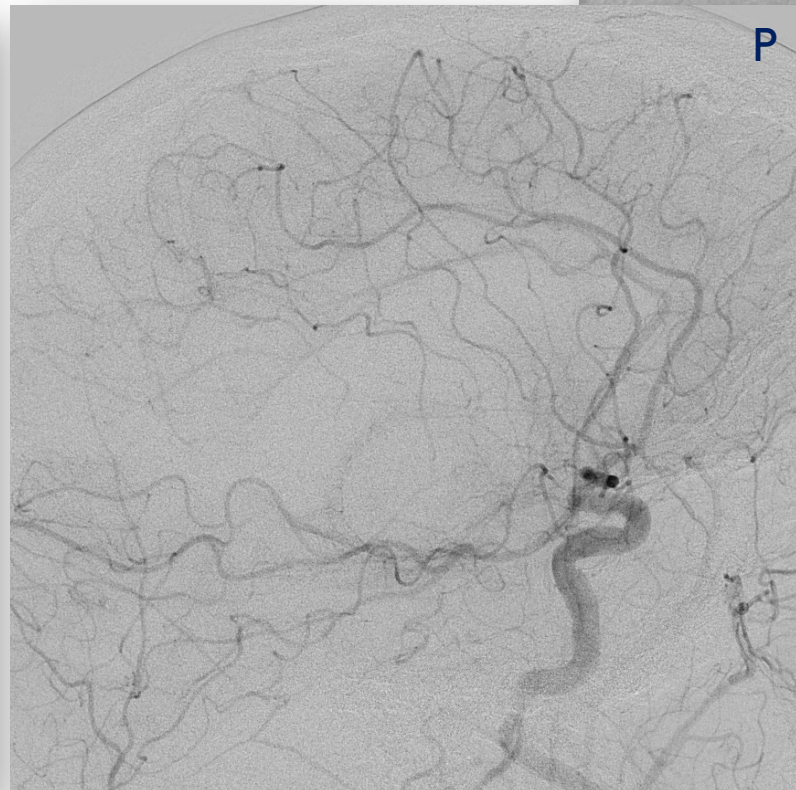
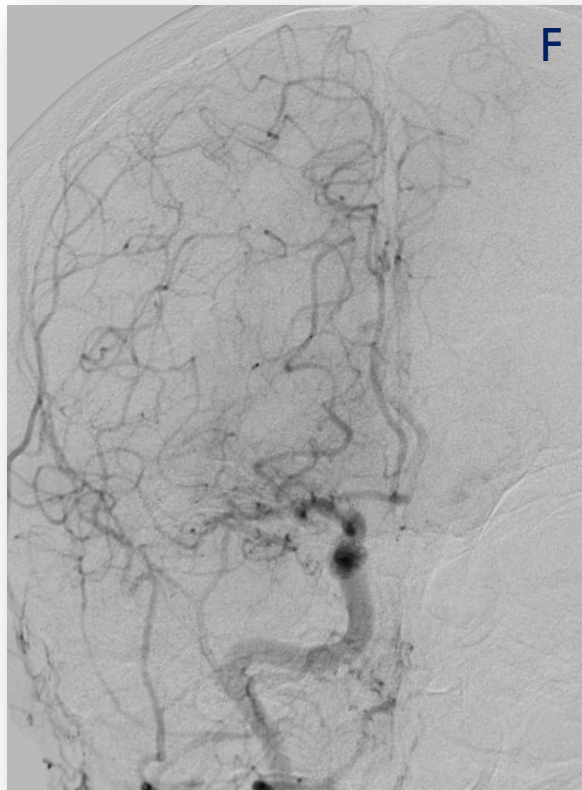
Déploiement du stent



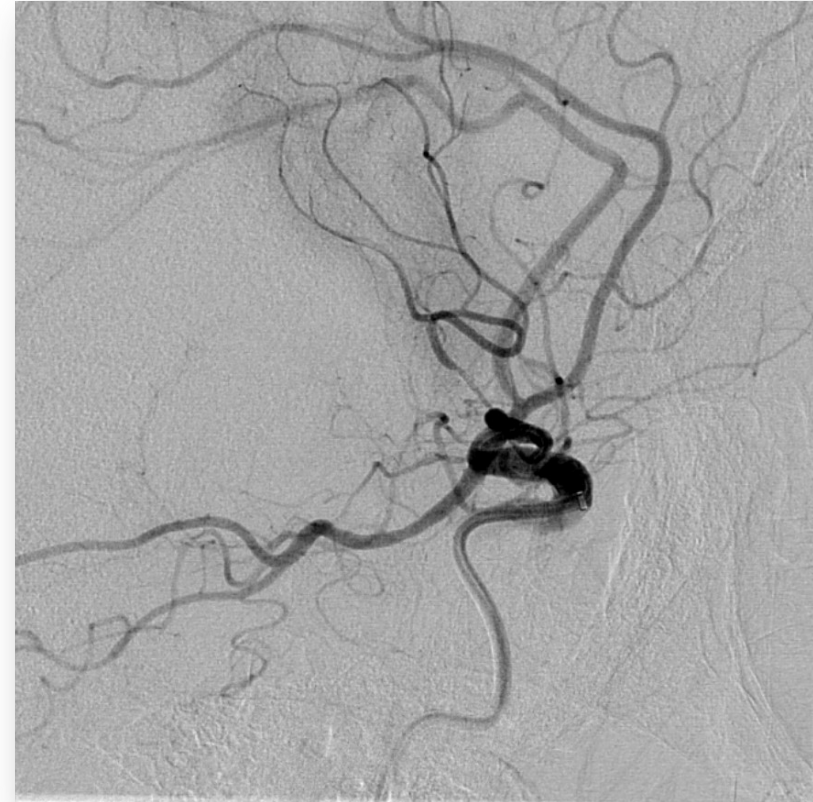
+/- Intérêt de l'injection par micro KT ?

→ Vérifier l'absence de complication distale lors du cathétérisme

→ En cas d'occlusion M2

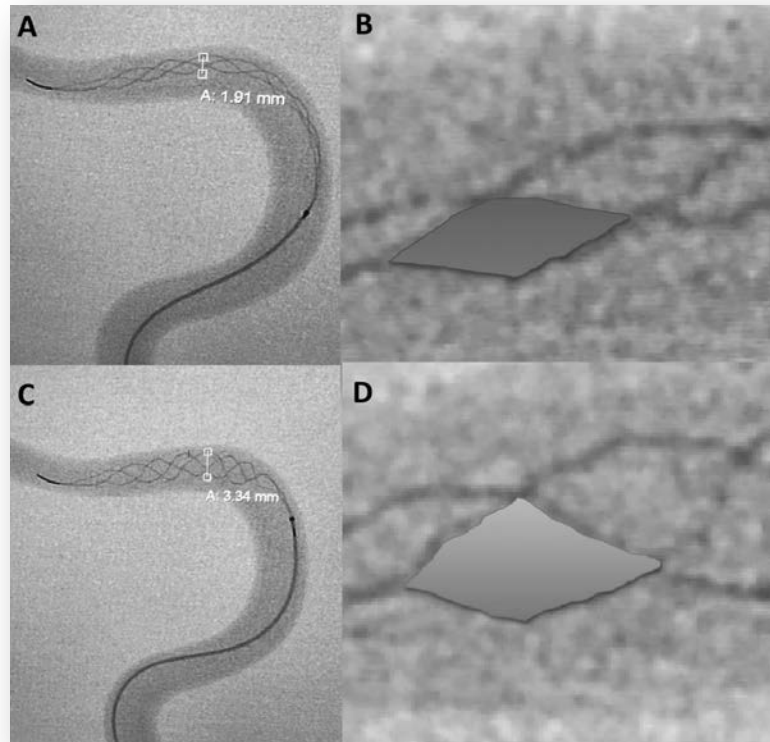


...localisation plus précise du caillot ?



