ICCA STROKE 2019

WIST

RESİSTANT THROMBECTOMY

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DISCLOSURE STATEMENT OF FINANCIAL INTEREST

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below

AFFILIATION/FINANCIAL RELATIONSHIP	COMPANY
• Grant/Research Support	• Company One
• Consulting Fees/Honoraria	• Company Two
• Major Stock Shareholder/Equity	• Company Three
• Royalty Income	• Company Four
• Ownership/Founder	• Company Five
• Intellectual Property Rights	• Company Six
• Other Financial Benefit	

DISCLOSURE STATEMENT OF FINANCIAL INTEREST

I, (A Ozcan Ozdemir) DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

What is resistant thrombectomy?

Correlation of Thrombectomy Maneuver Count with Recanalization Success and Clinical Outcome in Patients with Ischemic Stroke

F. Seker, J. Pfaff, M. Wolf, P.A. Ringleb, S. Nagel, S. Schönenberger, C. Herweh, M.A. Möhlenbruch, M. Bendszus, and M. Pham

AJNR 2017[1]

✓Prognosis is better within 2 passes

✓NO good prognosis after 4 passes

Neuroradiology (2014) 56:397–403
DOI 10.1007/s00234-014-1346-y

INTERVENTIONAL NEURORADIOLOGY

Clinical experience with the pREset stent retriever for the treatment of acute ischemic stroke—a review of 271 consecutive cases

Wiebke Kurre · Marta Aguilar-Pérez · Elisabeth Schmid · Wolfgang Sperber · Hansjörg Bäzner · Hans Henkes

	pREset, ≤ 3 passes	pREset, >3 passes	pREset and rescue devices	All
n=	216 (79.7 %)	23 (8.5 %)	32 (11.8 %)	271 (100 %)
TICI 0	2 (0.7 %)	0 (0.0 %)	3 (1.1 %)	5 (1.8 %)
TICI 1	1 (0.4 %)	0 (0.0 %)	0 (0.0 %)	1 (0.4 %)
TICI 2a	6 (2.2 %)	0 (0.0 %)	4 (1.5 %)	8 (3.0 %)
TICI 2b	24 (8.9 %)	4 (1.5 %)	11 (4.1 %)	41 (15.1 %)
TICI 3	183 (67.5 %)	19 (7.0 %)	14 (5.2 %)	216 (79.7 %)
Median no. of passes (range)	1 (1–3)	6 (4–8)	5 (4–10)	2 (1–10)
Average procedure time (range)	44 min (8–192)	114 min (51–274)	185 min (17–738)	67 min (8–738)
HT I	22 (10.2 %)	2 (8.7 %)	3 (9.4 %)	27 (10.0 %)
HT II	20 (9.3 %)	2 (8.7 %)	3 (9.4 %)	25 (9.2 %)
PH I	8 (3.7 %)	4 (17.4 %)	2 (6.2 %)	14 (5.2 %)
PH II	11 (5.1 %)	1 (4.3 %)	1 (3.1 %)	13 (4.8 %)
Focal SAH	21 (9.7 %)	4 (17.4 %)	8 (25.0 %)	33 (12.2 %)
Diffuse SAH	6 (2.7 %)	0 (0.0 %)	0 (0.0 %)	6 (2.2 %)
Any hemorrhage	76 (35.2 %)	10 (43.5 %)	15 (46.9 %)	101 (37.2 %)
mRS 0–2 at 90 days	97 (44.9 %)	3 (13.0 %)	7 (21.8 %)	107 (39.5 %)

Angermaier et al. Intravenous thrombolysis and passes of thrombectomy as predictors for endovascular revascularization in ischemic stroke. Journal of Stroke and Cerebrovascular Disease 2016 [2]

CAUSES OF RESİSTANT THROMBECTOMY

Anatomical

- Arc type
- Servical loop
- Cavernous segment
- MCA-ICA angle

Technical

- Balloon guiding catheter
- Stent size
- Retrieval technique
- Aspiration
- Combination

Thrombus and etiology

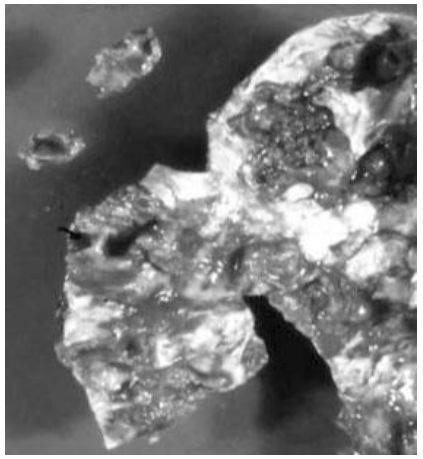
Occkusion site

- Thrombus
- Intracranial atherosclerosis

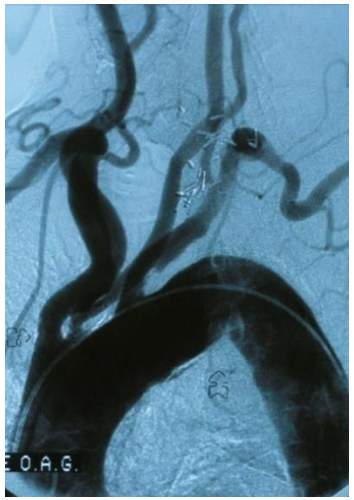
Ischemic complication

- ENT
- Distal emboli

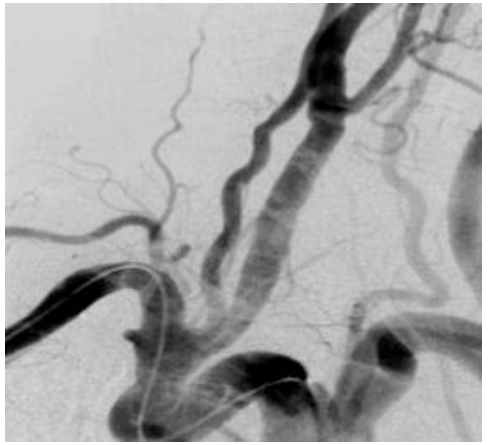
ANATOMICAL -ARCUS AORTA



Arch thrombus



Tip III arch



Carotid tortuosity

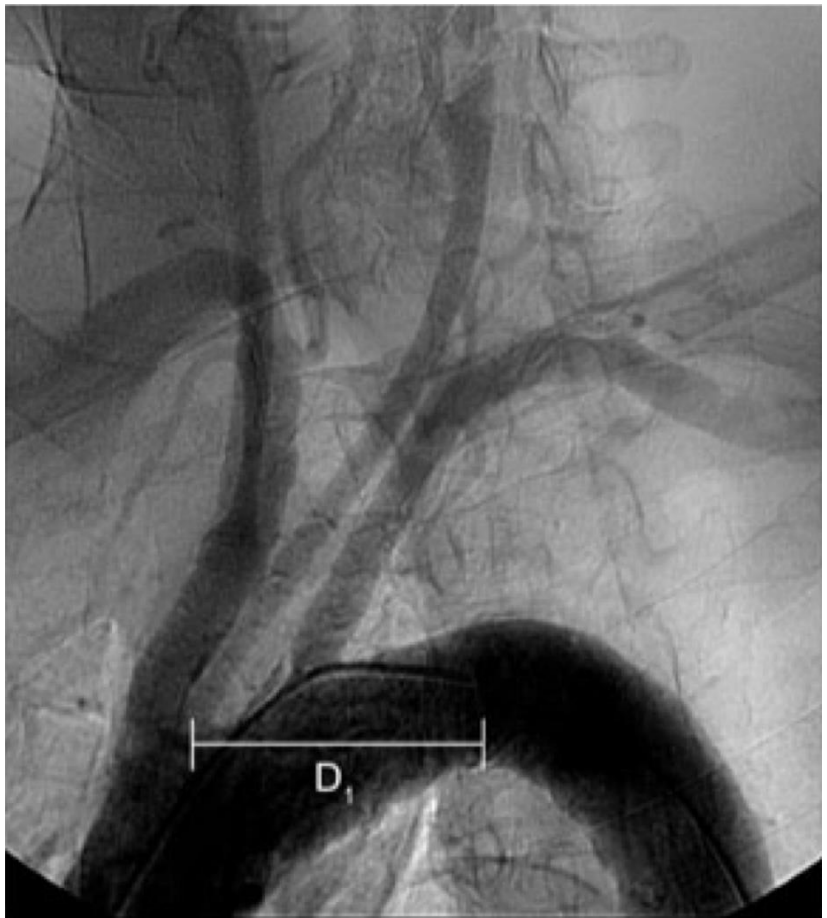
Ali F Abu Rahma. Predictors of perioperative stroke/death after carotid artery stenting: a review article. Ann Vasc Dis. 2018

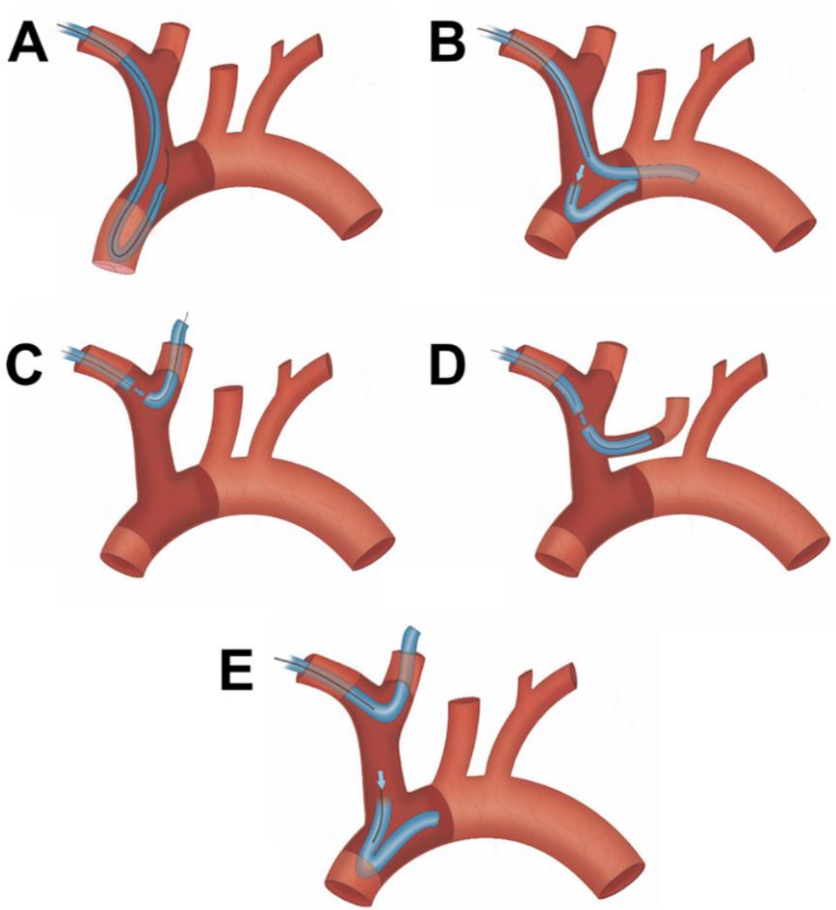
Solution 1

ORIGINAL RESEARCH

Transradial cerebral angiography: techniques and outcomes JNIS 2017

Brian M Snelling,[1] Samir Sur,[1] Sumedh S Shah,[1] Priyank Khandelwal,[1] Justin Caplan,[1] Rianna Haniff,[1] Robert M Starke,[1,2] Dileep R Yavagal,[3] Eric C Peterson[1]





