

How to do Thrombectomy – Step by Step

Kenneth V Snyder MD PhD FACS FAANS

University at Buffalo Neurosurgery
Toshiba Stroke and Vascular Research Center
Gates Vascular Institute
Kaleida Health

Disclosures

- Research and consultant support: Canon, Stryker, Penumbra, Medtronic, Jacobs Institute
- Founding member: Neurovascular Diagnostics
- Stockholder: Blockade Medical

Initial Planning

- Check to ensure Brain perfusion imaging and/or CTA/MRA suggests single distribution affected.
- Review arch to plan initial access approach
- Heparin in Flush only
- If needs stent (even if tPA)
 - 2000 IU heparin and oral load of Brilinta and ASA.
- Conscious sedation unless 3 strike rule
 - Need pt to autoregulate during case, on treat SBP > 185

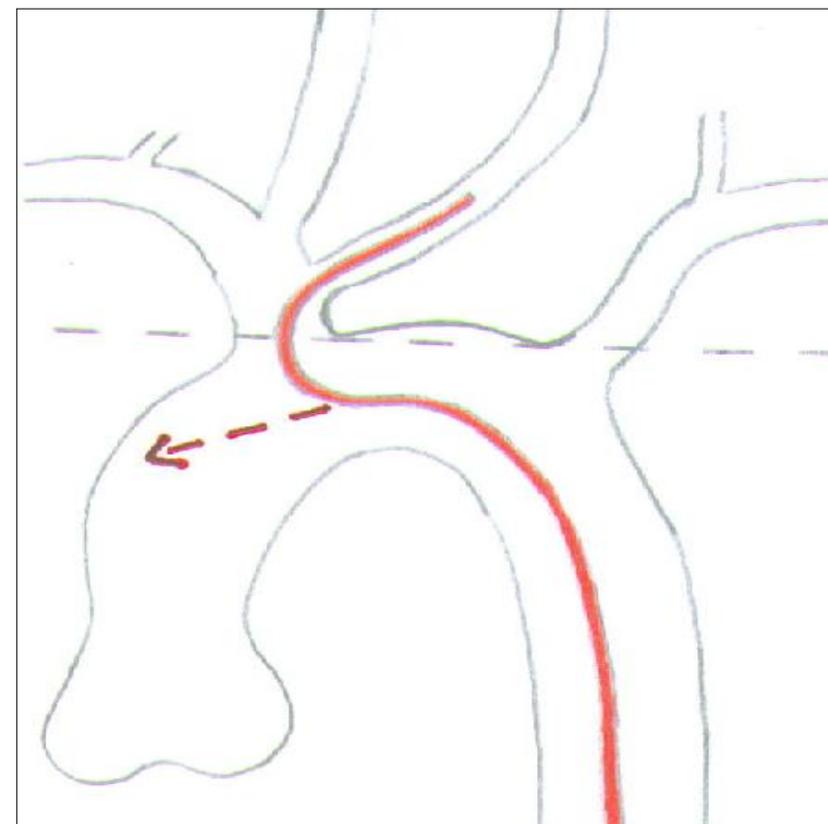
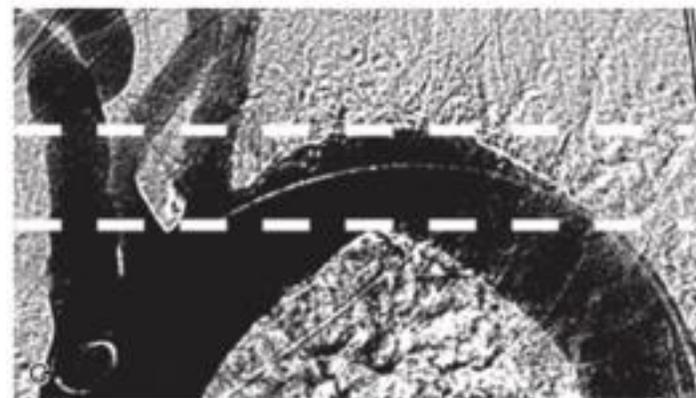
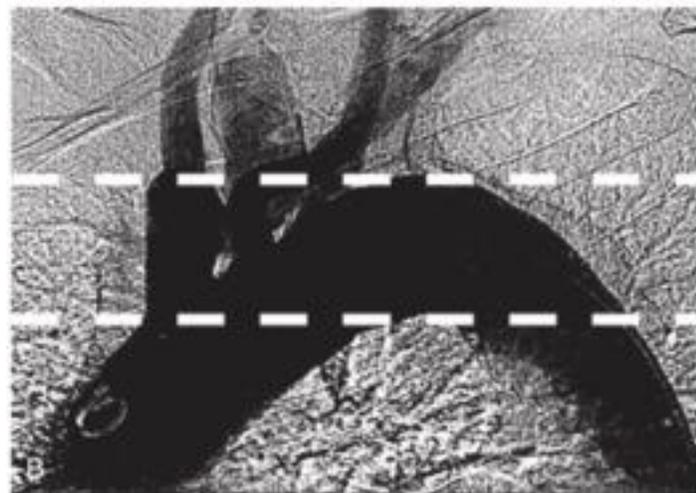
Access/Guide Choice

- Micropuncture or Ultrasound
- Femoral – 9 Fr Sheath – wire around arch!
 - Anterior Circulation: 9 Fr Balloon if non tortuous anatomy, take guide into internal
 - Neuron Max if Tortuous
 - IF significant arch tortuosity, consider alternates:
 - 8 fr Sim 2 if anatomy such that need to stay in proximal carotid. Significantly limits toolset.
 - Radial or Direct Carotid Stick
 - Posterior Circulation: Neuron Max or Benchmark
- Radial – 6 fr sheath or sheathless Neuronmax if radial vessel is greater than 2.5 mm vessel
- Brachial – 8 fr Sheath