Optimizing Clot Retrieval in Acute Stroke The Push and Fluff Technique for Closed-Cell Stentriever

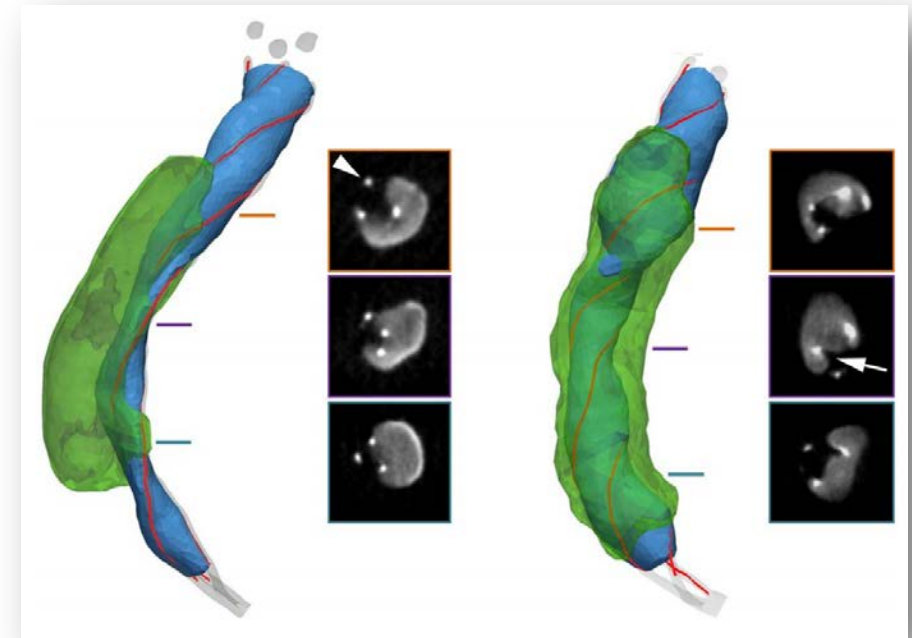
Diogo C. Haussen, MD; Leticia C. Rebello, MD; Raul G. Nogueira, MD



Quantitative assessment of device-clot interaction for stent retriever thrombectomy

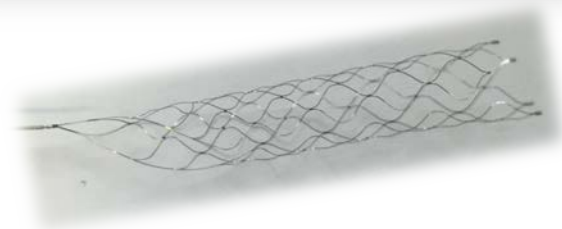
Kajo van der Marel,¹ Ju-Yu Chueh,¹ Olivia W Brooks,¹ Robert M King,¹ Miklos G Marosfoi,¹ Erin T Langan,¹ Sarena L Carniato,² Matthew J Gounis,¹ Raul G Nogueira,³ Ajit S Puri¹

J NeuroIntervent Surg 2016;**0**:1–6.

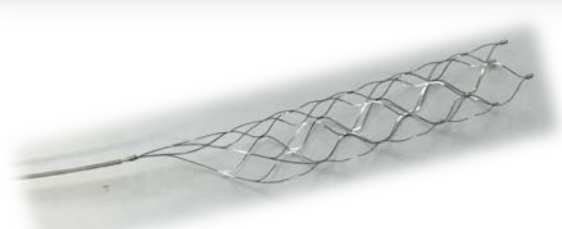


Conclusions—The PFT is safe and leads to optimization of wall apposition and cell size/configuration, resulting in higher chances of first-pass reperfusion, lower number of passes, and better rates of complete reperfusion. (*Stroke*. 2015;**46**:2838-2842. DOI: 10.1161/STROKEAHA.115.010044.)

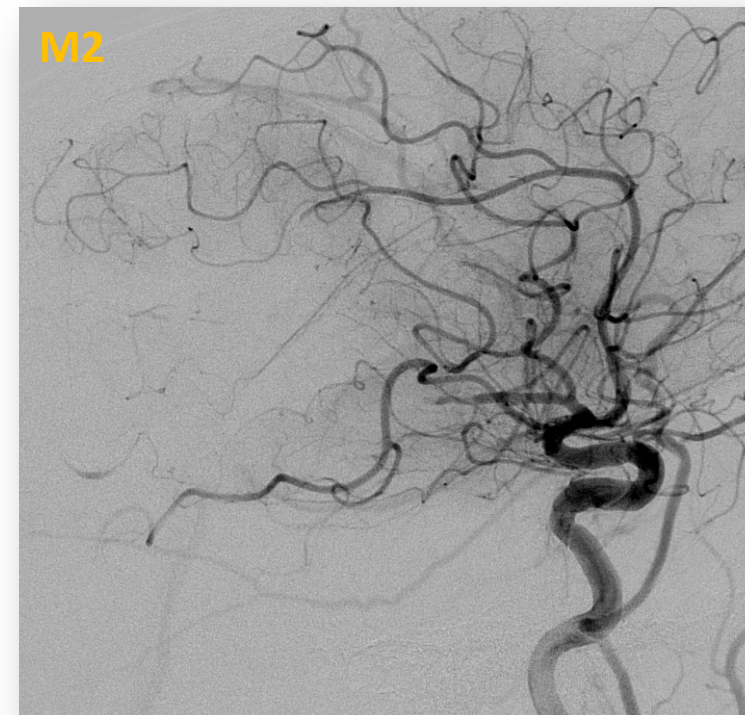
CHOIX DE LA TAILLE DU STENT



6 mm

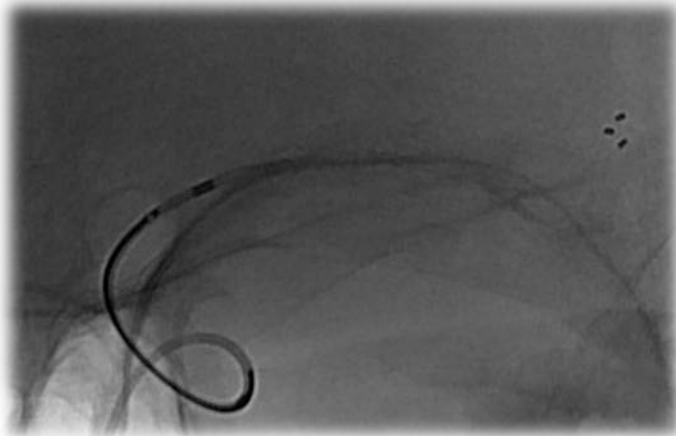
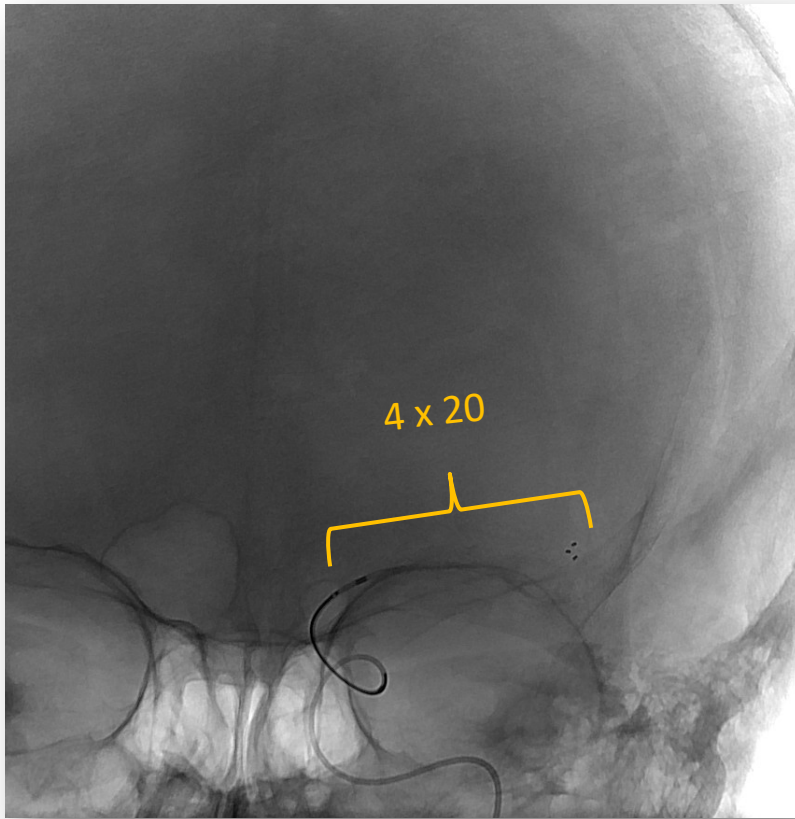