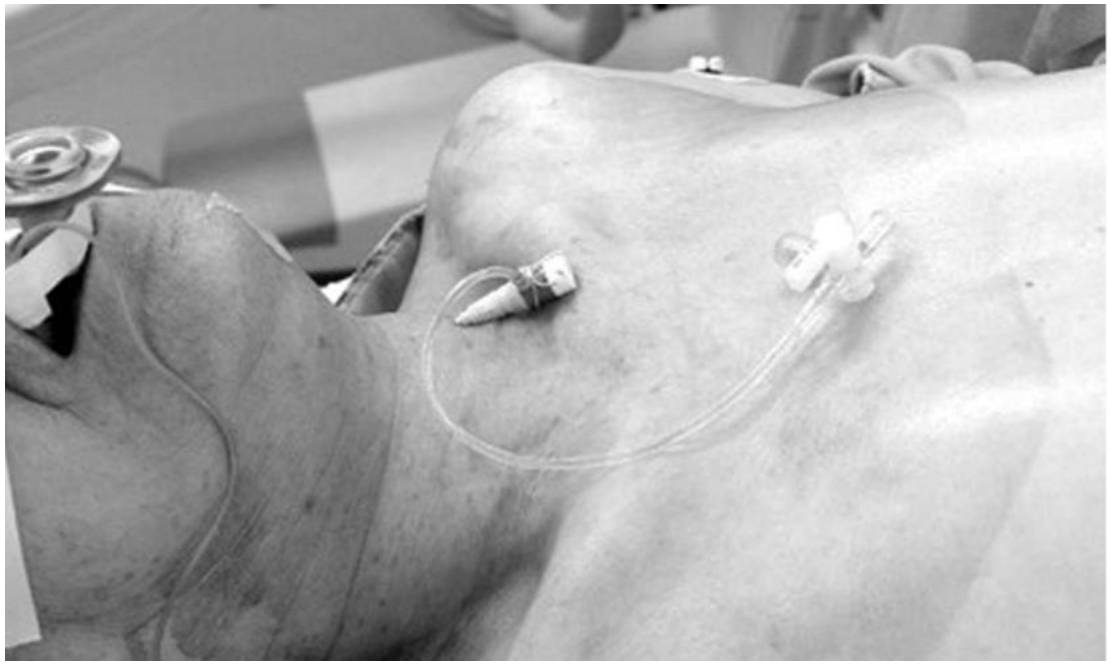
Solution 2

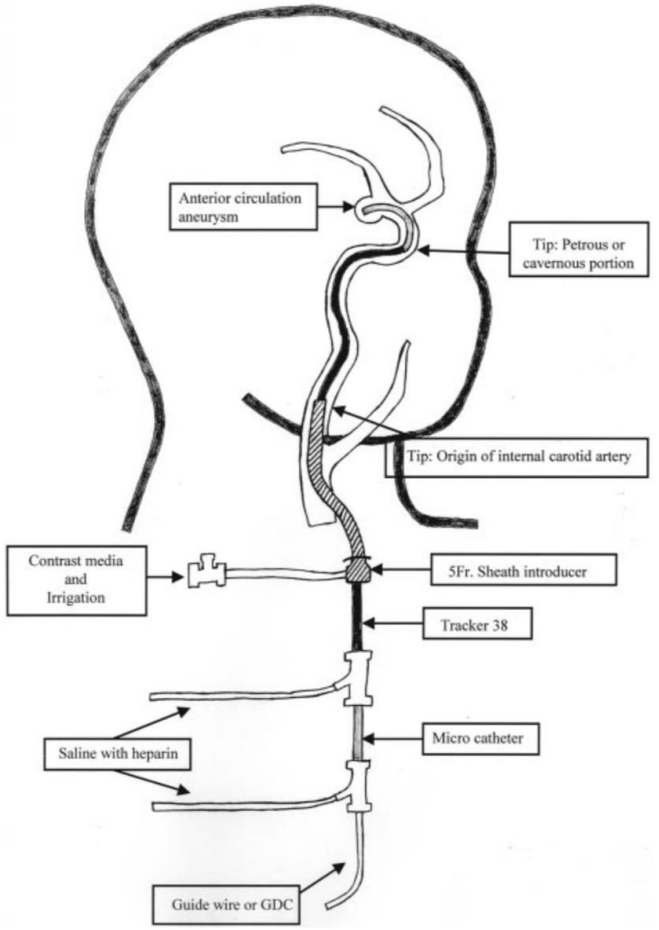
ORIGINAL RESEARCH

Transcervical access in acute ischemic stroke

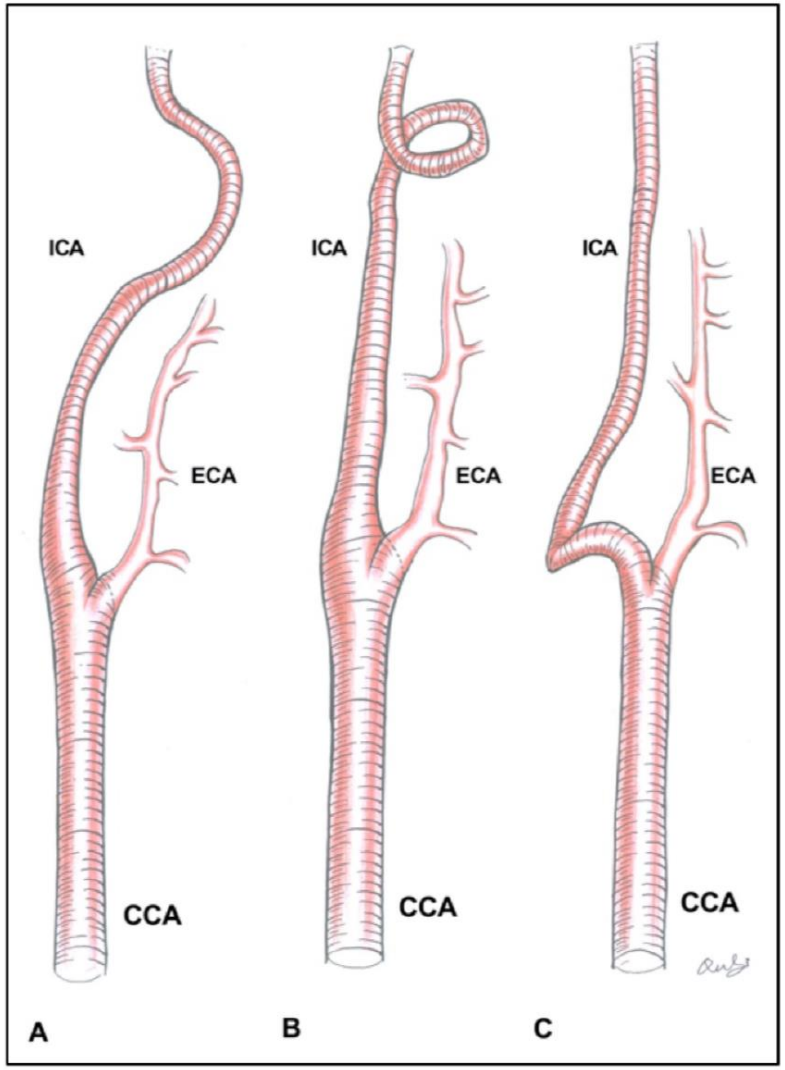
Ashutosh P Jadhav,[1] Marc Ribo,[3] Ramesh Grandhi,[2] Guillermo Linares,[1]
Amin Aghaebrahim,[1] Tudor G Jovin,[1] Brian T Jankowitz[2]

JNIS 2015

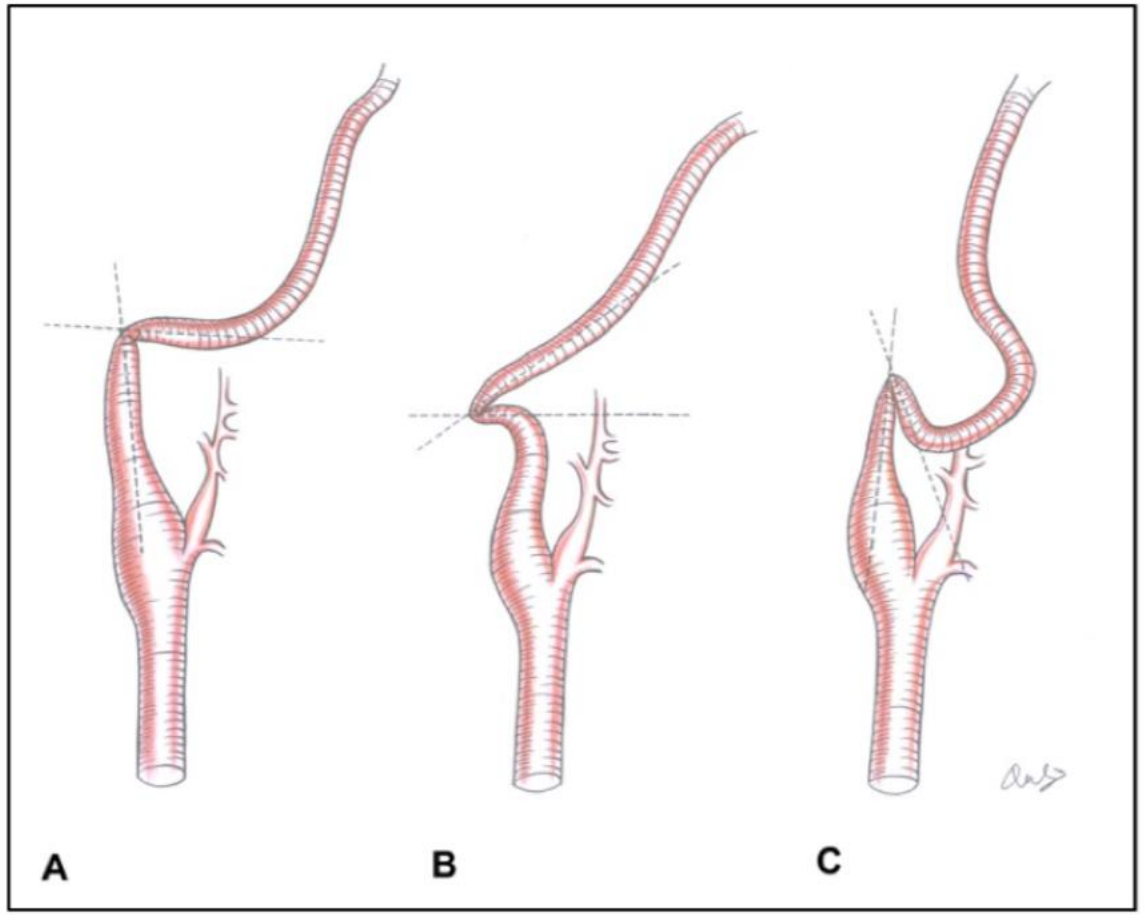




ANATOMICAL-Carotid loop



Tortuöz Koil Kink



90˚-60˚ 60˚-30˚ 30˚<

Recommendation

- ✓Perform road map while passing the cervical kink or coil
- ✓Do not pass cervical severe looop with guiding cathether or sheath.
- ✓Guide-wire needs to be in J shape
- ✓Combination of DAC and stent may be used
- ✓Nimodipine can be administered
- ✓Be ready for dissection

Technical

Balloon guiding catheters ?