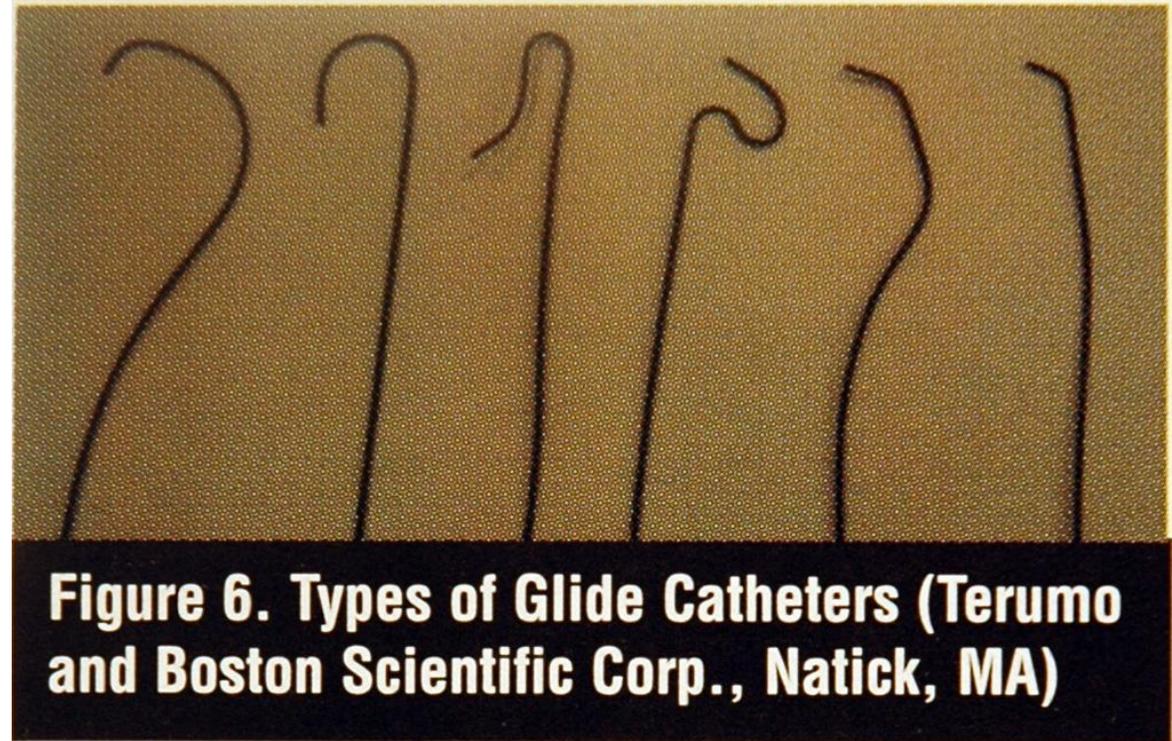
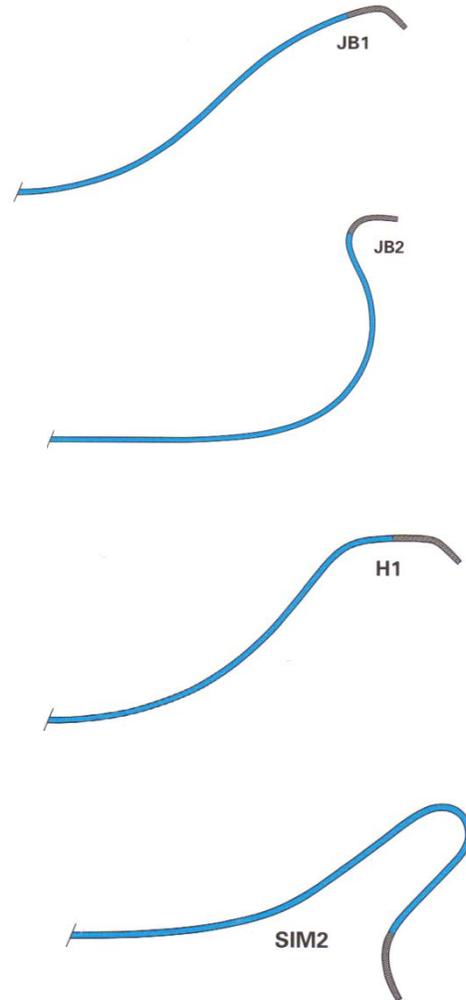
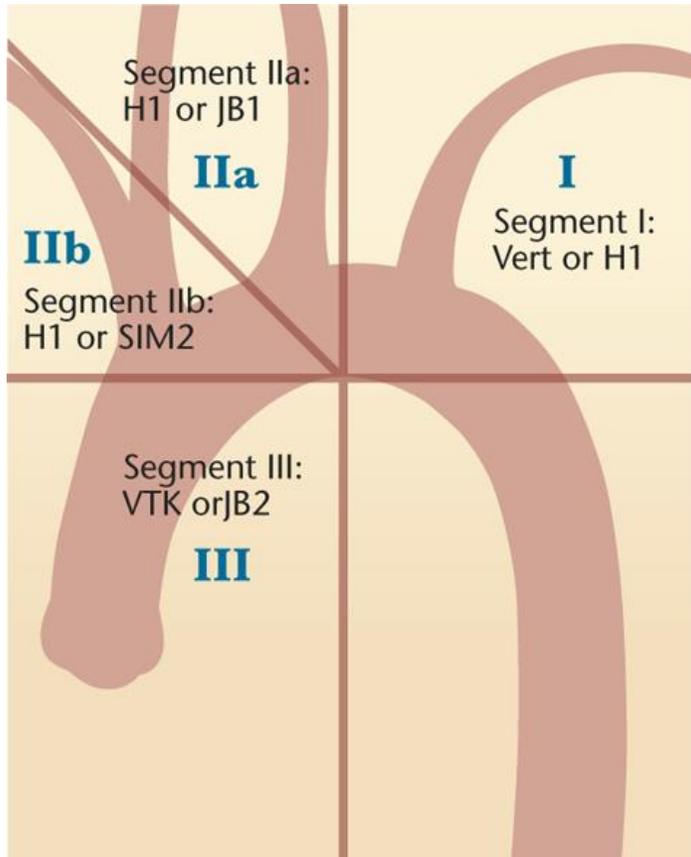
Dx Angiogram

- Primary just do dx run of Vessel of concern
 - Dx multiple dx run only if needed
- Check Collateral Flow
- Pay attention to lenticulostriates

Navigating the Arch



When do I need which catheter configuration?



Initial experience with a multiple parallel guidewire support system for complex tortuous aortic arch navigation and great vessel catheterization: technical note

Leonardo Rangel-Castilla, MD,^{1,2} Hakeem J. Shakir, MD,^{1,2} and Adnan H. Siddiqui, MD, PhD¹⁻⁵

Departments of ¹Neurosurgery and ³Radiology, Jacobs School of Medicine at State University of New York; ²Department of Neurosurgery, Gates Vascular & Vascular Research Center, University at Buffalo, State University of New York