4 mm

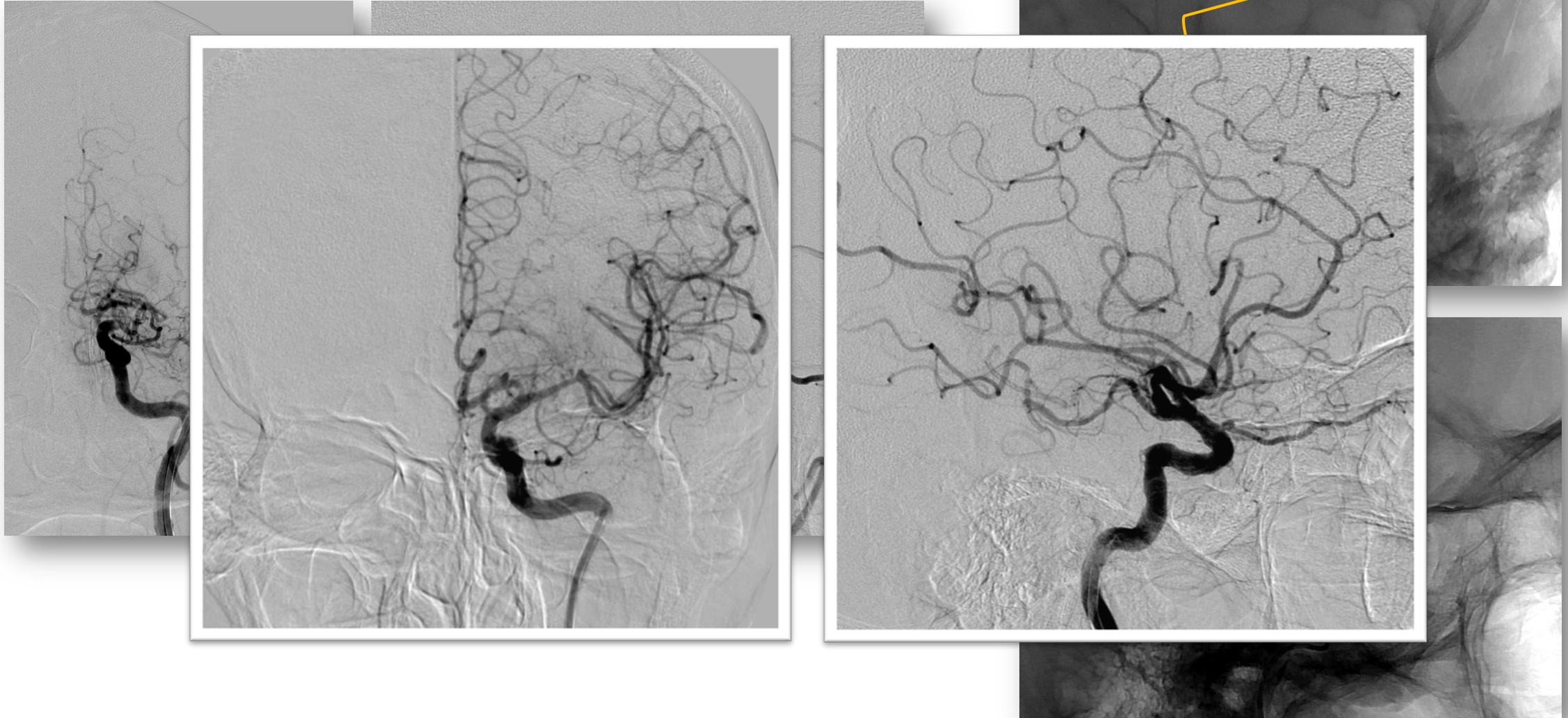


3 mm

Occlusion MI



Occlusion T carotidien



Quelle longueur de stent ?

Longer stent retrievers enhance thrombectomy performance in acute stroke

Diogo C Haussen, Alhamza R Al-Bayati, Jonathan A Grossberg, Mehdi Bouslama, Clara Barreira, Nicolas Bianchi, Michael R Frankel, Raul G Nogueira

J NeuroIntervent Surg 2018;**0**:1–4.

Table 1 Univariate analysis comparing long versus short retrievers

	Long (n=221)	Short (n=199)	P value
Primary outcome			
First-pass reperfusion	138 (62%)	101 (50%)	0.01
Secondary outcomes			
First-pass full reperfusion	91 (41%)	66 (33%)	0.10
Parenchymal hematoma type 2	5 (2%)	6 (3%)	1.00
Subarachnoid hemorrhage	15 (6%)	12 (6%)	0.72

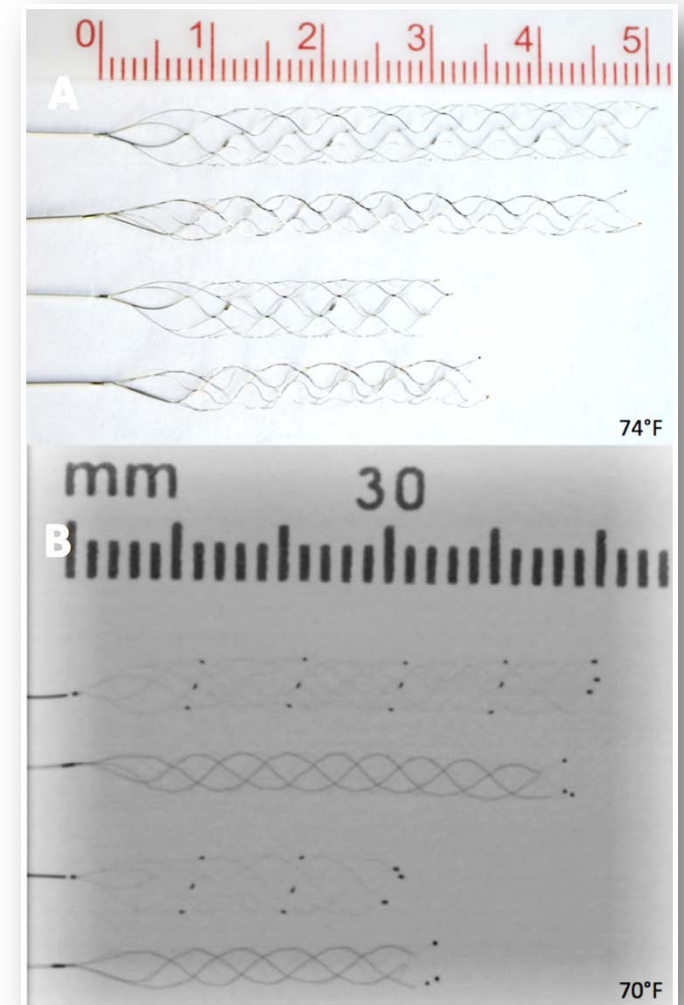


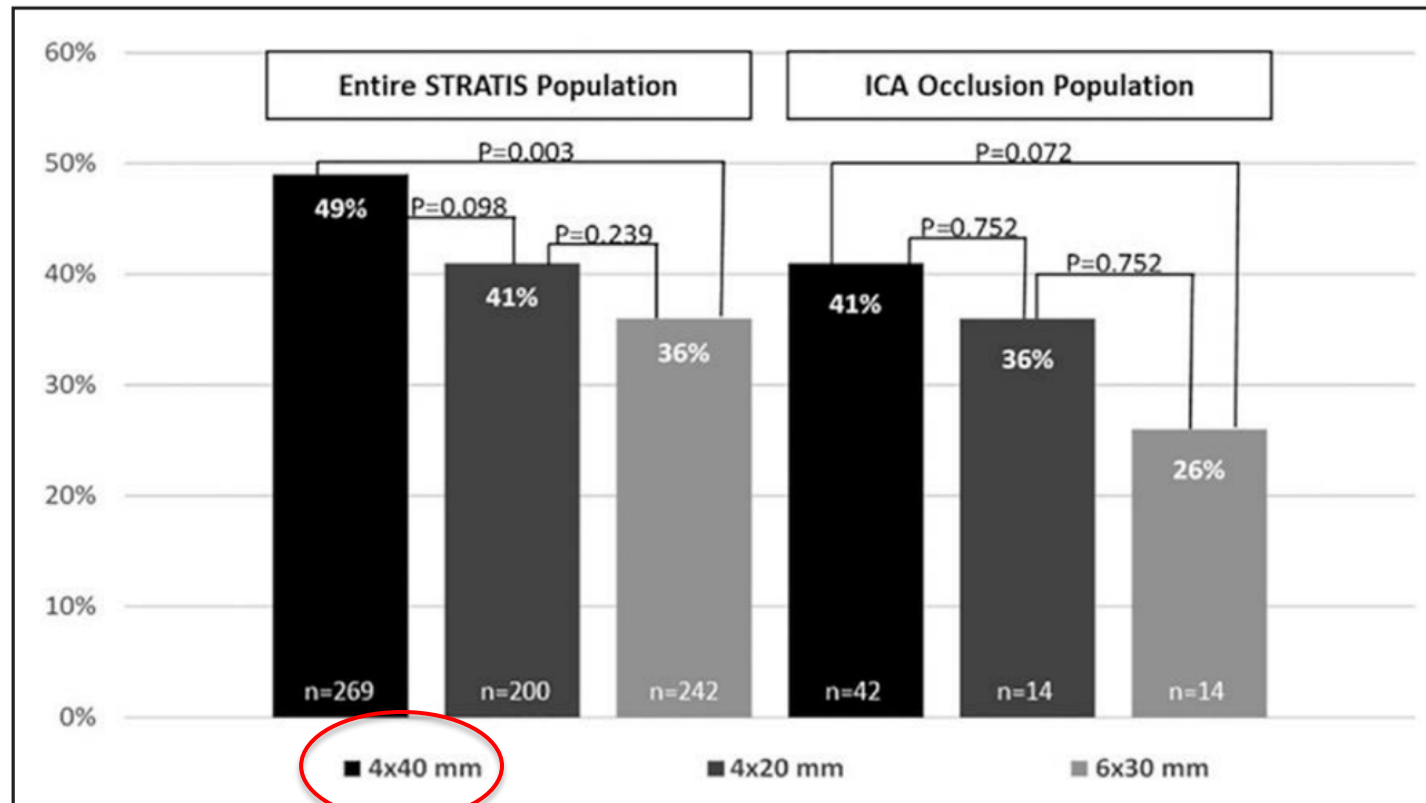
Figure 1 Illustrative image of the different 4 mm stent retriever lengths and fluoroscopic characteristics. (A) Macroscopic and (B) fluoroscopic appearance of the devices. From top to bottom: Solitaire 4x40 mm; Trevo 4x30 mm; Solitaire 4x20 mm; Trevo 4x20 mm.