NASA Registry

Subgroup Analysis: Anterior Circulation Only, BGC vs. No BGC

	Solitaire with Balloon Guide (N=149)	Solitaire without BGC (N=189)	P Value
Procedure Time	120 min	161 min	0.02
Rescue Therapy	29	54	0.05
TICI 3 Revascularization	53.7%	32.5%	<0.0001
Discharge NIHSS	12	17.5	NA
90 Day mRS 0-2	51.6%	35.8%	0.02

Balloon guide catheter improves recanalization, procedure time, and clinical outcomes with Solitaire in acute stroke: analysis of the NASA Registry. T Nguyen et al. J Neurointervent Surg 2013(5) A2-A3 2013. Stroke. 2014

Optimizating Clot Retrieval in Acute Stroke

The Push and Fluff Technique for Closed-Cell Stentrievers

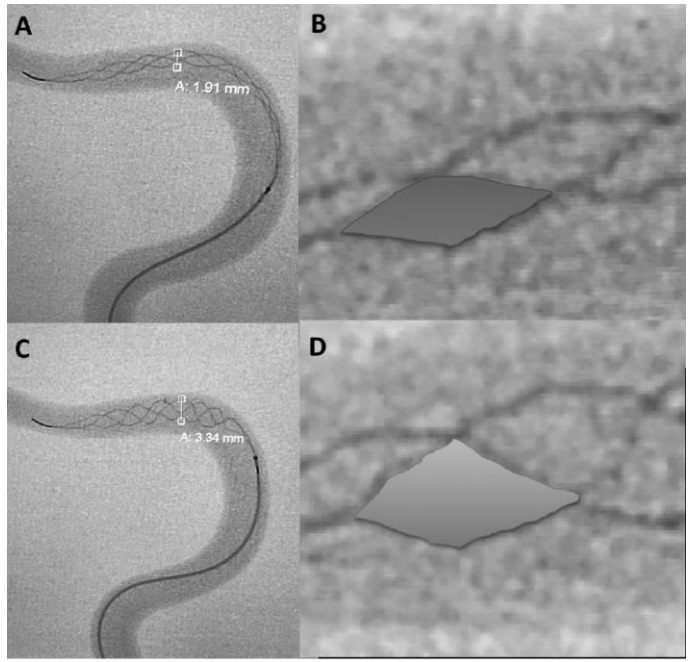
Diogo C. Haussen, MD; Leticia C. Rebello, MD; Raul G. Nogueira, MD

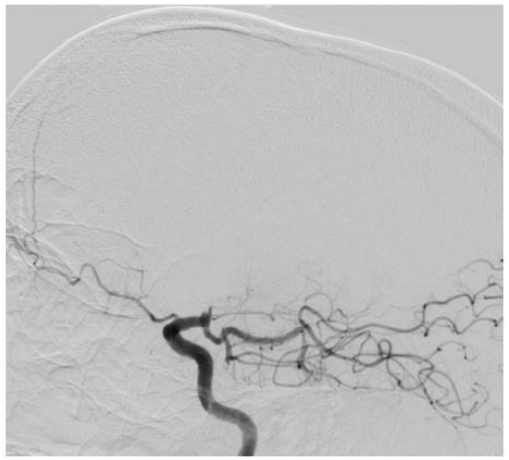
Background and Purpose—We aimed to investigate the safety and efficacy of the Push and Fluff technique (PFT) as compared with the standard unsheathing technique for closed-cell stent retrievers in acute ischemic stroke.

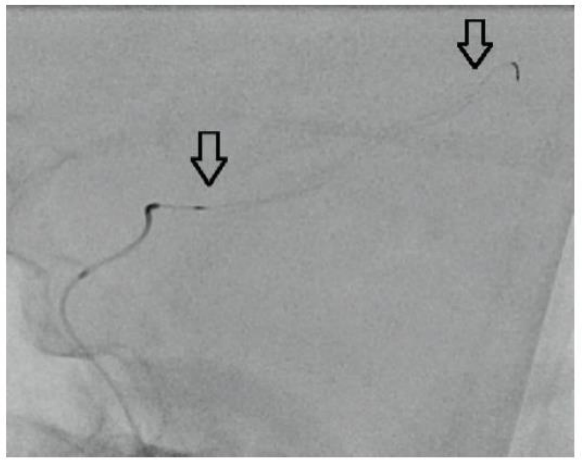
Methods—Acute ischemic stroke thrombectomy database was analyzed (September 2010 to January 2015) with the Trevo Retriever as a primary strategy. The PFT was compared with our internal standard unsheathing technique and with the Trevo Versus Merci Retrievers for Thrombectomy Revascularization of Large Vessel Occlusions in Acute Ischemic Stroke 2 (TREVO2) trial. Additionally, a silicon flow model was used to compare cell size/configuration, wall apposition/device diameter, and degree of foreshortening/device length across the 2 techniques.

Results—One hundred fifty-one out of 662 patients qualified for the study. The PFT (n=71) was associated with higher rates of first-pass reperfusion (54% versus 35%, P=0.03; 54% versus 32.6%, P<0.01), lower number of passes (1.3±0.8 versus 1.8±1.0, P<0.01; 1.7±1.0 versus 2.4±1.6, P<0.01), and higher rates of modified treatment in cerebral ischemia-3 reperfusion (58% versus 40%, P=0.03; 58% versus 14%, P<0.01) as compared with the standard unsheathing technique (n=81) and the TREVO2 Trevo arm (n=88), respectively. No differences in hemorrhagic complications were observed across the groups. The in vitro model indicated that, compared with standard unsheathing technique, PFT resulted in improved wall apposition (device diameter, 75% larger) and cell size (mean area, 51% larger) at the cost of a mild degree of foreshortening (25% length reduction).

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.)**





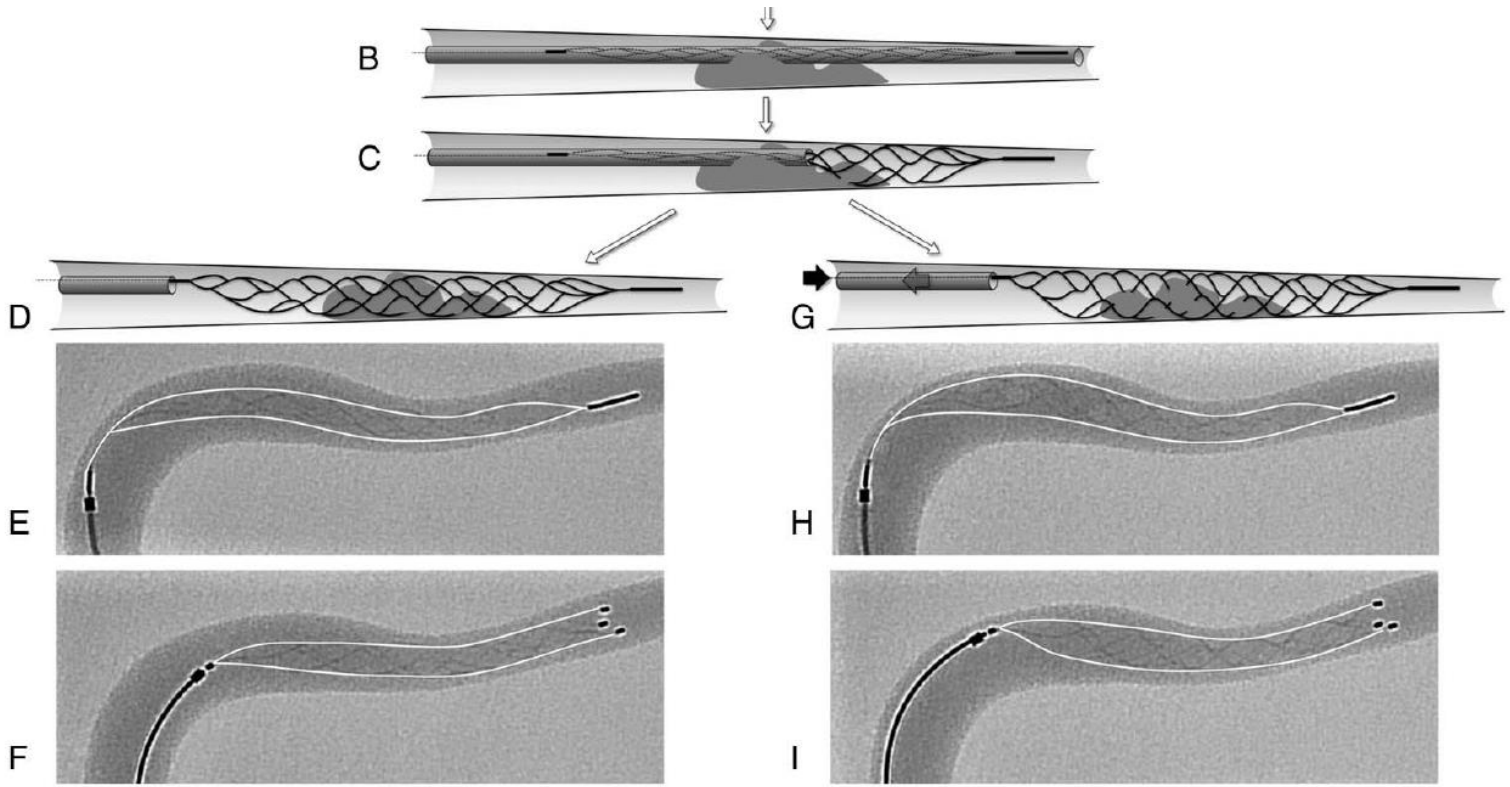


- ✓ First pass thrombectomy
- ✓ Reperfusion rate

ORIGINAL RESEARCH

Active push deployment technique improves stent/ vessel-wall interaction in endovascular treatment of acute stroke with stent retrievers