Neurosurg Focus 42 (4):E14, 2017

Each 0.014

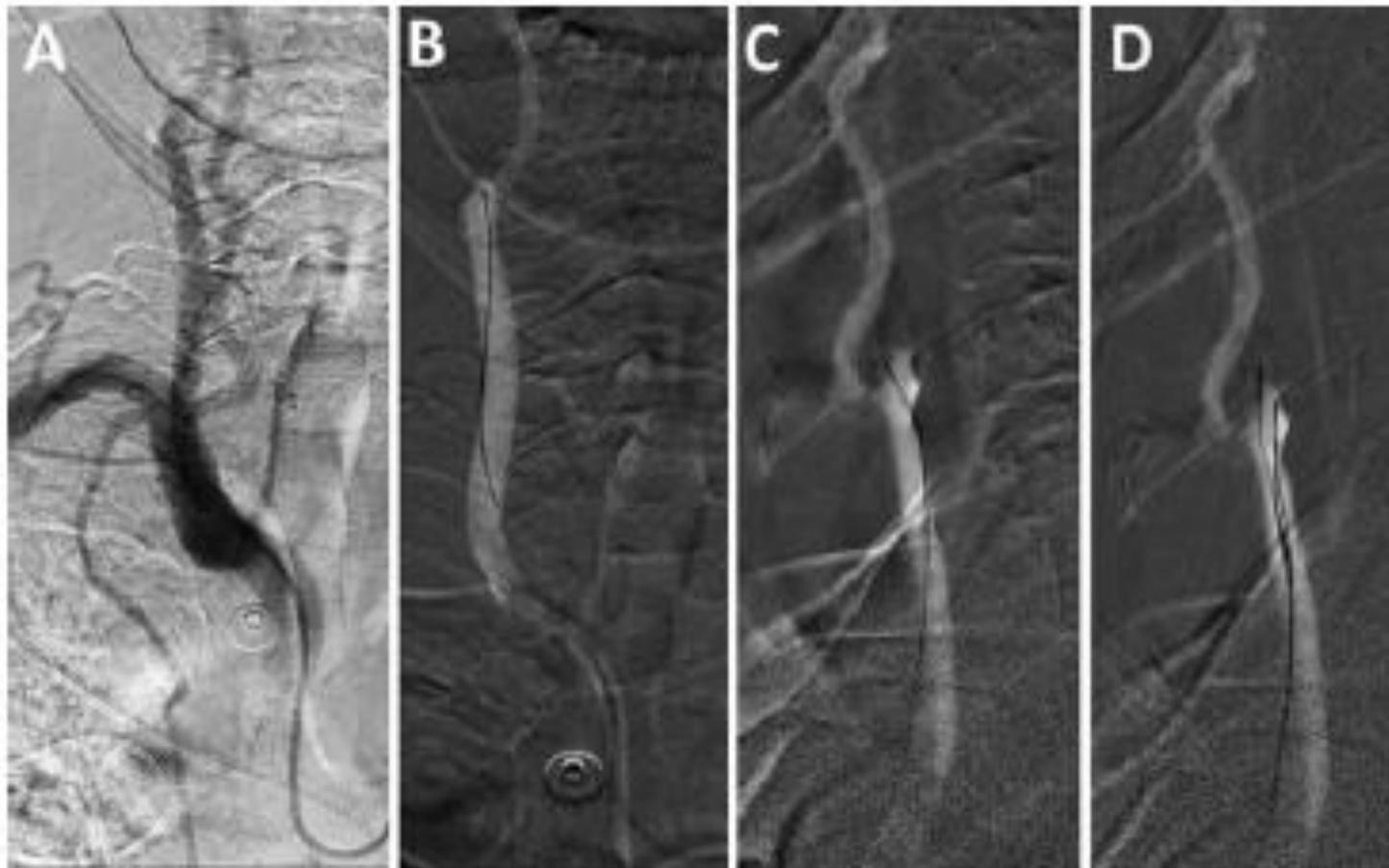
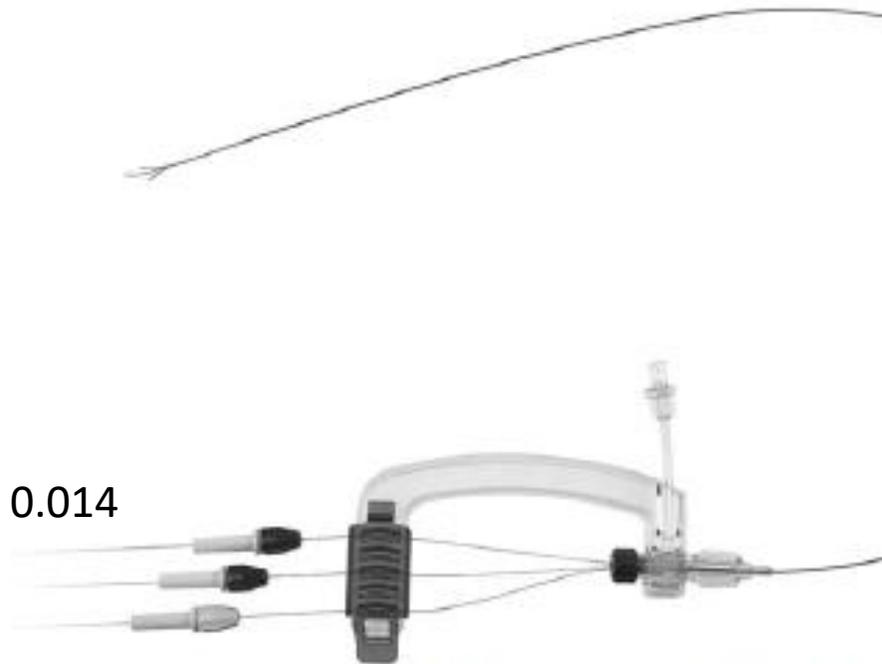
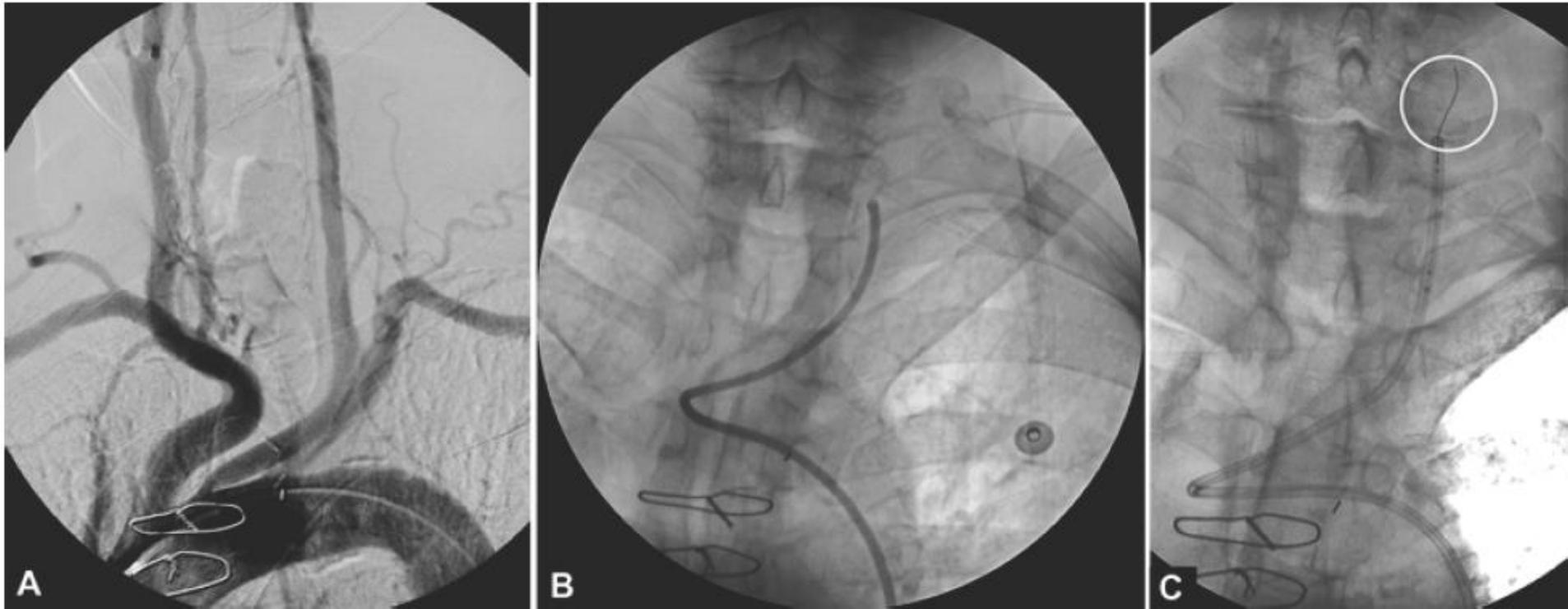


FIG. 1. ZigiWire Mode 3. Illustration of this multiple parallel guidewire system. Published with permission from Vadiswire Corp.