The longer, the better...

Impact of Stent Retriever Size on Clinical and Angiographic Outcomes in the STRATIS Stroke Thrombectomy Registry

Osama O. Zaidat, MD; Diogo C. Haussen, MD; Ameer E. Hassan, DO;
Ashutosh P. Jadhav, MD, PhD; Brijesh P. Mehta, MD; Maxim Mokin, MD, PhD;
Nils H. Mueller-Kronast, MD; Michael T. Froehler, MD, PhD

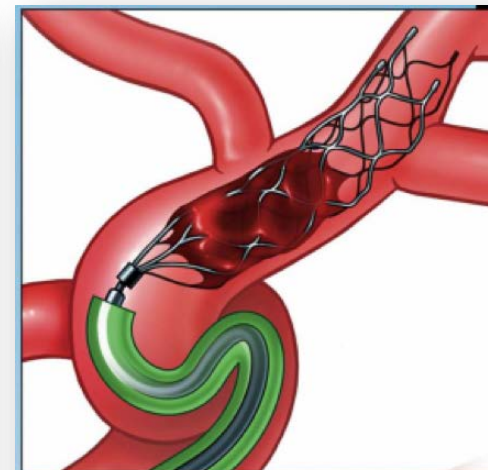
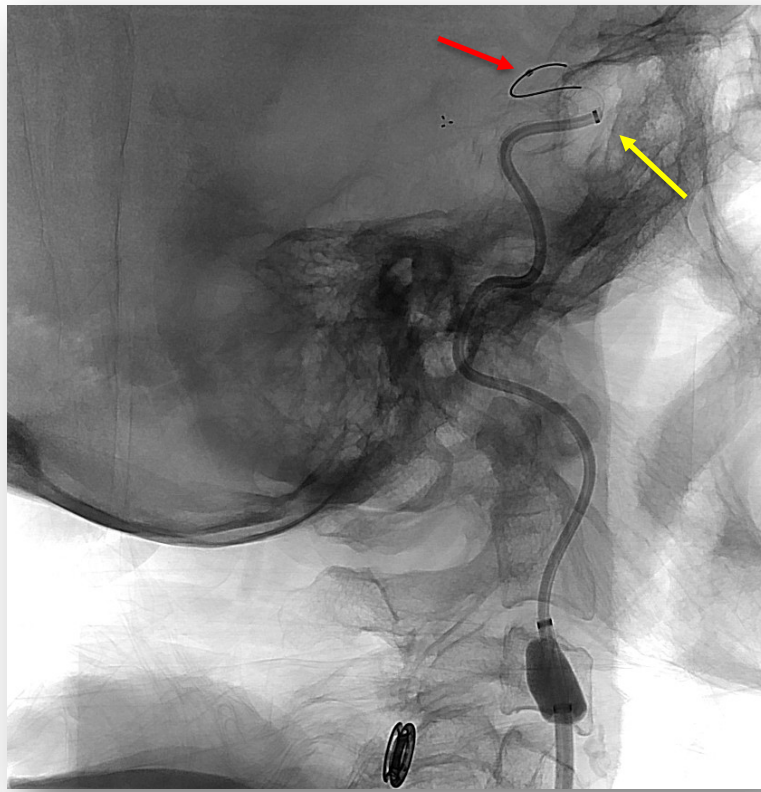
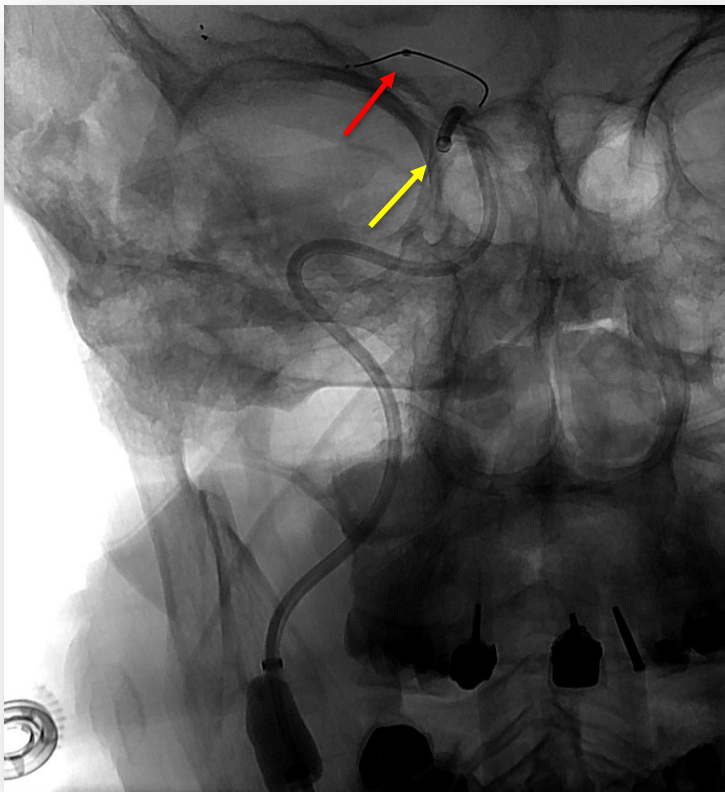
Stroke February 2019



Taux de first-pass effect, avec stents solitaires de tailles différentes, dans les occlusions de la circulation antérieure.