Martin Wiesmann,[1] Marc-Alexander Brockmann,[1] Sarah Heringer,[1]
Marguerite Müller,[1] Arno Reich,[2] Omid Nikoubashman[1,3]



J NeuroIntervent Sur 2017;9:253-256

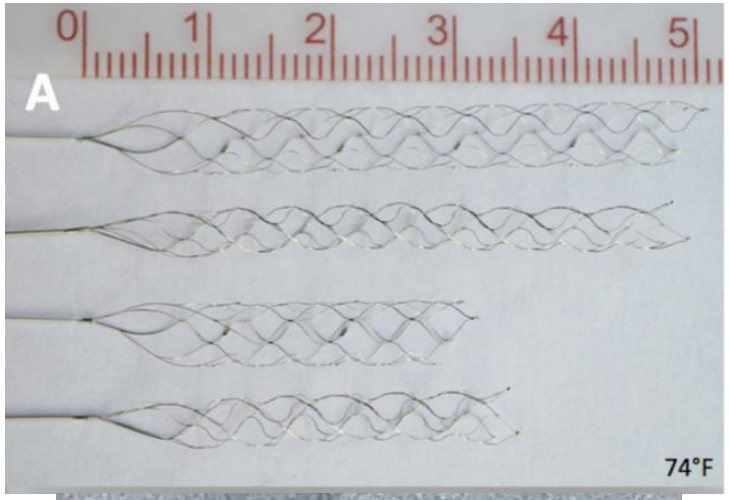
TICI 3 rekanalizasyon

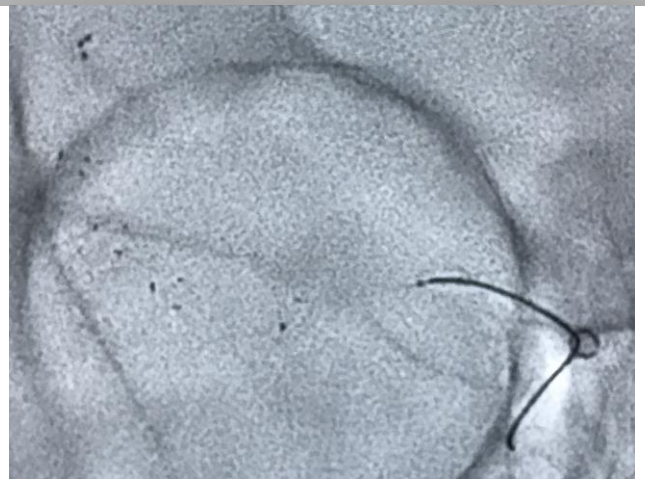
ORIGINAL RESEARCH

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

Haussen DC, *et al*. *J NeuroIntervent Surg* 2018;**0**:1–4. doi:10.1136/neurintsurg-2018-013918





Soliteire 4-40 mm
Trevo 4-30 mm

→ Soliteire Platinium
Trevo ProVue

Soliteire 4-20 mm
Trevo 4-20 mm

→ Non-Radioopaque
Trevo, Soliteire

Multivariate analysis for first pass thrombectomy

	OR	%95 CI	p
Lon stent retriever	2.21	1.36-3.60	0.001
Radiopaque device	2.10	1.29-3.42	0.003
Local tromboaspiration	2.43	1.34-4.38	0.003
IV rtPA	1.57	0.99-2.49	0.05
NIHSS	1.01	0.57-1.05	015

Switching Strategy for Mechanical Thrombectomy of Acute Large Vessel Occlusion in the Anterior Circulation

Dong-Hun Kang, MD; Yong-Won Kim, MD; Yang-Ha Hwang, MD; Jaechan Park, MD; Jeong-Hyun Hwang, MD; Yong-Sun Kim, MD

Background and Purpose—We introduce the concept of a switching strategy for mechanical thrombectomy with period-to-period analysis. In period 1, forced arterial suction thrombectomy with a Penumbra reperfusion catheter was performed, even in difficult cases; in period 2, forced arterial suction thrombectomy was initially performed, with switching to Solitaire in difficult cases.

Methods—We analyzed 135 consecutive patients treated with mechanical thrombectomy with acute large vessel occlusion in the anterior circulation, 61 from period 1 and 74 from period 2. We defined difficult case for both periods as ≥3 failed attempts at recanalization.

Results—Period 2 showed a trend for better angiographic outcome of Thrombolysis in Cerebral Infarction 2b-3 (73.8%, period 1 versus 85.1%, period 2; P=0.10). In interperiod subgroup analysis of difficult cases, switching significantly outperformed nonswitching in Thrombolysis in Cerebral Infarction 2b-3 recanalization (52.7% versus 82.9%; P=0.030). Differences in puncture-to-recanalization time, symptomatic intracranial hemorrhage incidence, and procedure-related complications were not statistically significant.

Conclusions—A switching strategy using 2 mechanical thrombectomy techniques (forced arterial suction thrombectomy to Solitaire) may harbor better angiographic outcomes than a 1 technique only strategy (forced arterial suction thrombectomy). **(*Stroke*. 2013;44:3577-3579.)**

Strateji 1: Aspiration only
Strateji 2: ≥3 stent after aspiration

	Strateji 1 N=26	Strateji 2 N=35	p
TICI 2b-3 (%)	57.7	83	0.03
Symptomatic ISH (%)	7.7	11.4	0.628
mRS 0-2 (%)	27	63	0.005

ORIGINAL RESEARCH

Outcomes of manual aspiration thrombectomy for acute ischemic stroke refractory to stent-based thrombectomy

Seul Kee Kim,[1] Woong Yoon,[1] Sung Min Moon,[1] Man Seok Park,[2] Gwang Woo Jeong,[1] Heoung Keun Kang[1]

Kim SK, *et al*. *J NeuroIntervent Surg* 2015;**7**:473–477. doi:10.1136/neurintsurg-2014-011203

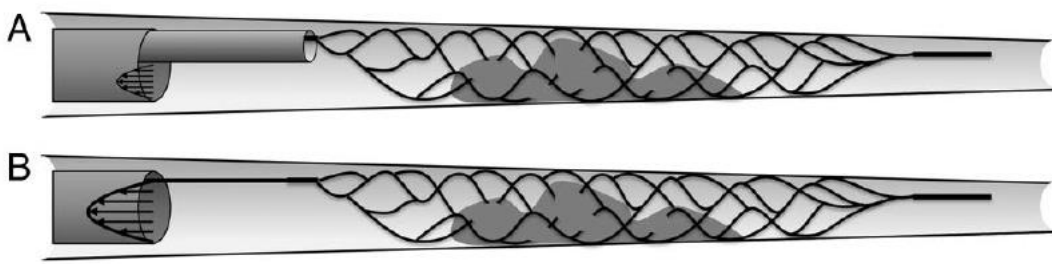
- ✓ Aspiration after >5 thrombectomy
- ✓ TICI 2b-3=%83
- ✓ TICI 3=%57
- ✓ 3 month mRS 0-2=%37
- ✓ ISH= %0

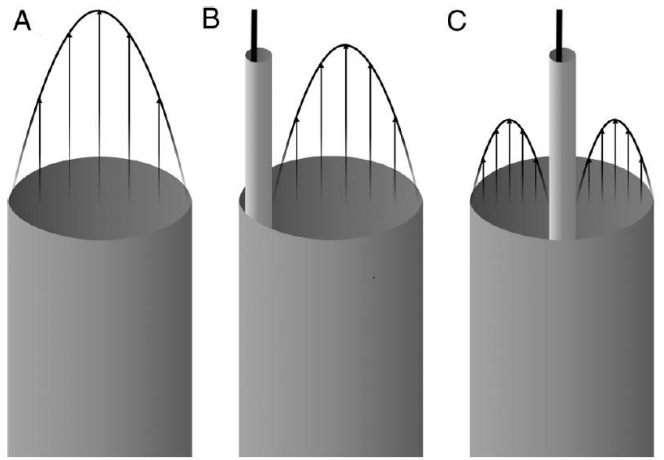
ORIGINAL RESEARCH

Optimizing endovascular stroke treatment: removing the microcatheter before clot retrieval with stent-retrievers increases aspiration flow

Omid Nikoubashman,[1,2] Jan Patrick Alt,[1] Arash Nikoubashman,[3] Martin Büsen,[4] Sarah Heringer,[1] Carolin Brockmann,[1] Marc-Alexander Brockmann,[1] Marguerite Müller,[1] Arno Reich,[5] Martin Wiesmann[1]

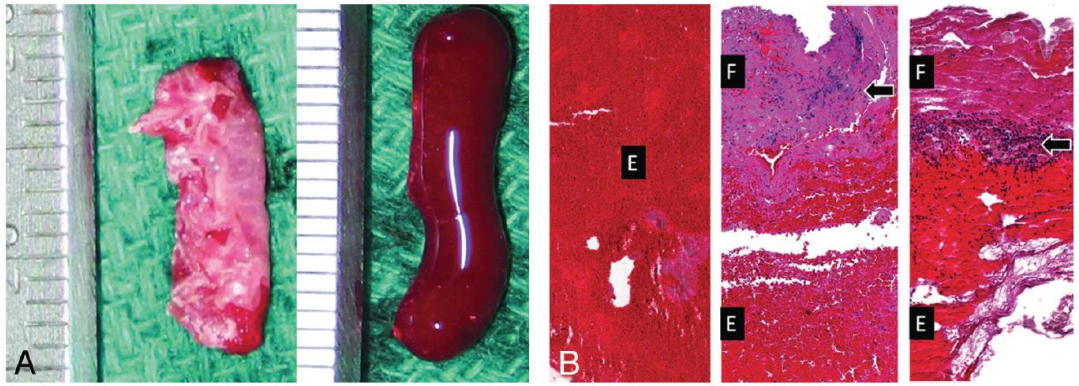
Nikoubashman O, *et al*. *J NeuroIntervent Surg* 2017;**9**:459–462. doi:10.1136/neurintsurg-2016-012319