Use of the 8 French Simmons-2 guide catheter for carotid artery stent placement in patients with difficult aortic arch anatomy

Technical note

FENG-CHI CHANG, M.D.,^{1,2} RAMACHANDRA P. TUMMALA, M.D.,^{3-6,8}
BABAK S. JAHROMI, M.D., PH.D.,^{5,6,8} RODNEY M. SAMUELSON, M.D.,^{5,6,8}
ADNAN H. SIDDIQUI, M.D., PH.D.,⁵⁻⁸ ELAD I. LEVY, M.D.,⁵⁻⁸ AND L. NELSON HOPKINS, M.D.⁵⁻⁸



Access

Guides (usu 90 cm length, 0.07-0.09)

- 9 Fr Merci Balloon Guide (Stryker 0.085)
- Flowgate 2 (Stryker 0.084)
- Neuron Max (Penumbra 0.088) – 2.5 mm min vessel size
- Benchmark (Penumbra 0.071)
- Cello 8 Fr or 9 Fr (Medtronic 0.075, 0.085)
- Envoy (0.070)
- 8 Fr Sim 2

Arch Catheters

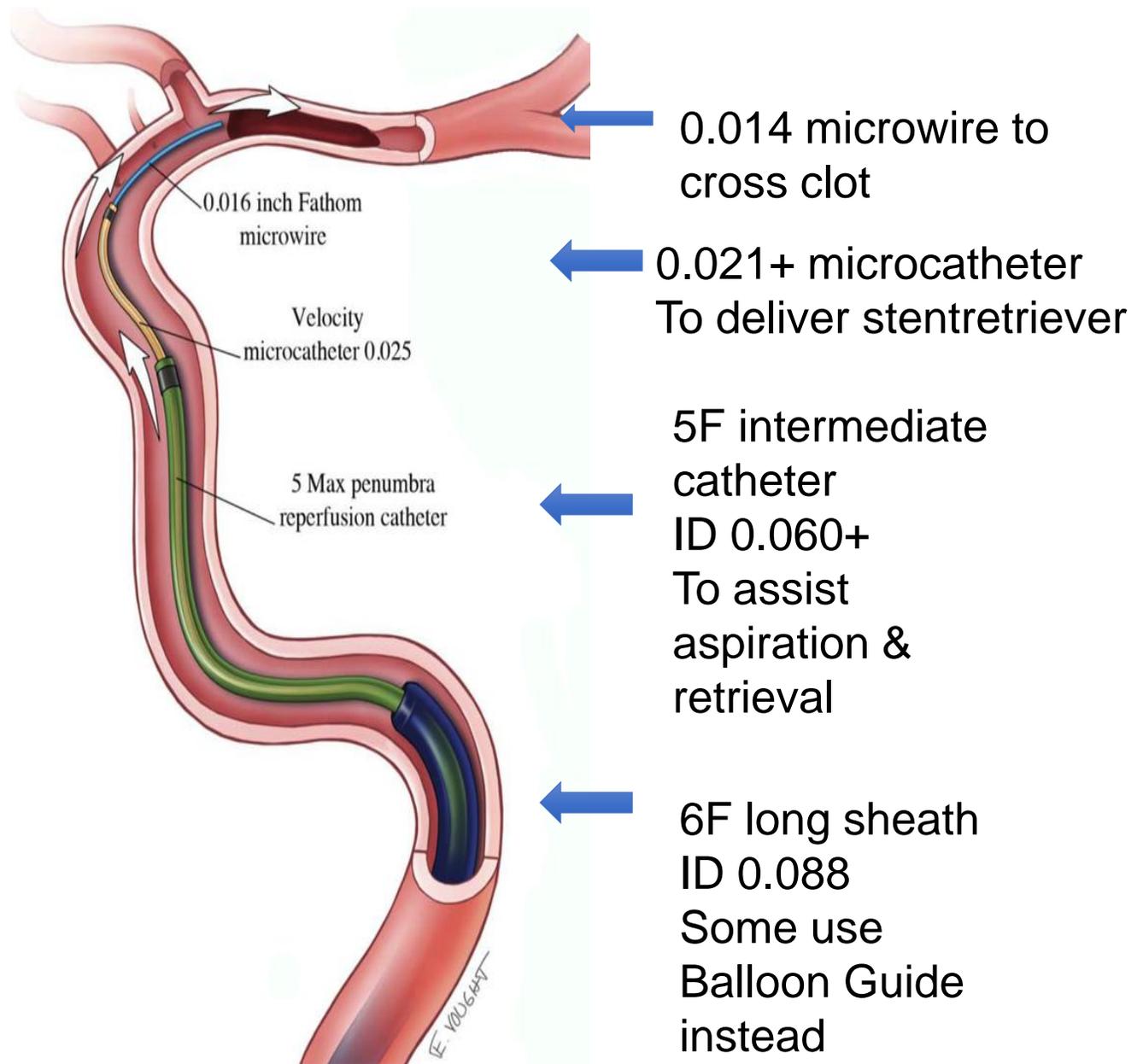
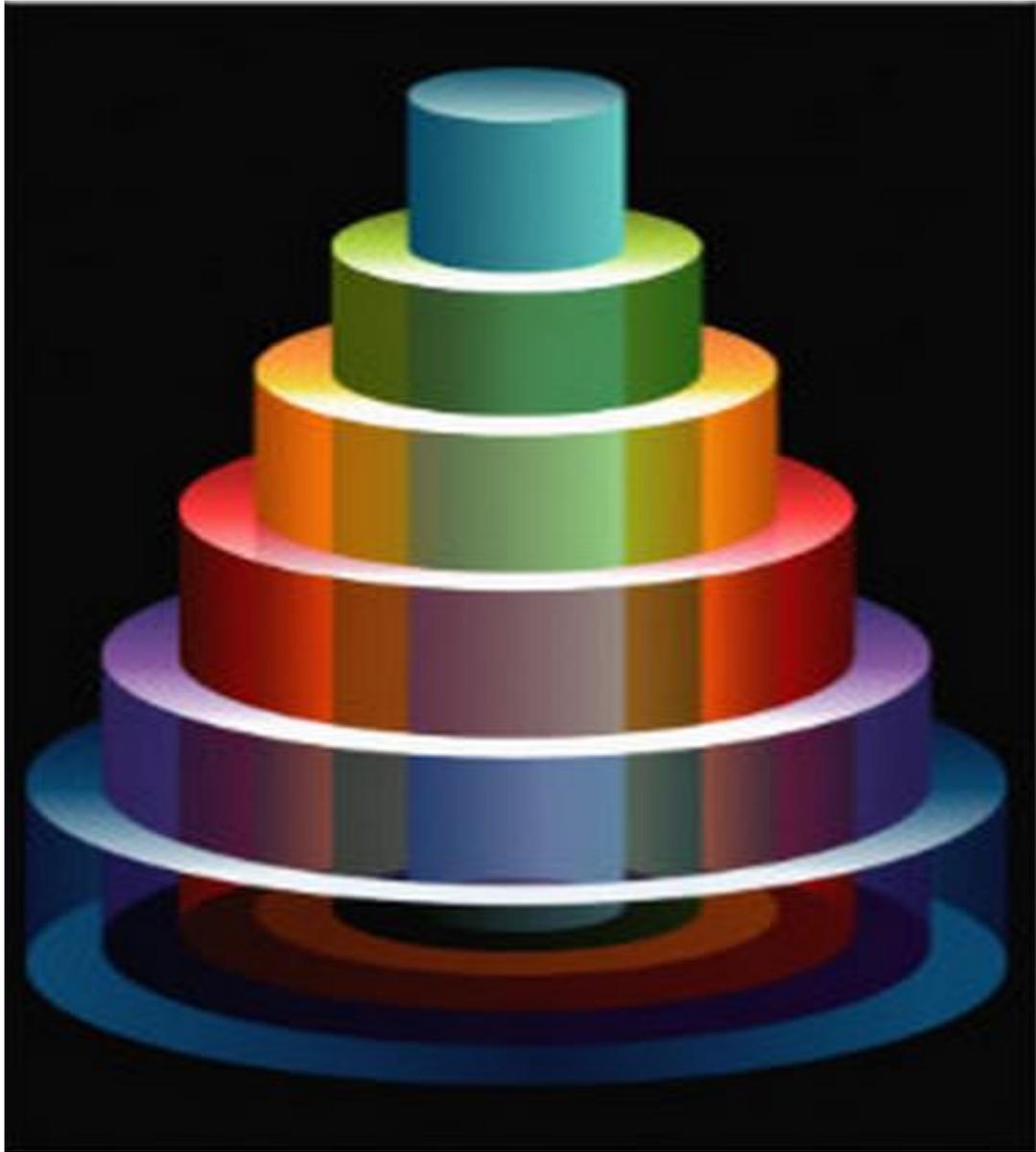
- Vitek (Cook)
- Sim 2, Sim Select, Sim 1
- JB 1 and 2, JR
- Angled