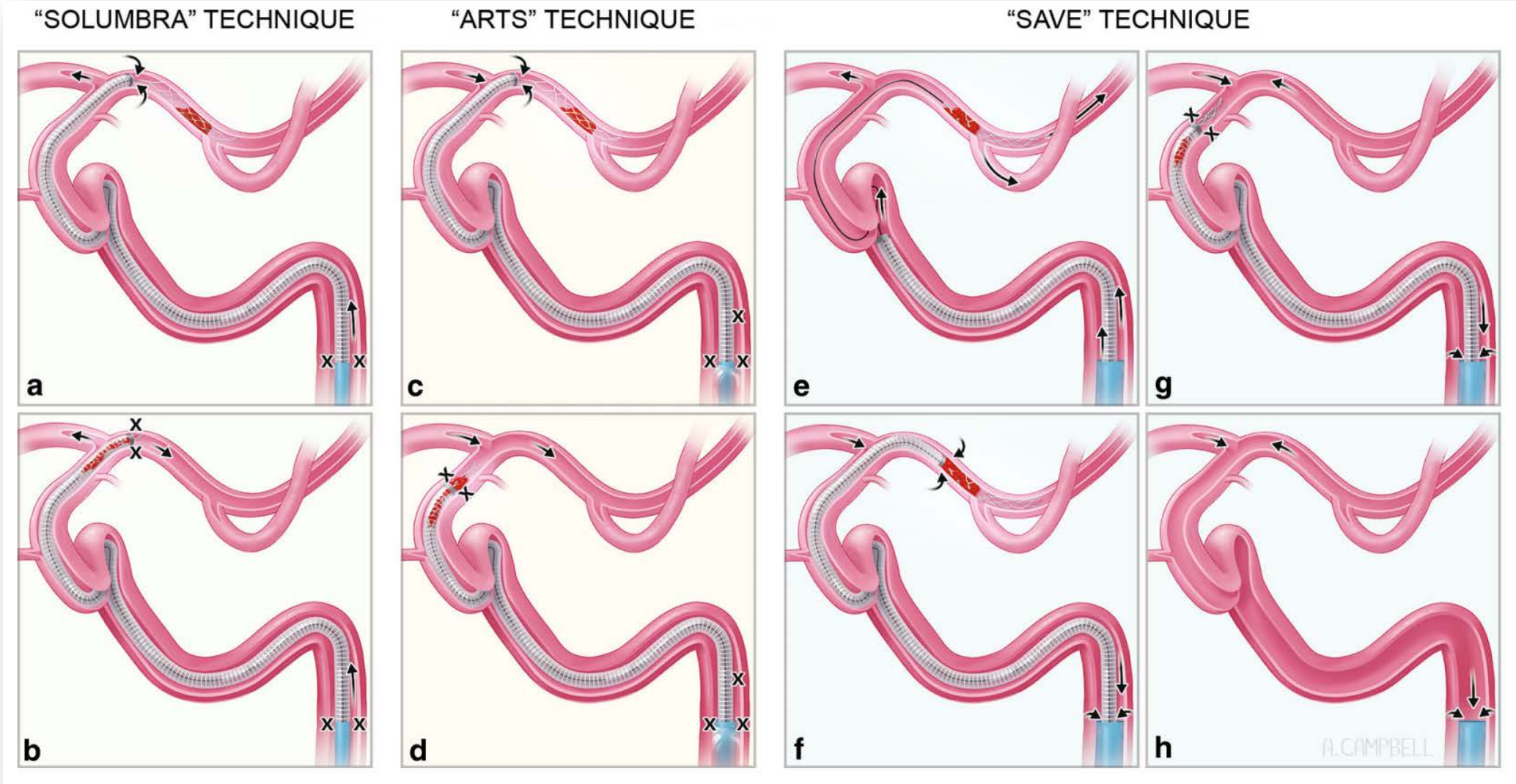
METHODE COMBINÉE

Utilisation combinée du stent retriever + cathéter intermédiaire d'aspiration
Historiquement = « solumbra »



SOLUMBRA (late 2012)

To minimize the distance the stent retriever must travel while engaging the thrombus and mitigate the possibility of losing purchase of the clot, the stent retriever is then pulled directly into a large bore intermediate catheter while maintaining aspiration.

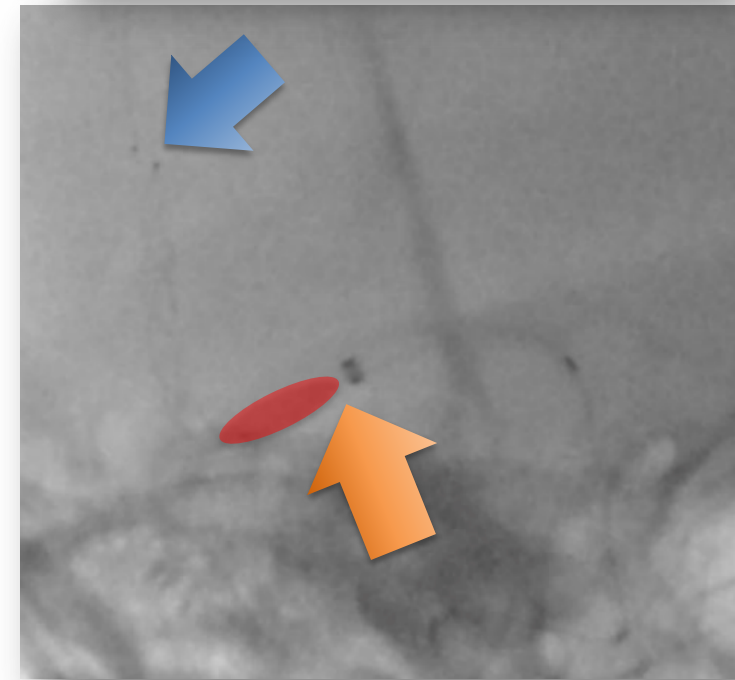
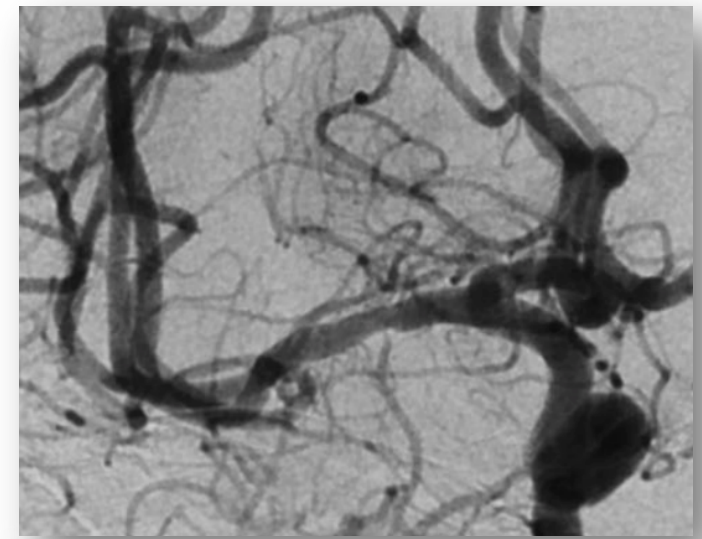
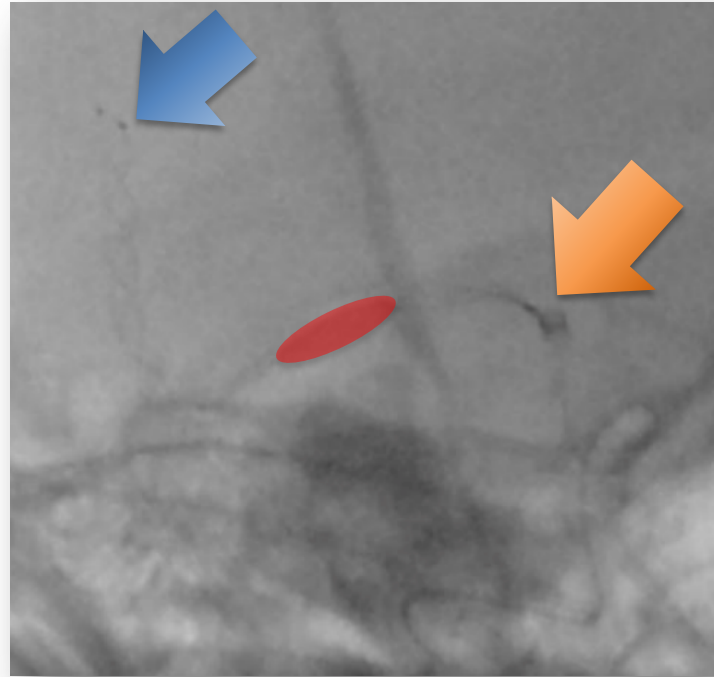
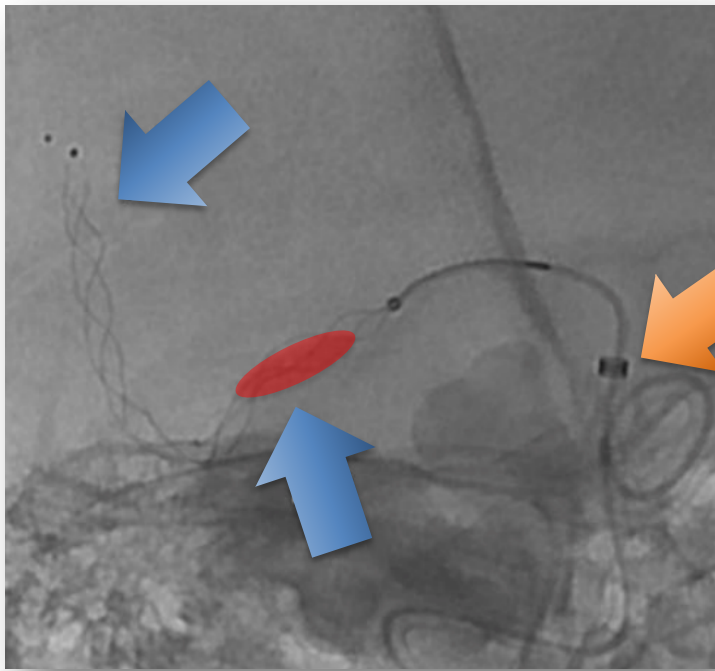


Nombreuses variantes décrites...