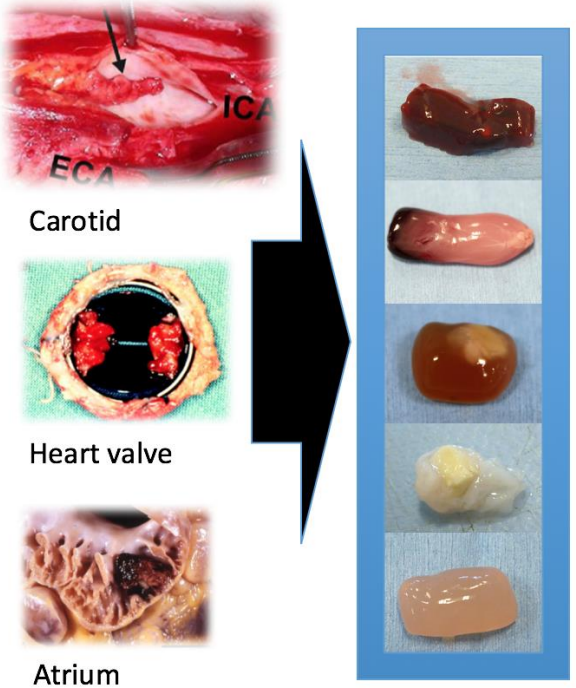


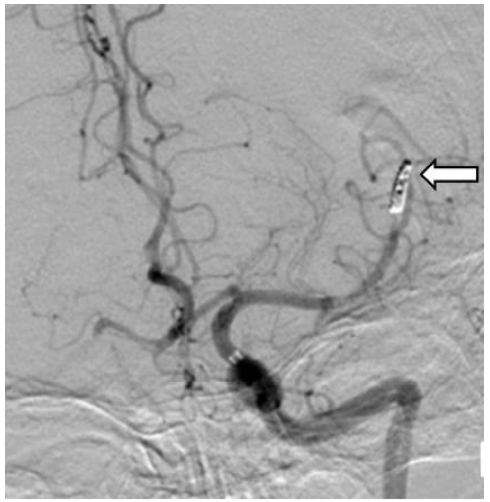


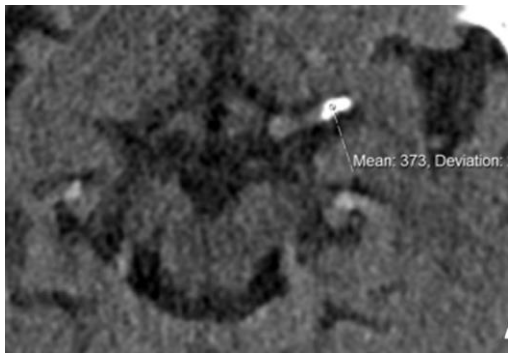
$$\dot{V} = \frac{\pi \Delta P}{8 \eta l}\left[R_e^4 - R_i^4 - \frac{(R_e^2 - R_i^2)^2}{\ln(R_e/R_i)}\right]$$

Thrombus structure

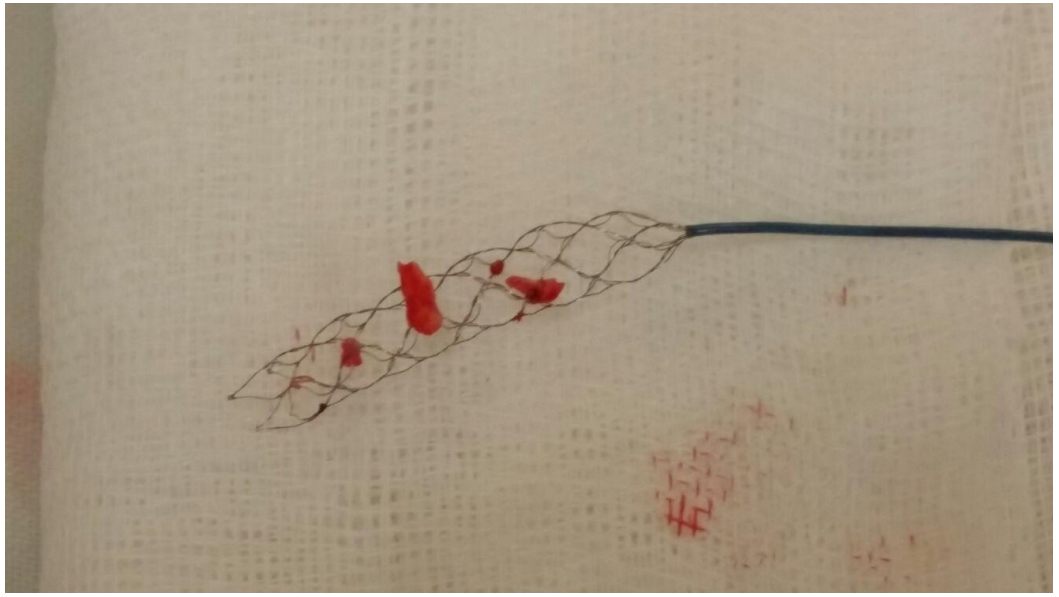








Liebeskind et al. CT and MRI early vessel signs reflect clot composition in acute stroke. Stroke 2011
Ahn H S et al. Histological features of acute thrombi retrieved from stroke patients during mechanical reperfusion therapy. International Journal of Stroke 2016
Dubrocy T et al. Thrombectomy of calcified emboli in stroke. Does histology of thrombi influence the effectiveness of thrombectomy? J Neurointerventional Surg 2017

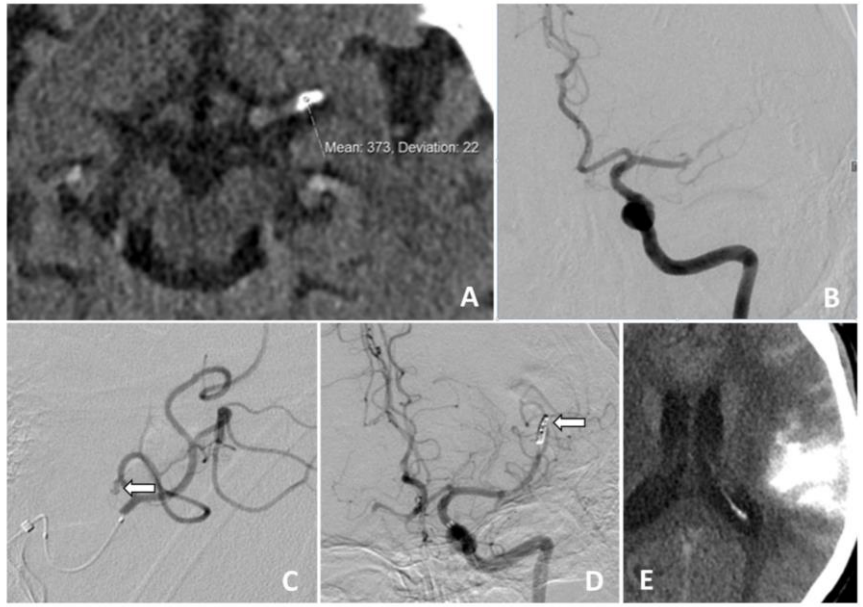


Missing clot during mechanical thrombectomy in acute stroke using Soliteire stent retrieval system. Ann Indian Acad Neurol 2016

ORIGINAL RESEARCH

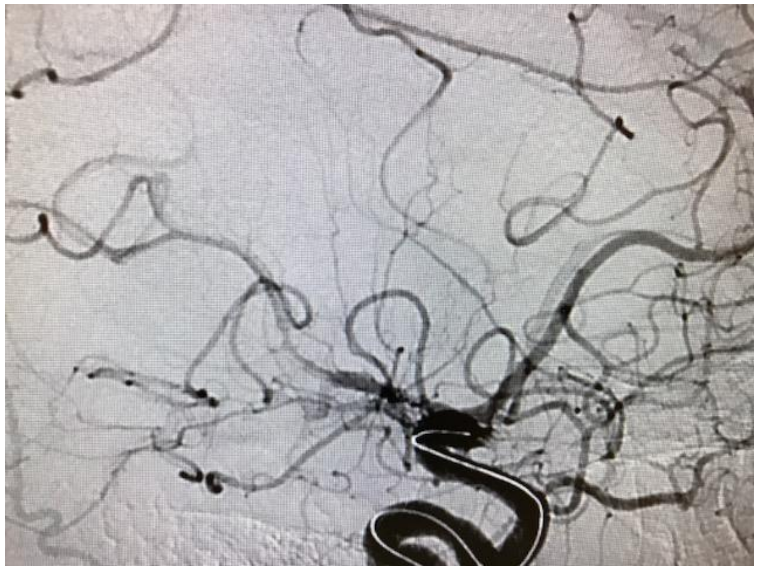
Thrombectomy of calcified emboli in stroke. Does histology of thrombi influence the effectiveness of thrombectomy? August 2017. JNIS

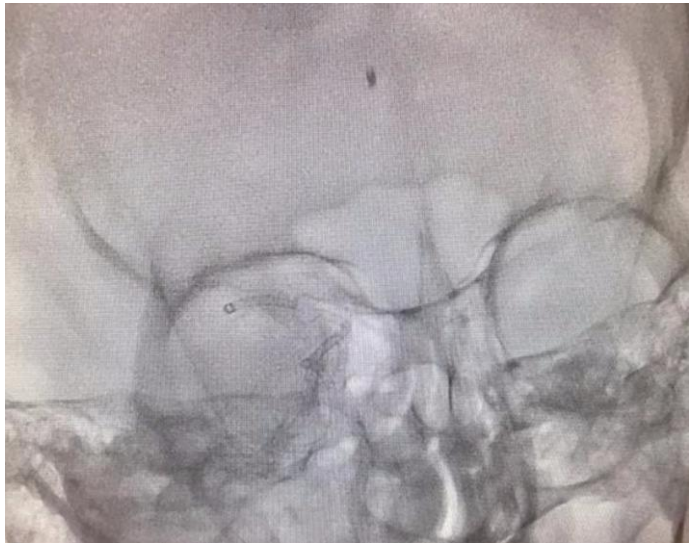
Tomas Dobrocky,[1] Eike Piechowiak,[1] Alessandro Cianfoni,[2]
Felix Zibold,[1] Luca Roccatagliata,[2] Pascal Mosimann,[1] Simon Jung,[3] Urs Fischer,[3]
Pasquale Mordasini,[1] Jan Gralla[1]

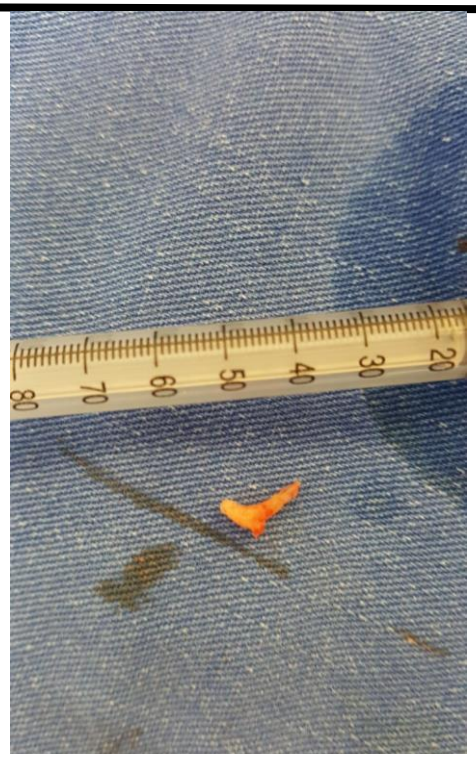


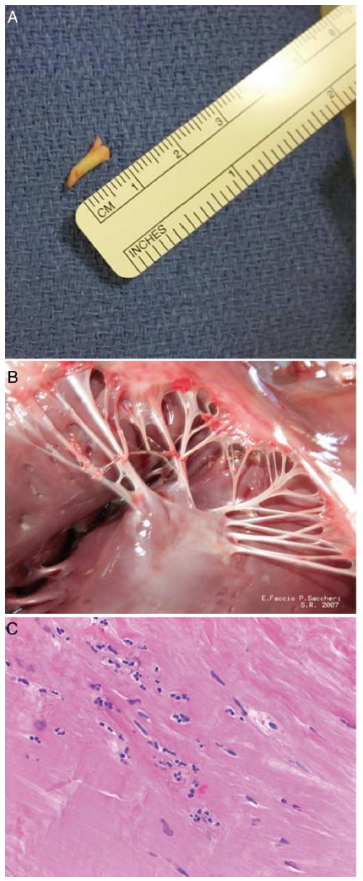
- ✓ TICI 2b-3 recanalization=12,5%
- ✓ Poor prognosis =12.5%
- ✓ ICH rate higher