Wires

- 35, 38 glide wires
- Supracore
- Ziggy (Vadiswire Corp)

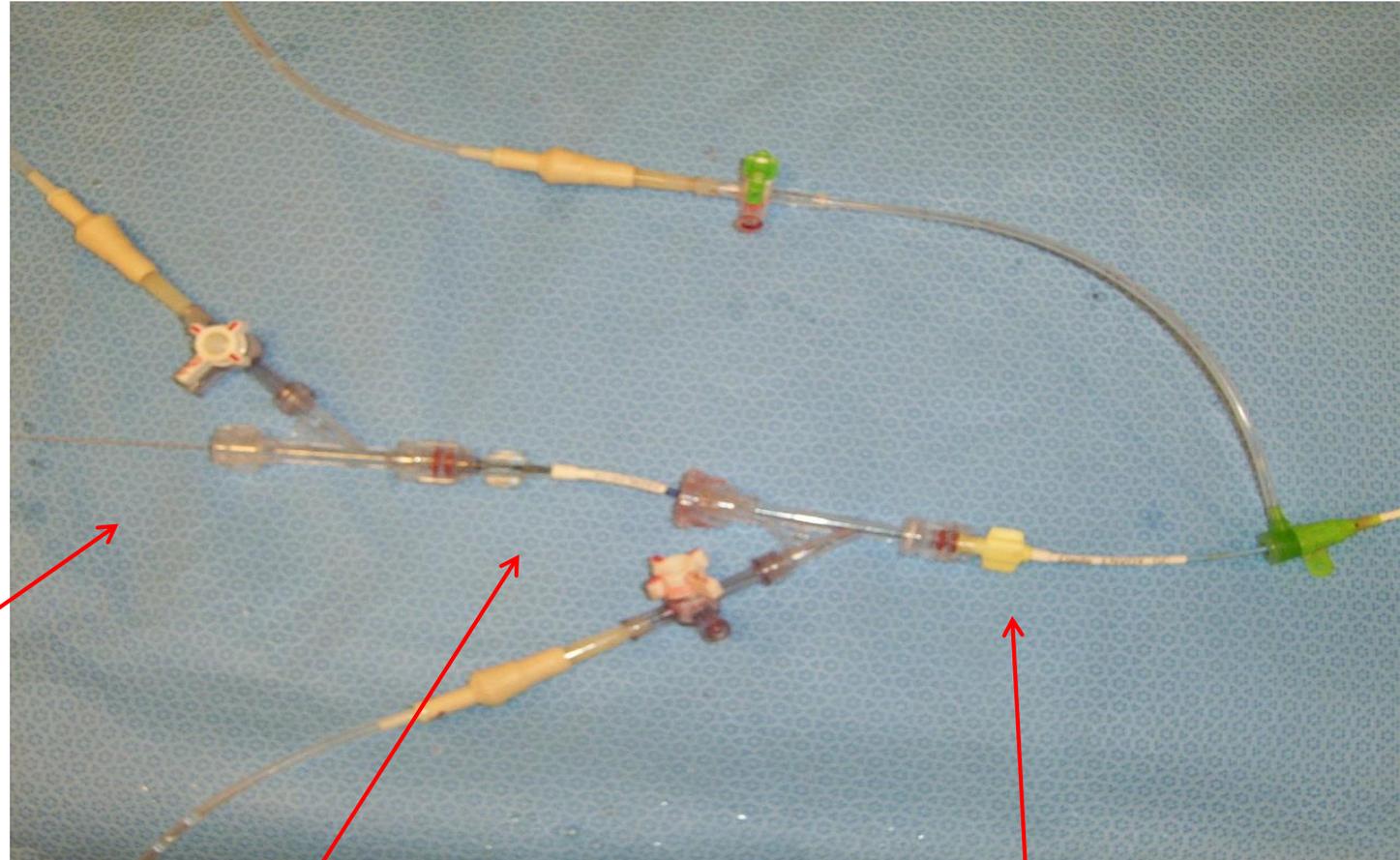
Type 3 with 360 degree loop





Tower of Power

Triaxial System for Intervention



Microcatheter and
microwire

Intermediate Catheter -

9Fr Guide Catheter

Intermediate, Microcatheter, and Wire

Intermediate (6 Fr, 115-135cm, 0.038-0.072)

- Sophia 5 Fr or 6 Fr (Microvention 0.055, 0.070)
- Navien (Medtronic 0.058)
- ACE68, ACE 64, ACE 60 (Penumbra 0.068, 0.064, 0.060)
- 4 max (0.041), 5 max (0.054)
- Jet 7 (penumbra 0.072)

Microcatheter (150 -170 cm, 0.012-0.038)

- 3 max (0.035)
- Velocity (0.025)
- Marksman (0.027)
- Phenom 27
- SL10 (0.0165)

Microwire

- Synchro 2 (0.014)
- Fathom (0.016)

Straight Forward M1 Occlusion

- Microwire – Synchro 2
- Microcatheter – Velocity
- Intermediate – Any

- Cross Clot with microcatheter and do run (personal preference)
- If excellent collaterals consider ADAPT
- If not stent-triever

Adapt with Balloon Guide

- Bring large aspiration system proximal to clot
- Turn on pump, ensure no bubbles and that system is flowing, blood should be filling canister
- KEEP CLOSE EYE ON AMOUNT OF BLOOD!!
- Drive asp catheter into proximal clot
- Flow should be stopped or slow
- Wait two min...if clot does not make its way through system, pull back on asp catheter...move it only a small amount...if flow restarts...then drive catheter back through clot...further this time.
- If there is no flow when back out catheter...then blow up balloon guide and asp from guide while removing catheter.