Maximizing First-Pass Complete Reperfusion with SAVE

Volker Maus¹ · Daniel Behme² · Christoph Kabbasch¹ · Jan Borggrefe¹ · Ioannis Tsoqkas² · Omid Nikoubashman³ · Martin Wiesmann¹ · Michael Knauth² · Anastasios Mpotsaris¹ · Marios Nikos Psychogios²

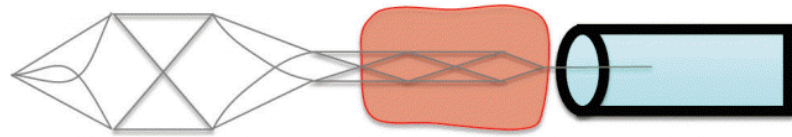
Clin Neuroradiol
13 February 2017



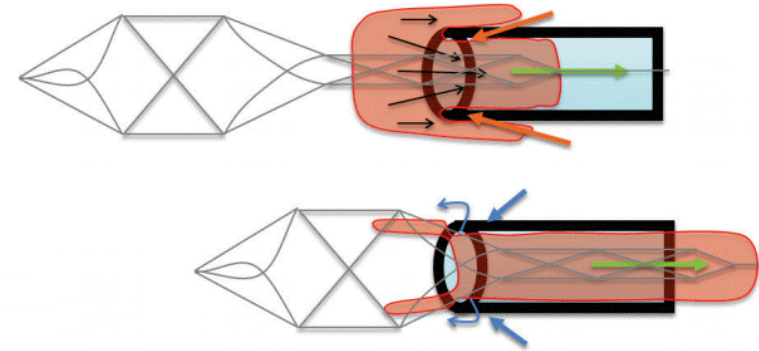
Thrombectomy in Acute Ischemic Stroke: Challenges to Procedural Success

Albert J. Yoo,^a Tommy Andersson^{b,c,d} *Journal of Stroke* 2017;19(2):121-130

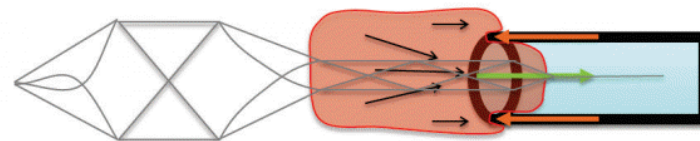
Quelle position du stent par rapport au KT d'aspiration ?



Pas de contact caillot – KT aspiration



Stent trop retiré dans le KT aspiration



Position satisfaisante du stent/KT aspiration



ASTER²
COMBINED

Combined Use of Contact Aspiration and the Stent Retriever Technique Versus Stent Retriever Alone for Recanalisation in Acute Cerebral Infarction (**ASTER2 Combined**)

Bertrand Lapergue, Raphaël Blanc, Julien Labreuche, Xavier Barreau, Jérôme Berge, Arturo Consoli, Georges Rodesch, Susanna Saleme, Vincent Costalat, Serge Bracard, Hubert Desal, Alain Duhamel, Mikael Mazighi, Laurent Spelle, Emmanuel Houdart, Frédéric Clarençon, Jean Christophe Ferré, Maalek Ben Maacha, C Prevot, Benjamin Gory, Michel Piotin.

On behalf of the ASTER2 Trial Investigators.

→ Méthode combinée Stent + KT aspiration
vs
Stent seul

Frontline Treatment	TICI 2c/3 % Patients
Combined CA+SR	131 (64.5%)
STENT RETRIEVER	117 (57.9%)

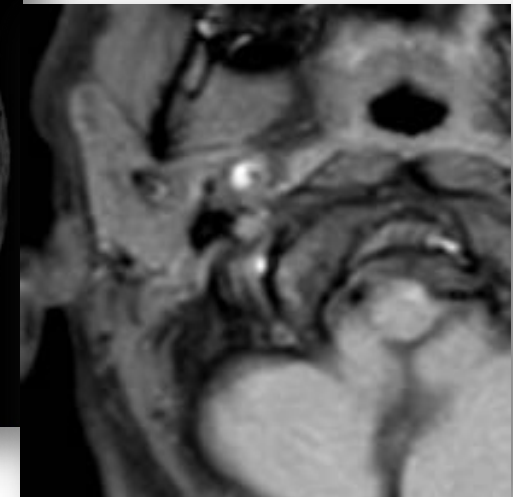
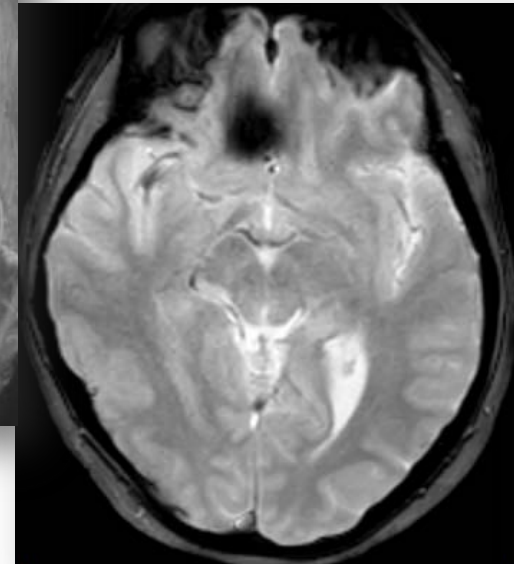
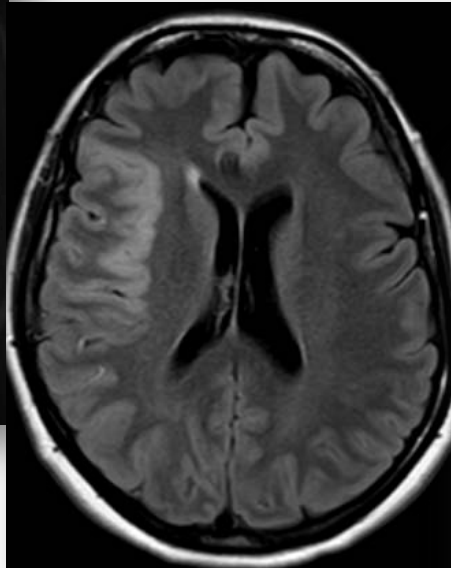
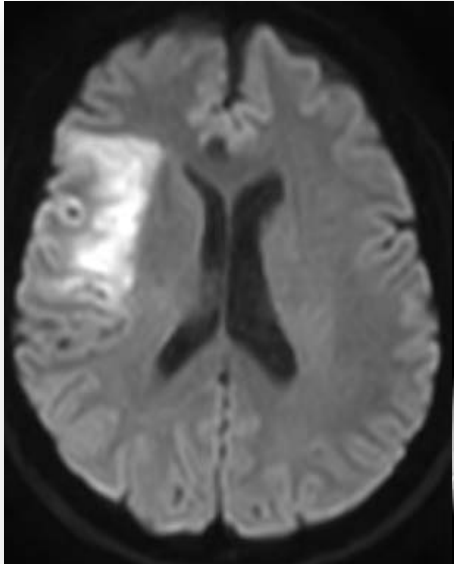
P value = 0.17

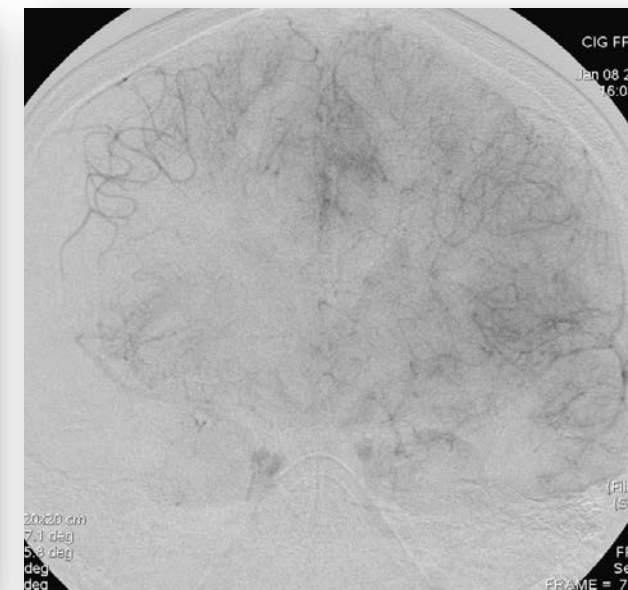
*Pas de différence statistiquement significative
entre les 2 méthodes*

CAS PARTICULIERS

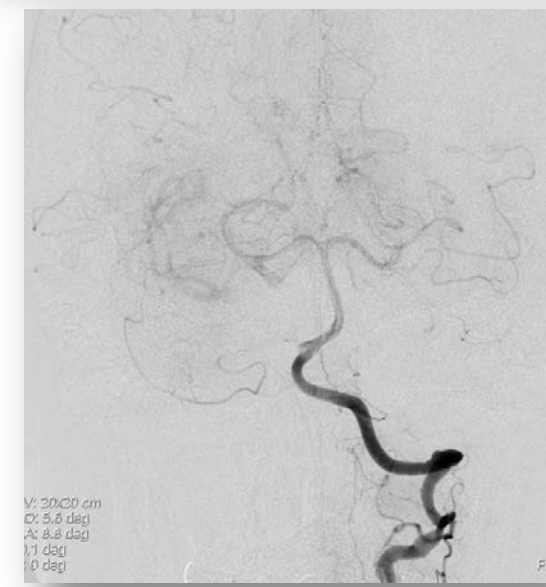
Femme de 40 ans.