DİFFERENT EMBOLİC MATERİALS









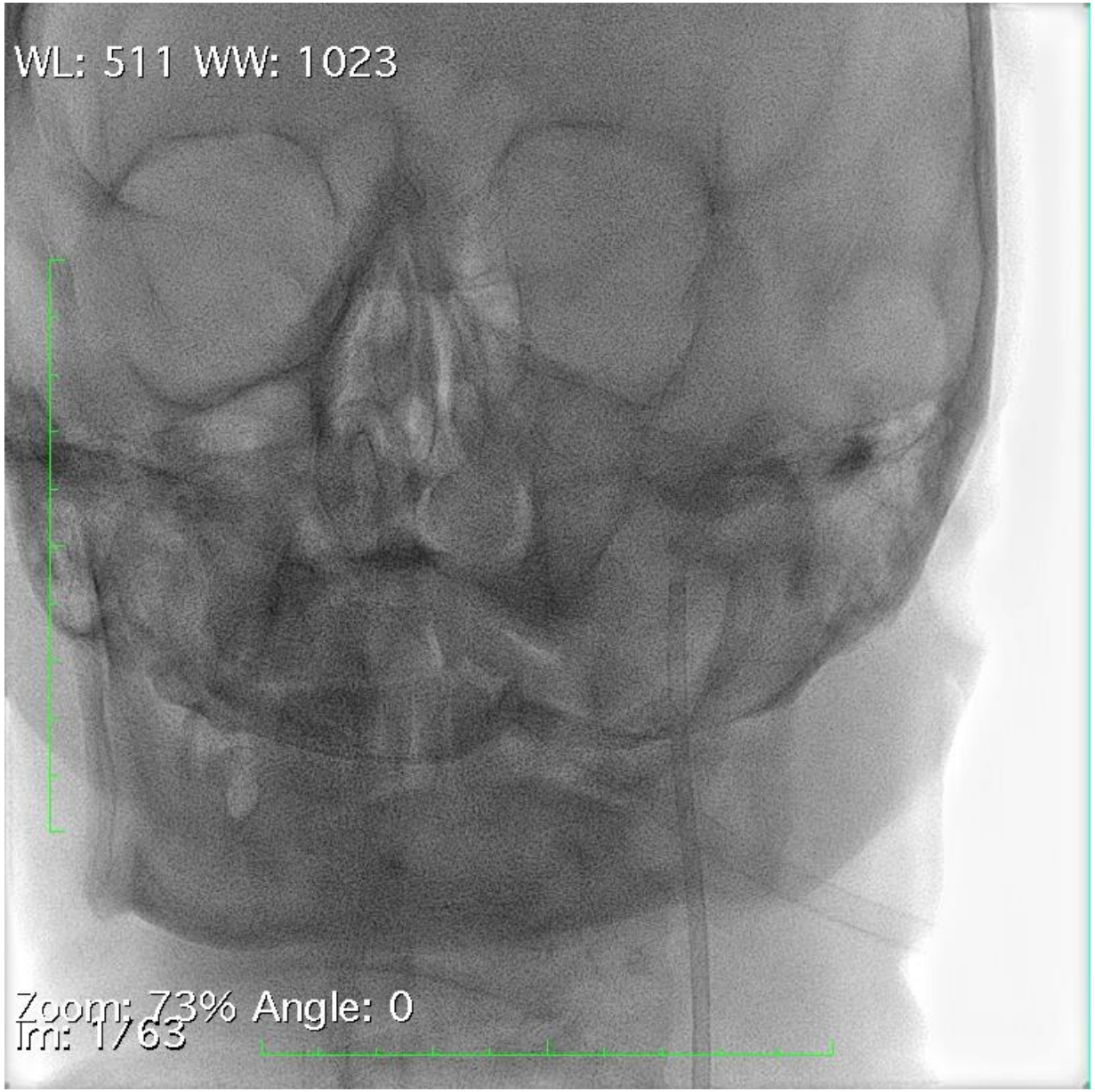
CASE REPORT

A case of right middle cerebral artery 'tendonectomy' following mitral valve replacement surgery

Mary C Thomas,[1] Josser E Delgado Almandoz,[2] Adam J Todd,[3] Mark L Young,[3] Jennifer L Fease,[1] Jill Marie Scholz,[2] Anna M Milner,[2] Maximilian Mulder,[4] Yasha Kayan[2]

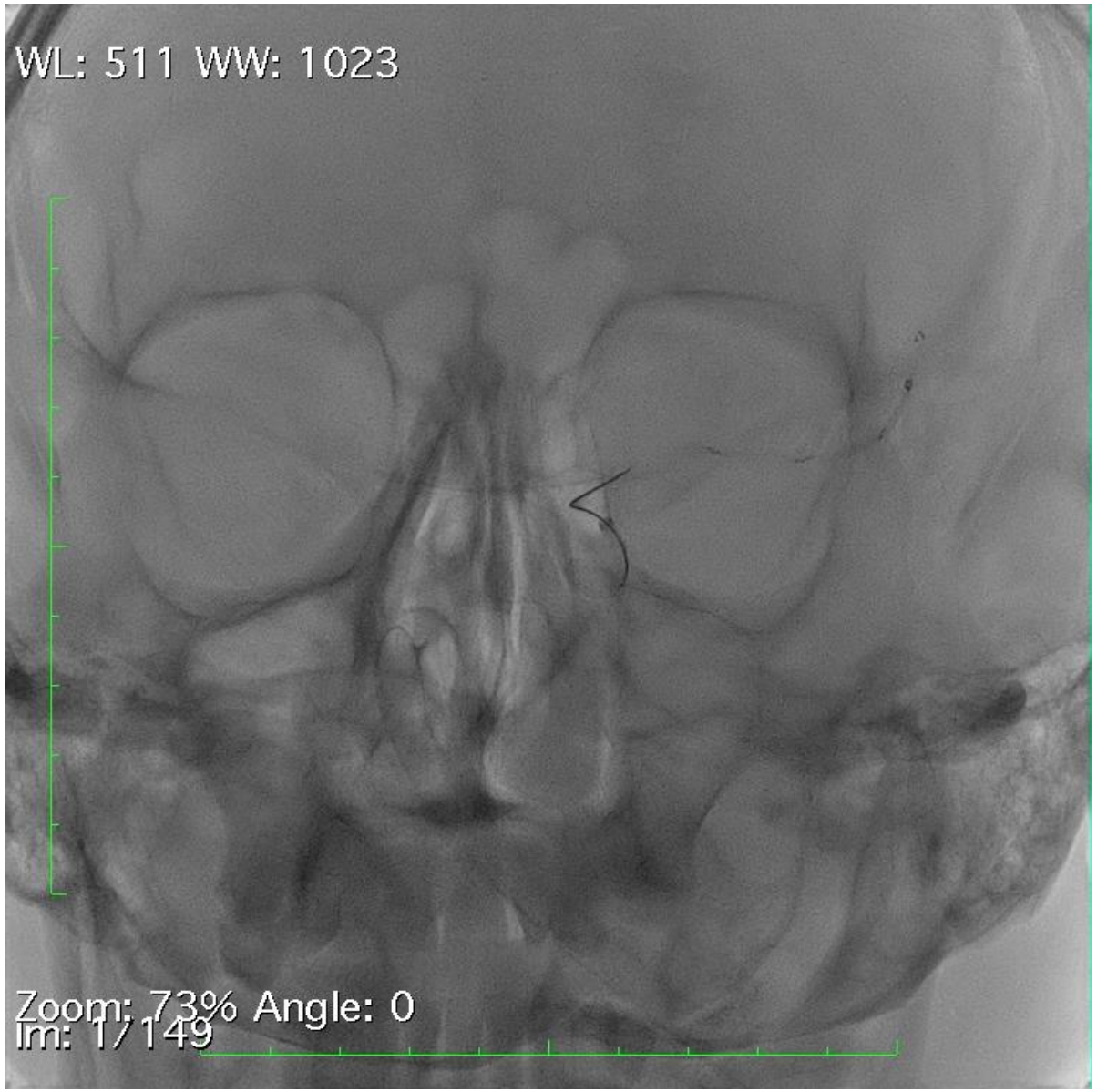
Case-57 years old, male , global aphasia, right hemiplegia, forced eye deviation during TEE examination NIHSS:20