Adapt with Balloon Guide – Catheter Removal

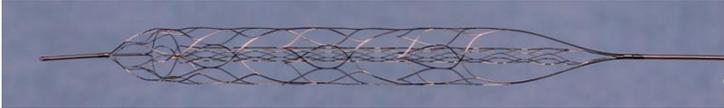
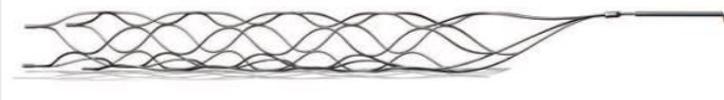
- Once asp catheter is out, Use more aggressive suction on guide catheter with balloon up. Ok to switch syringes if needed since balloon is protective.
- If have good blood return through guide, ok to deflate Guide balloon and do dx injection and run
- IF no blood return through guide, get a large syringe and apply suction, while applying suction deflate guide balloon. If no blood return, then slowly remove guide while maintaining suction. If still no blood return, then maintain aspiration and pull guide out completely.
- IF this is the case, Aspirate from Femoral line while removing the guide ...ensure good flow through sheath once guide is out.

Stent Trierer

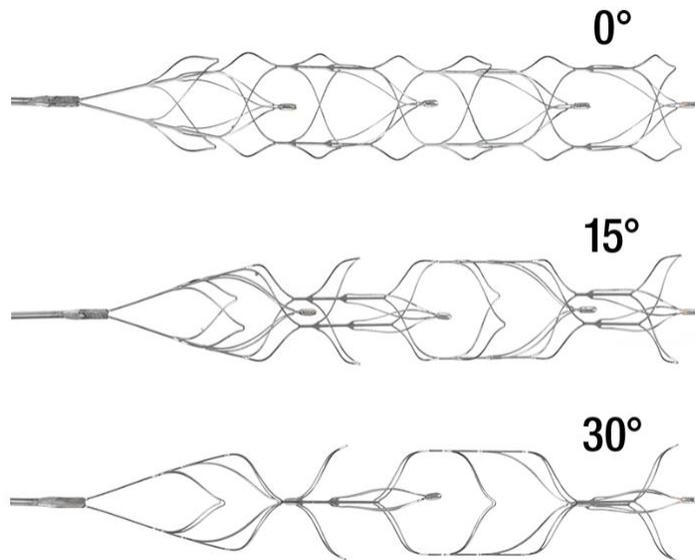
- If decide to use stent-triever...I usually use 4x40 or 4x30 for typical M1. Navigating Catheter to lateral orbit on AP is usually sufficient. Remove microcatheter completely once stent triever is unsheathed.
- Do run from intermediate once unsheathe stent-triever to ensure flow
- If good flow...WAIT! That is the moment of revasc!
- If no flow once stent triever is opened then only wait short period of time before attempting retrieval.
- If not working with intermediate, the blow up balloon guide and aspiration and remove Stent-triever.
- IF using intermediate....bring up to engage on proximal clot, ensure vacuum, take out slack, then use flow arrest to remove stent-triever and intermediate.



Comparison of the most technically-similar, 'stent-retriever'-like neurothrombectomy devices

Device Name (Manufacturer)	Image	Design Overview
EmboTrap® Device (Neuravi Ltd.)	 A photograph of the EmboTrap device, showing a self-expanding Nitinol stent-like structure with an outer cage and inner flow channel, attached to a thin shaft.	Self-expanding Nitinol stent-like device, attached to guide-wire like shaft. The Nitinol self-expanding portion contains an outer cage and inner flow channel with connected ends and a distal radiopaque tip.
Solitaire FR (Covidien)	 A photograph of the Solitaire FR device, showing a self-expanding Nitinol stent-like structure with a seam running along its length, attached to a thin shaft.	Self-expanding Nitinol stent-like device, attached to guide-wire like shaft. The Nitinol self-expanding portion has a seam running along its length, and open ends.
Trevor Pro / ProVue (Stryker)	 A photograph of the Trevor Pro / ProVue device, showing a self-expanding Nitinol stent-like structure with open ends and a guidewire-like radiopaque tip at its distal end, attached to a thin shaft.	Self-expanding Nitinol stent-like device, attached to guide-wire like shaft. The Nitinol self-expanding portion has open ends and a guidewire-like radiopaque tip at its distal end.

Penumbra 3D Revascularization Device



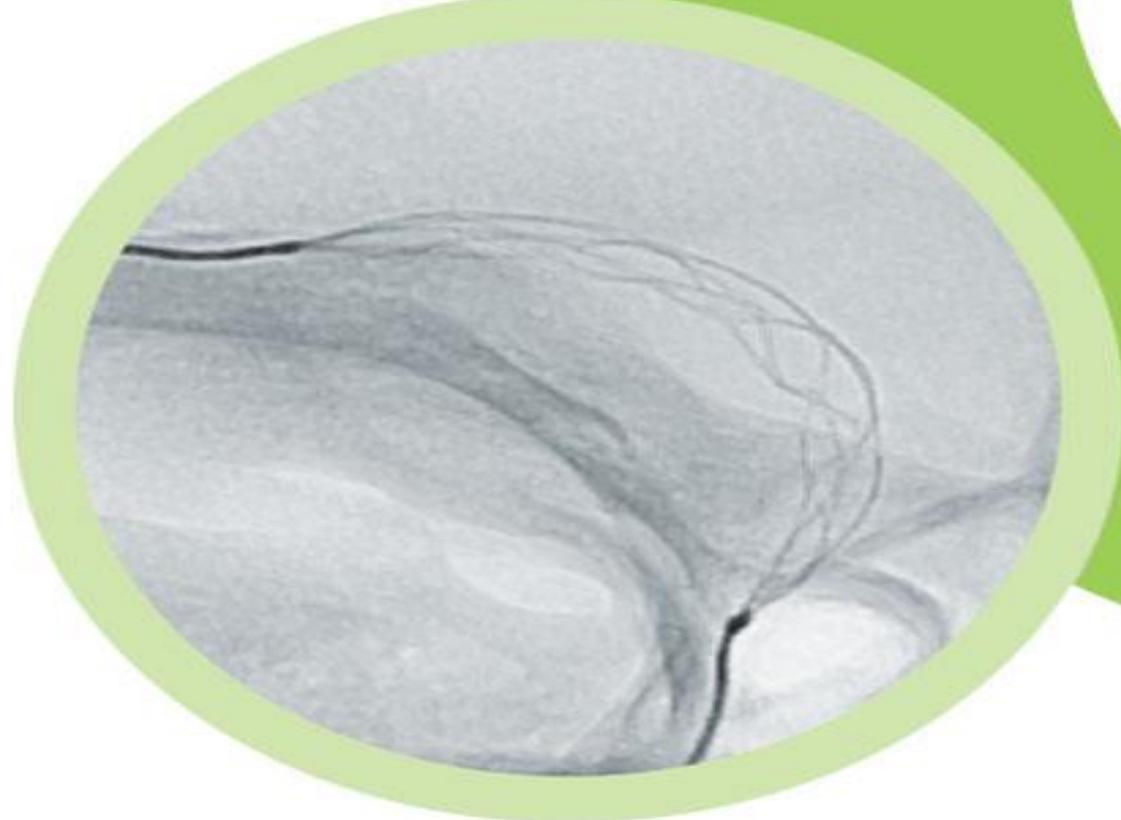
Intraluminal chambers designed to lock, and petals to trap clot for maximum extraction with Proximal aspiration catheters