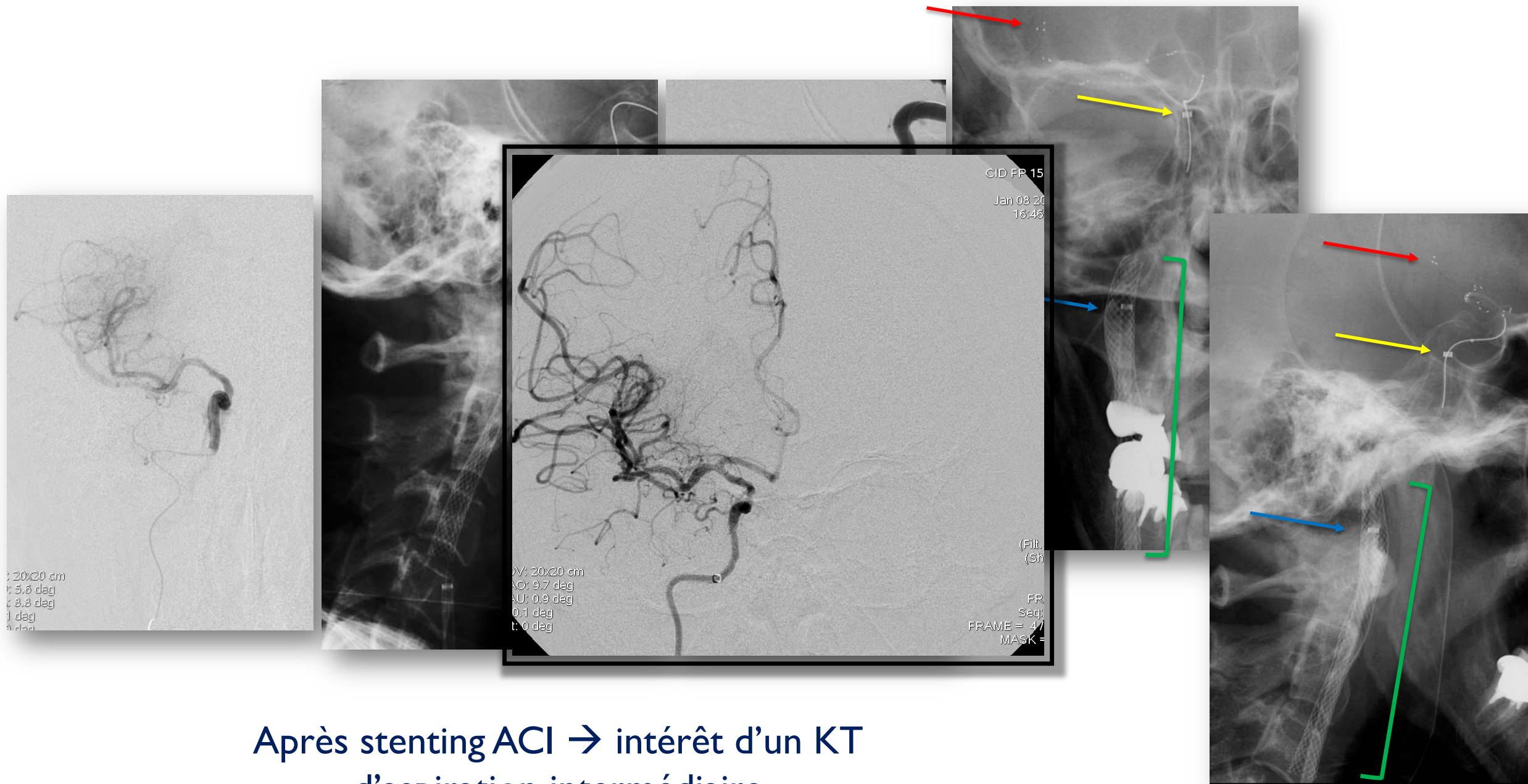
Hémiplégie gauche, troubles phasiques il y a 5h.
NIHSS 15.





Dissection ACI
+
occlusion MI-M2





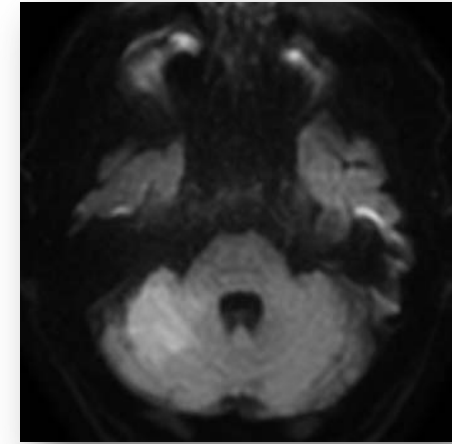
Après stenting ACI → intérêt d'un KT
d'aspiration intermédiaire

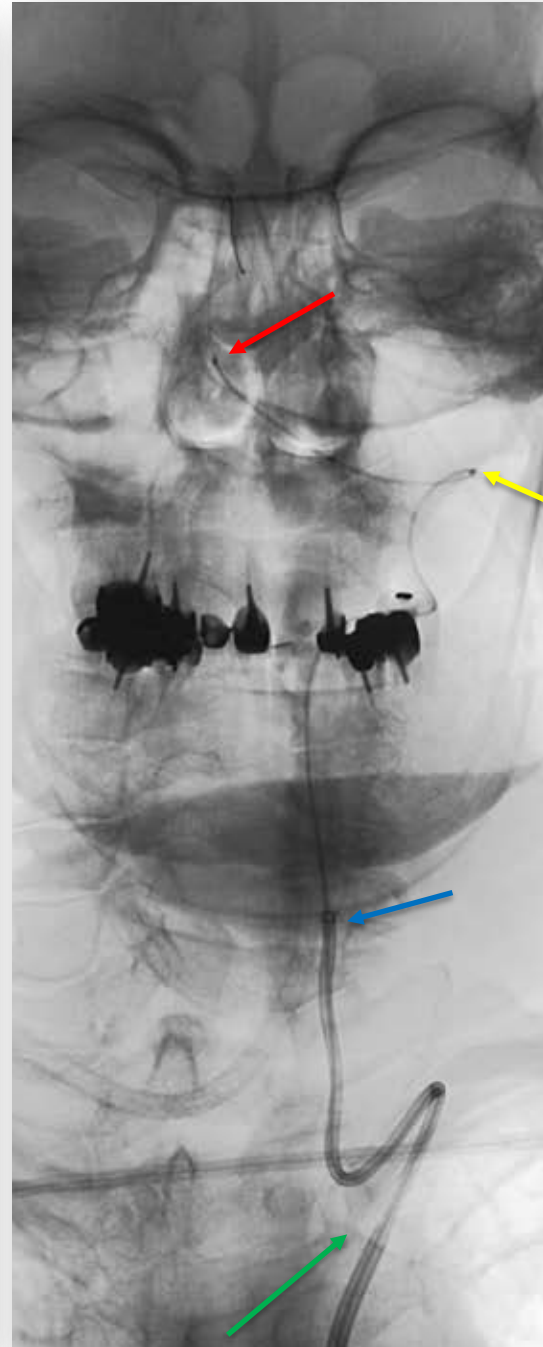
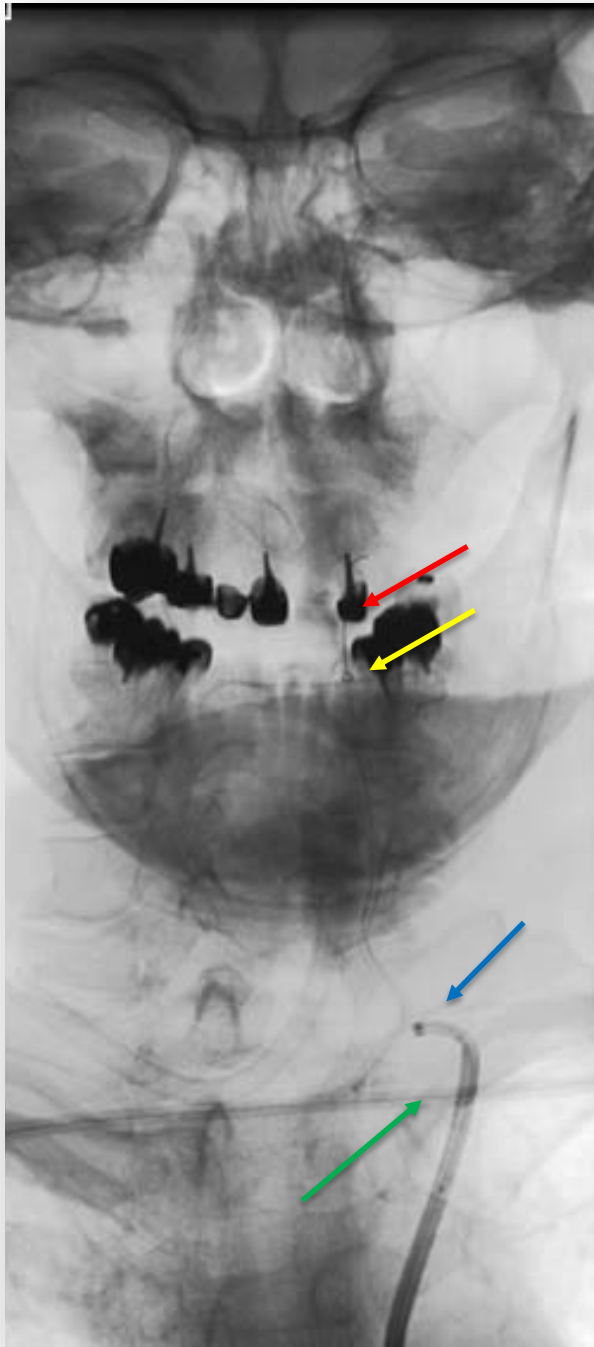
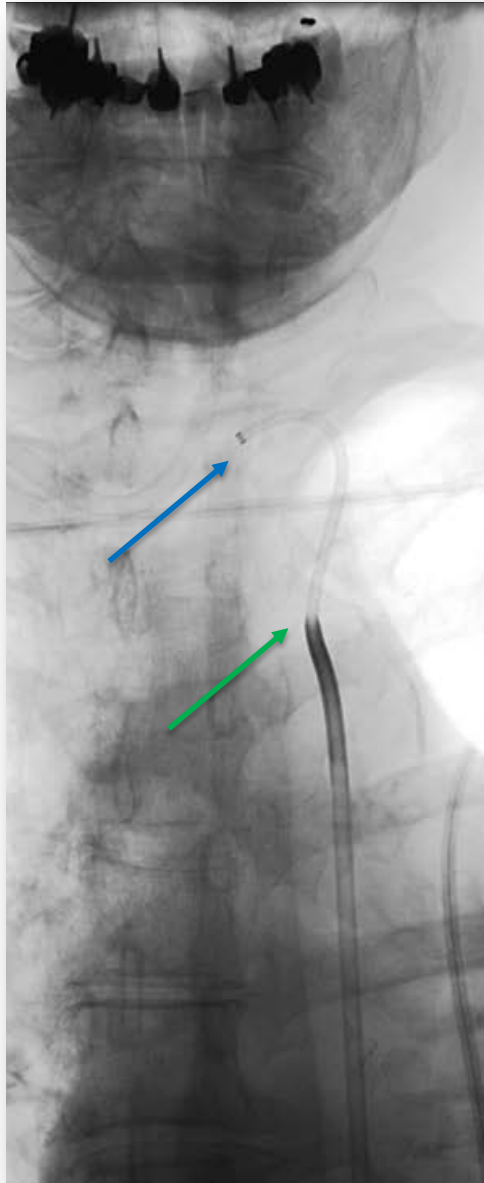
CAS PARTICULIERS