Navigation of 9F Balloon guiding catheter

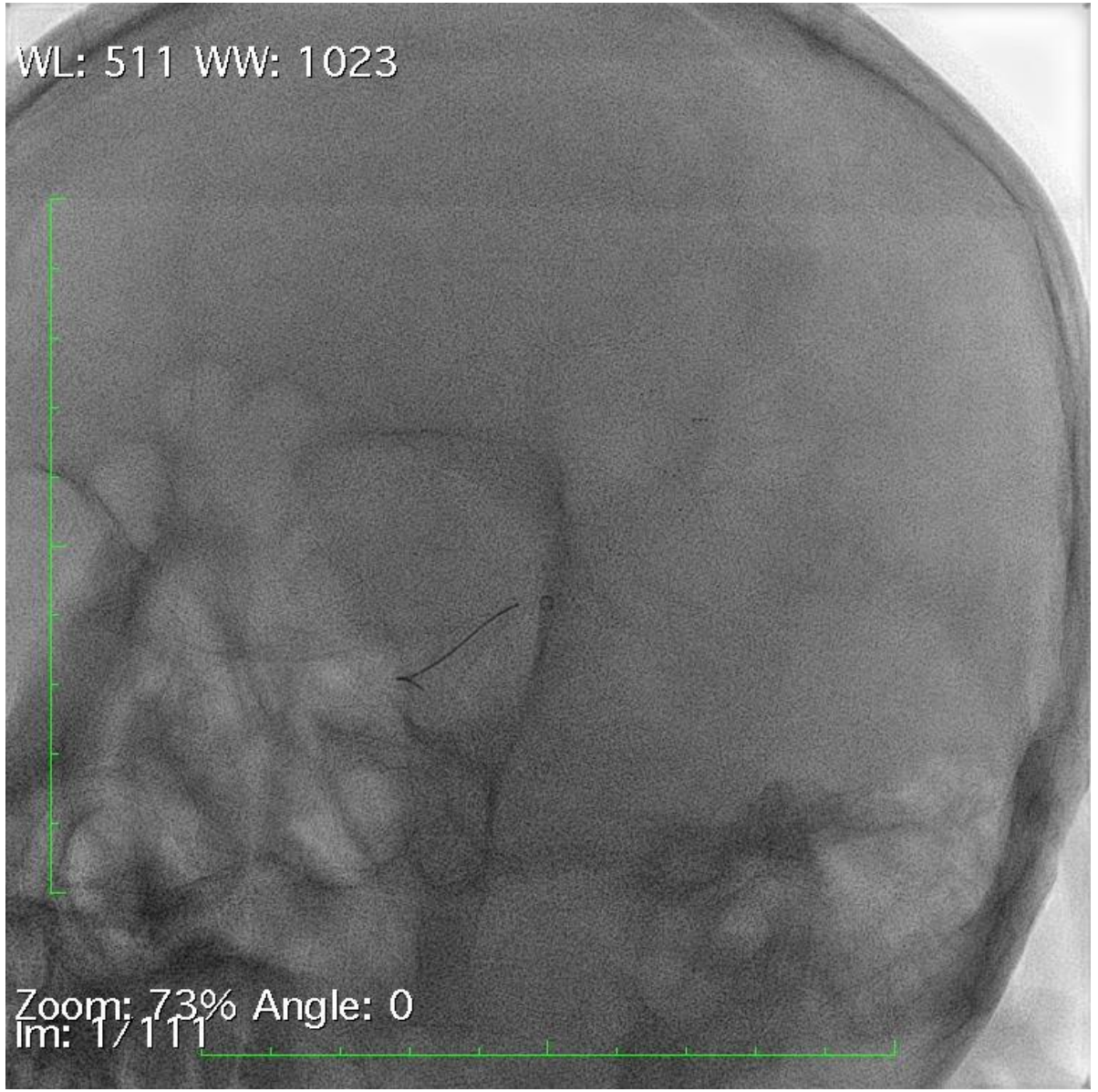


Aspiration with Balon guding and 6F DAC ARC

MCA occlusion

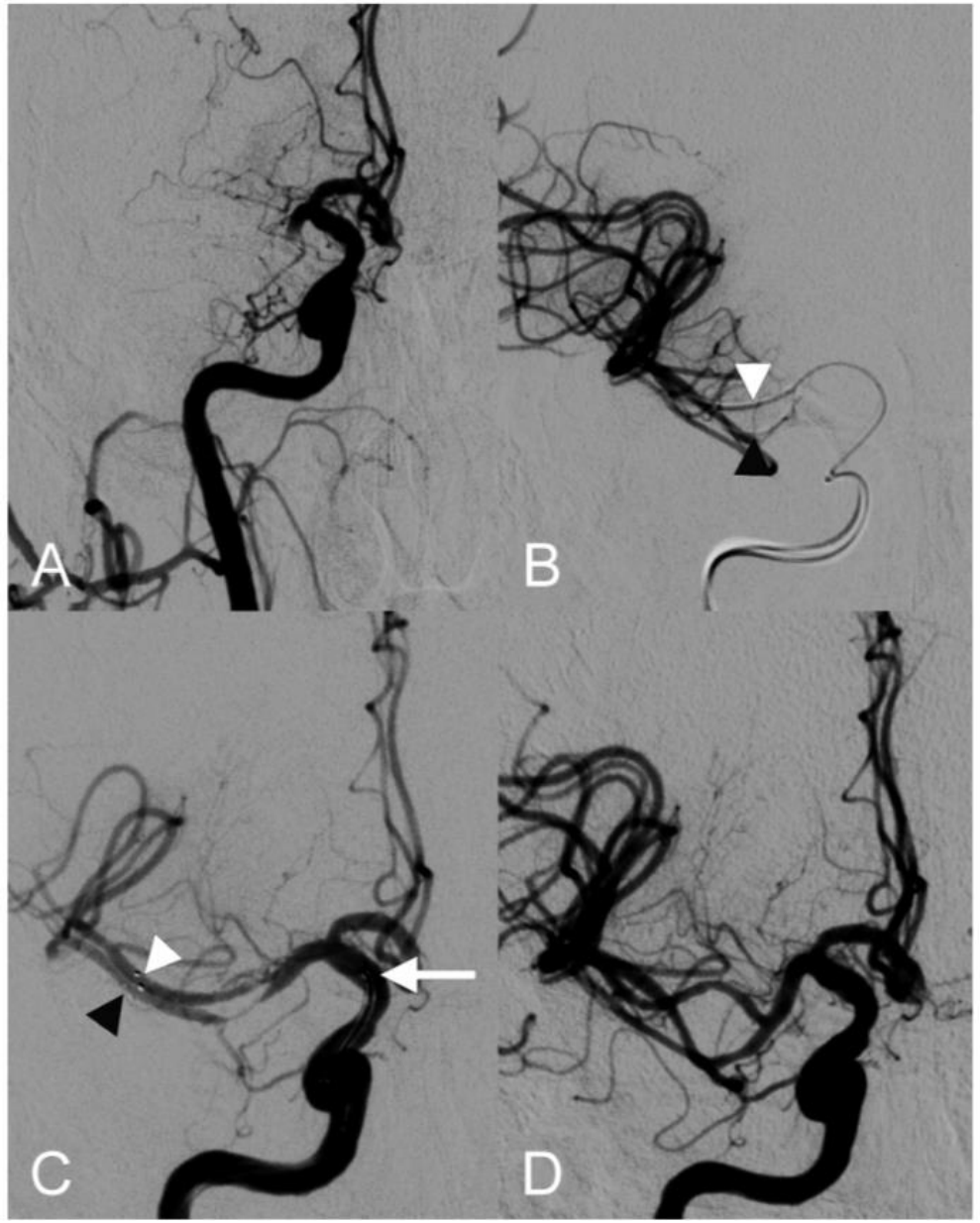


Soliteire platinium 6-40
DAC



Aspiration with DAC and balon guiding catheter

Aspiration-2 passes with combined technique
3 month mRS= 2

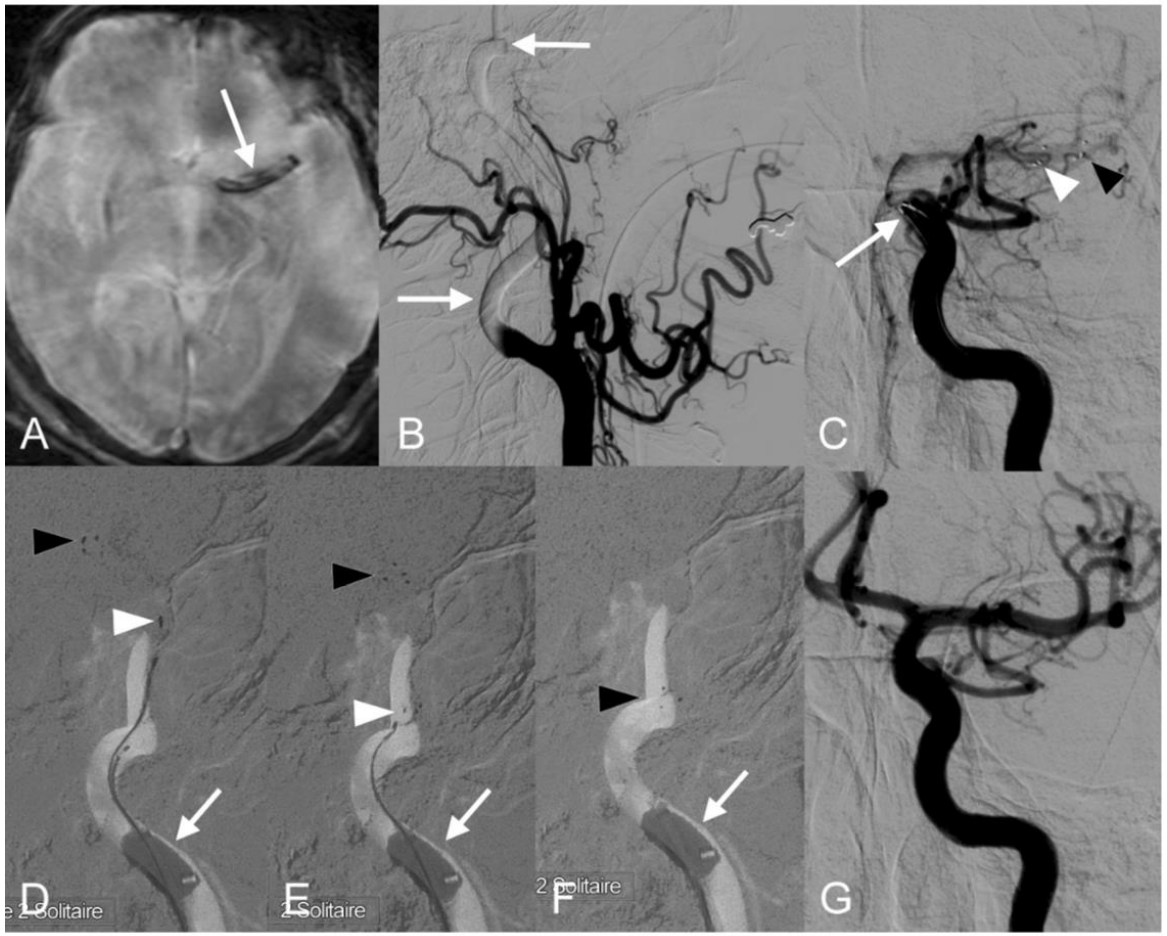


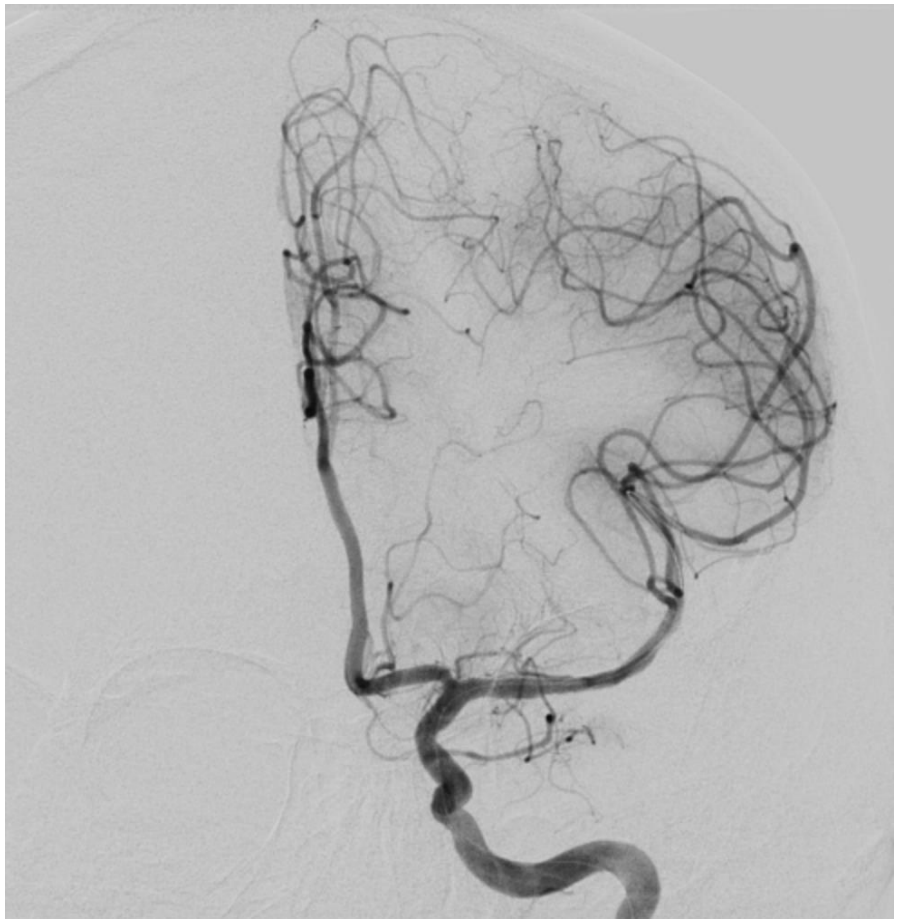
ORIGINAL RESEARCH
INTERVENTIONAL

Double Solitaire Mechanical Thrombectomy in Acute Stroke: Effective Rescue Strategy for Refractory Artery Occlusions?

J. Klisch, V. Sychra, C. Strasilla, C.A. Taschner, M. Reinhard, H. Urbach, and S. Meckel

AJNR 2016





Clin Neuroradiol
https://doi.org/10.1007/s00062-018-0697-x

ORIGINAL ARTICLE

Intracranial Stenting after Failure of Thrombectomy with the emboTrap® Device

Sandra A. Cornelissen[1] · Tommy Andersson[2,3] · Ake Holmberg[2] · Patrick A. Brouwer[2] · Michael Söderman[2] · Pervinder Bhogal[4] · Leonard L. L. Yeo[2,5]

Received: 23 February 2018 / Accepted: 9 May 2018

CASE SERIES

Permanent implantation of the Solitaire device as a bailout technique for large vessel intracranial occlusions

Syed Uzair Ahmed, Jenna Mann, Jeremie Houde, Evan Barber, Michael E Kelly, Lissa Peeling JNIS 2018

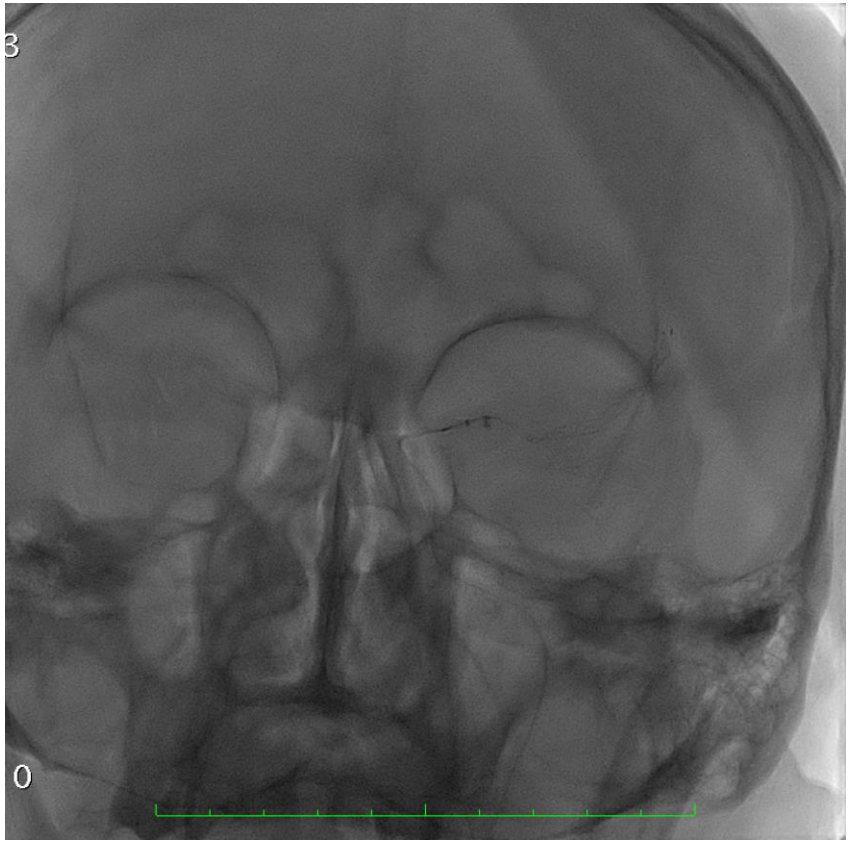