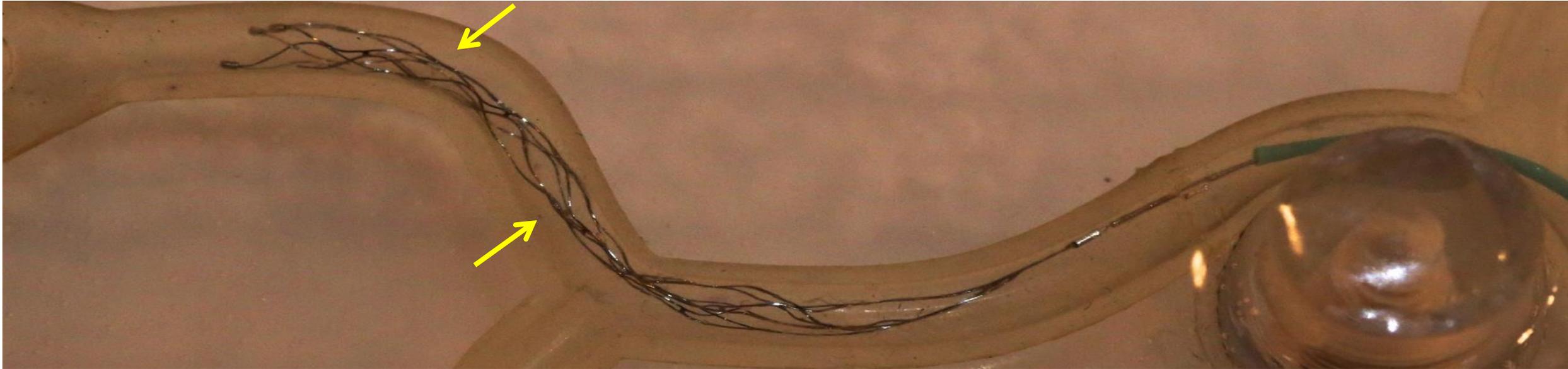
 **Rapid Medical**

Keep the Brain in the Game

The adjustable
Tigertriever

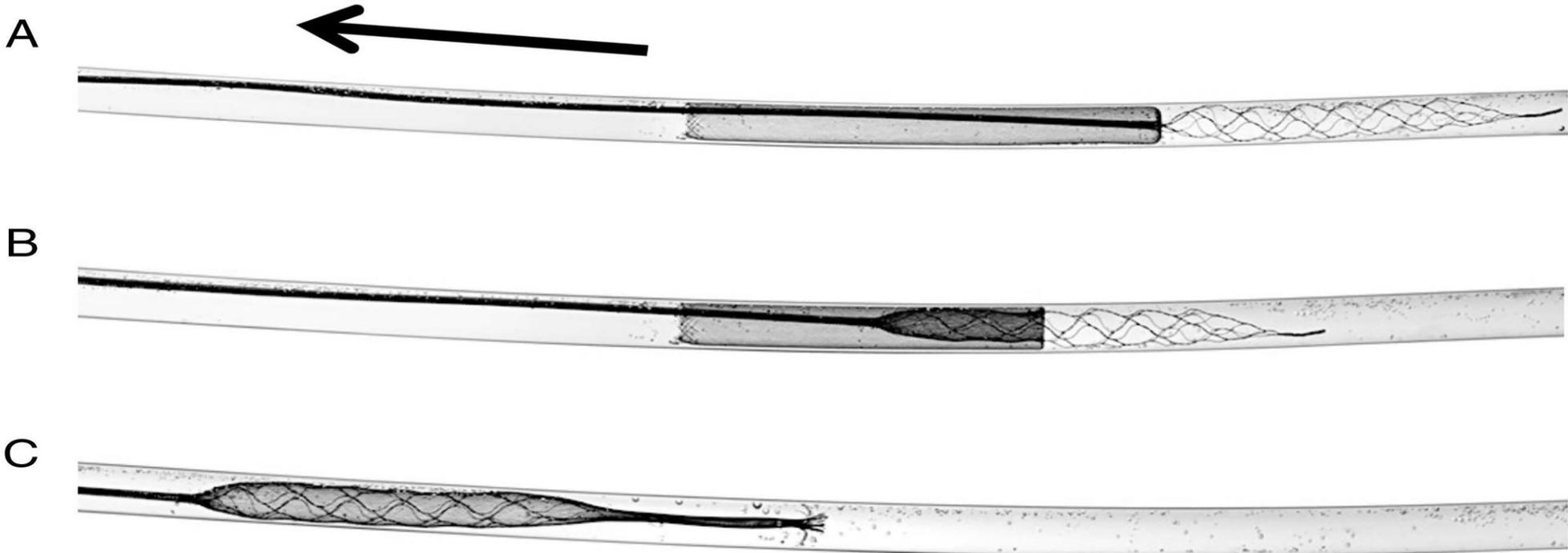


Squeezing Phenomenon



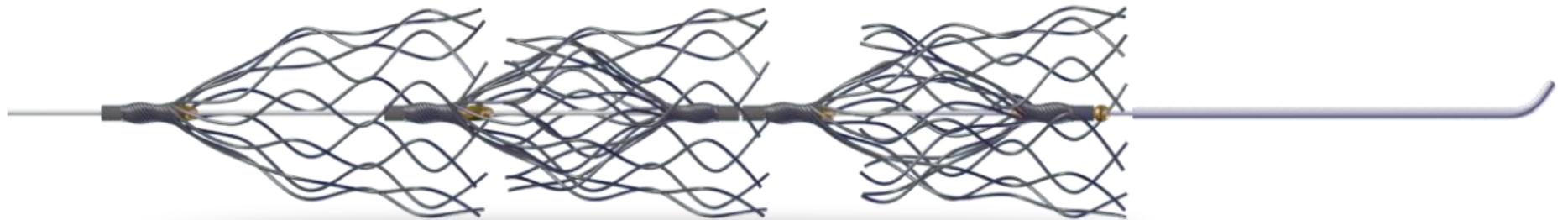
Lazarus COVER Device

Deployed with Solitaire™ Device (Medtronic/Covidien)



AMNIS Medical Golden Retriever Technology

- 0.014" wire tube equipped with a soft tip
- Active deployment (by an external operation handle)
- Five "crown" like elements, each composed of 12 micro-strands, engage the clot by rotational movement
- Full extension of the micro-strands forms *four engagement zones* for efficient clot retrieval