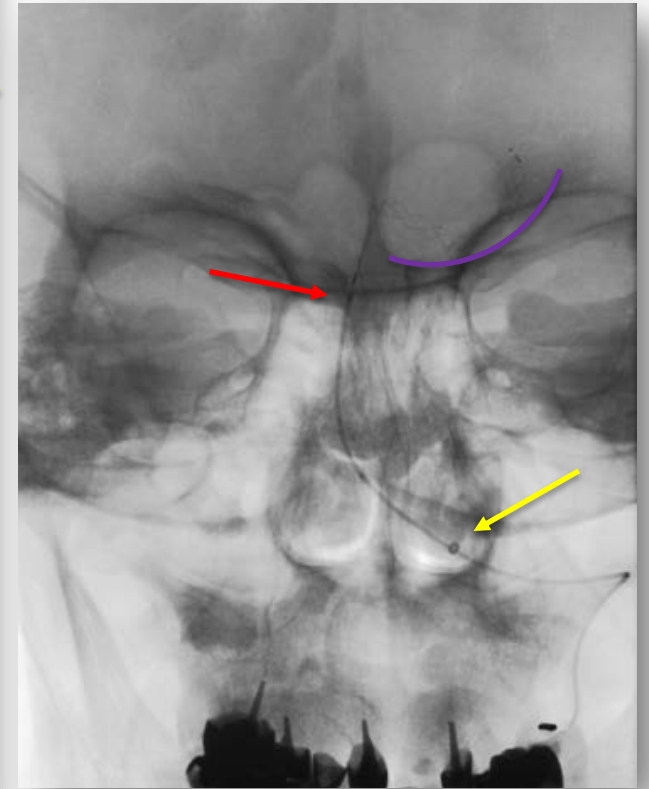
Ex : occlusion du tronc basilaire avec accès difficile...

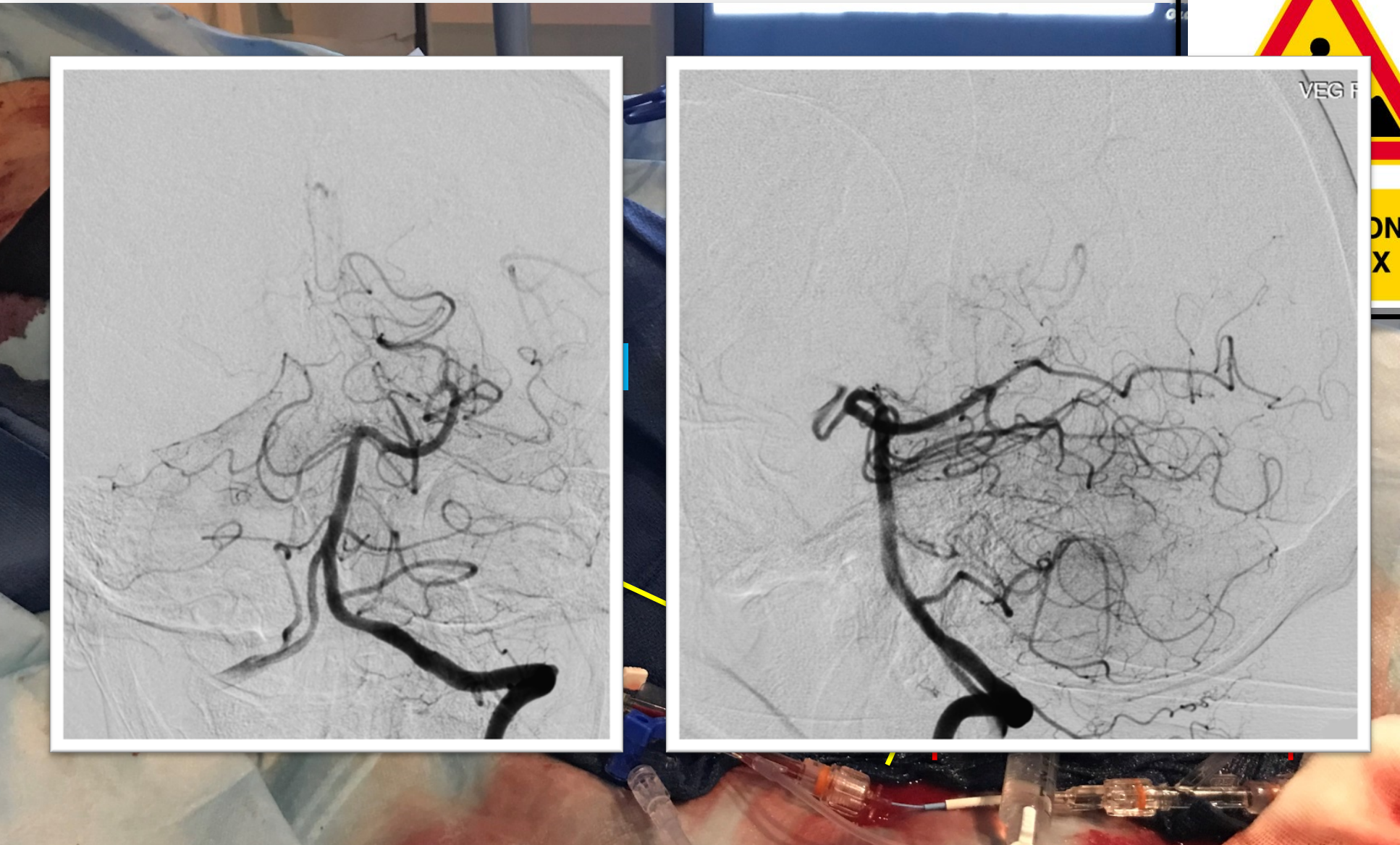
S'aider d'autres moyens pour monter le stent :
stratégie coaxiale, intro long, KT guide plus souple, KT intermédiaire etc.





Intro long 6F
Neuron 0.70
Sofia 5F
Rapid Transit
Trevor 4x20





TAKE HOME MESSAGE

Stent retriever seul vs avec KT intermédiaire...

Stratégie standardisée/systématique : améliore le workflow

Connaître quelques méthodes alternatives dans les cas difficiles

...et penser à récupérer les caillots !



MERCI !