Stenting as a Rescue Treatment After Failure of Mechanical Thrombectomy for Anterior Circulation Large Artery Occlusion

Jang-Hyun Baek, MD; Byung Moon Kim, MD; Dong Joon Kim, MD; Ji Hoe Heo, MD; Hyo Suk Nam, MD; Joonsang Yoo, MD

Stroke 2016

Ischemic complications

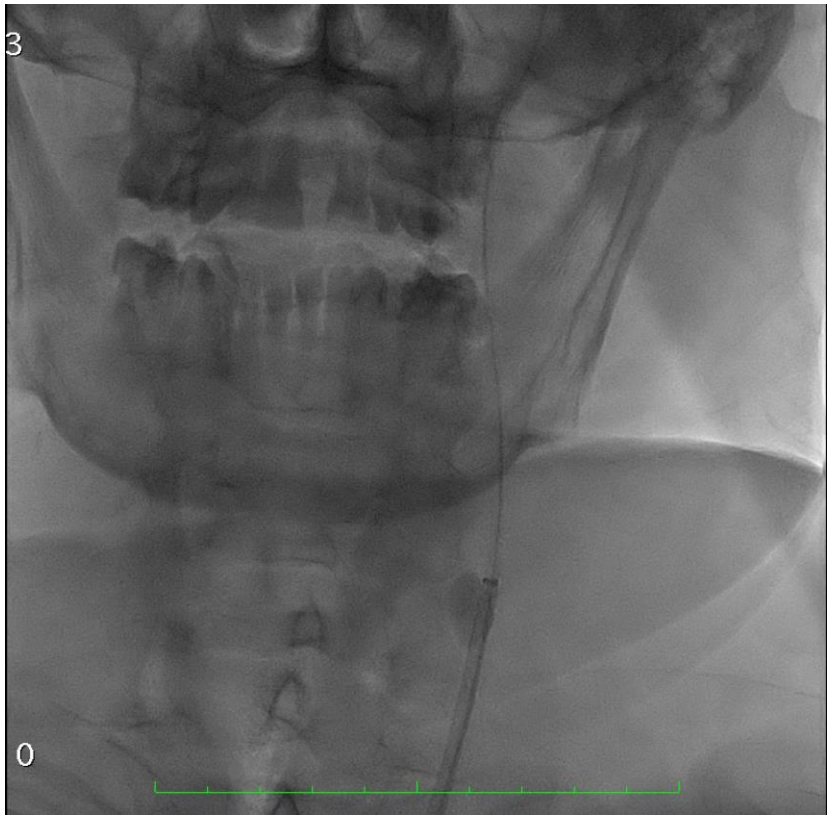
Carotid occlusion

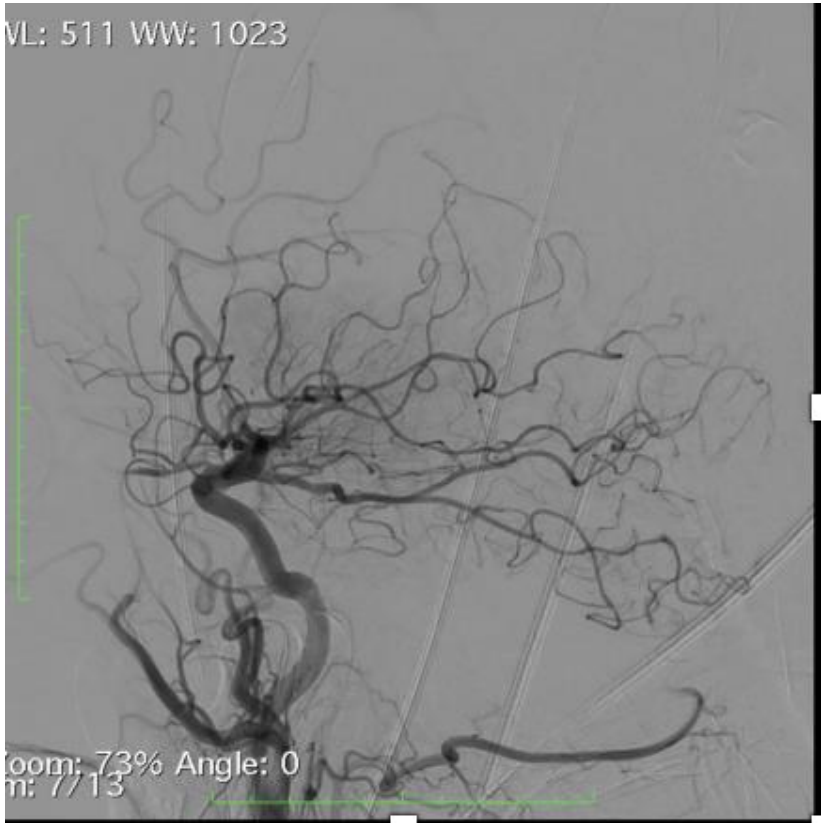


TREVO stent

ENT

Ischemic complications





Distal emboli
Distal fragmentasyon

Recommendation -STENT

- ✓Balloon guiding catheter is recommended when isolated stent retriever is performed
- ✓Stent can be performed with “push-fluff” or “push the wire “ technique
- ✓Wait for 3-5 minutes after the stent replacement
- ✓Recanalization rate is higher in longer stent

Recommendation-2 –Combined system

- ✓Withdrawal of microcatheter is recommended when a combined DAC and stent system is performed
- ✓Use of DAC system is recommended in tandem ICA occlusions
- ✓Combined DAC and stent system may be recommended in patients with tortuous anatomy

Recommendation -3

- ✓≥3 passes, switching the endovascular system may be recommended
- ✓Be careful for the back flow in ADAPT technique
- ✓ The desicion of permanent stent insertion should be based on initial neuroimaging, age, symptom onset
- ✓Newer generation stents