ADAPT and Stent-triever

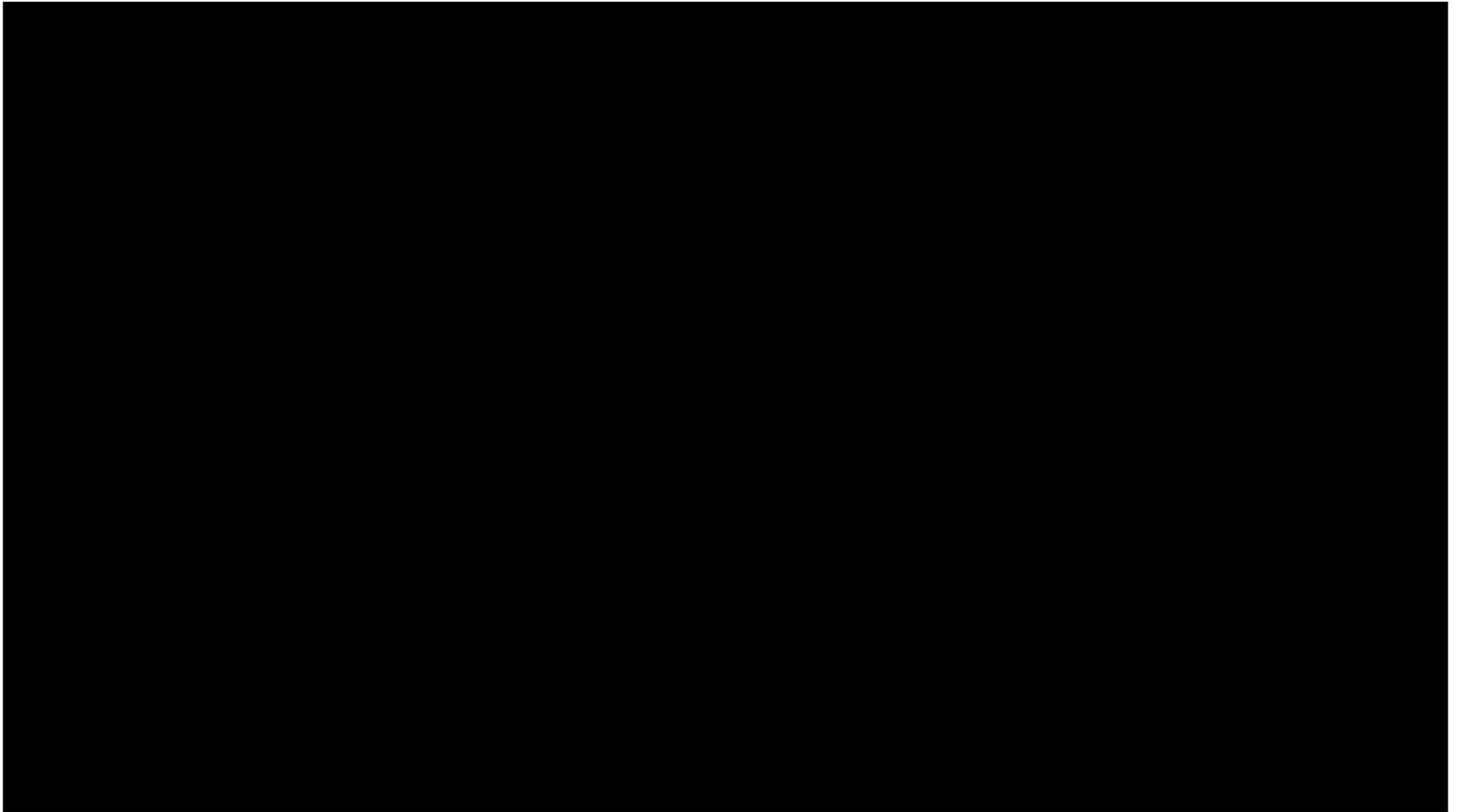


ICA T

- ICA occlusions can occur anywhere along the ICA and look like a proximal occlusion
- Must first rule out ICA origin occlusion, heavy calcification may be suggestive
- IF Triaxial system and intermediate cross without an issue then...
- ADAPT technique with large bore catheter (6 max) until Aspiration catheter gets to petrous segment. Must be careful not to push clot forward.
- Once at petrous, then use microsystem to cross occlusion to get into M1. These are the only cases I use long stent retriever...4x60, 6x60
- Then use similar method to stent-triever.
- IF multiple passes, consider angioplasty under flow arrest, rarely but sometimes need stent.

Tandem

- IF cannot cross ICA origin with microsystem or intermediate then must address proximal carotid.
- I use Balloon guide and attempt to get a Nav 6 filter distal. Sometimes I am able to navigate microsystem distally using a 5 fr MPA for support. Other times a 5 fr MPA, 35 glide wire, and quick cross are necessary. The Velocity microcather is large enough to put Nav 6 wire through allowing for distal protection.
- Place long Wallstent across origin and angioplasty if necessary.
- Then must bring intermediate beyond stent to work intracranially...ideally bring guide through stent.
- Careful if use Stent Trier, can never be pulling through stent unless fully captured.



IF significant distal clot

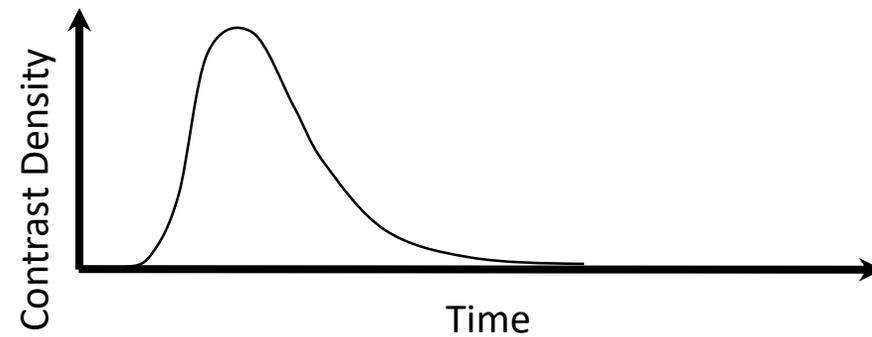
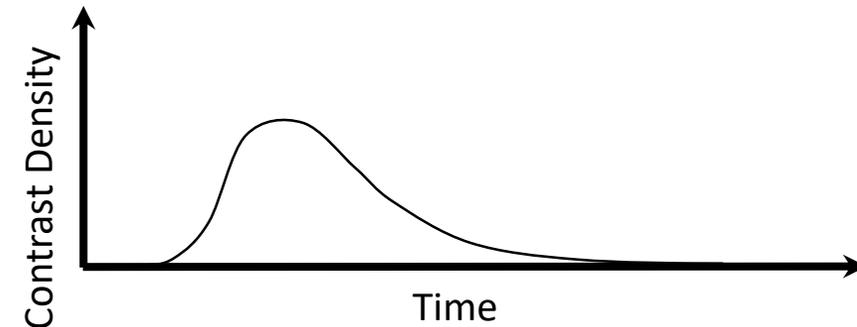
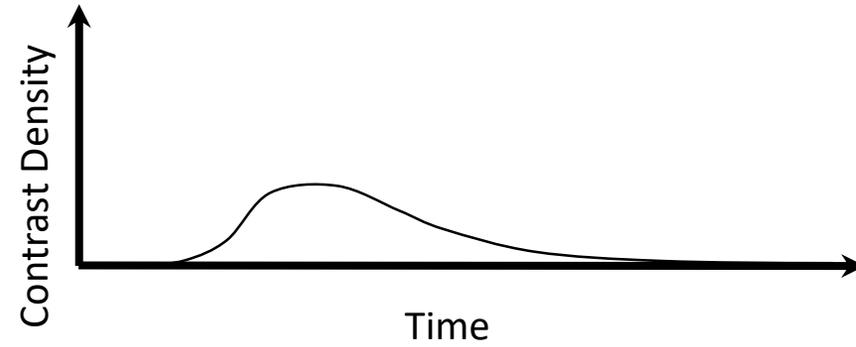
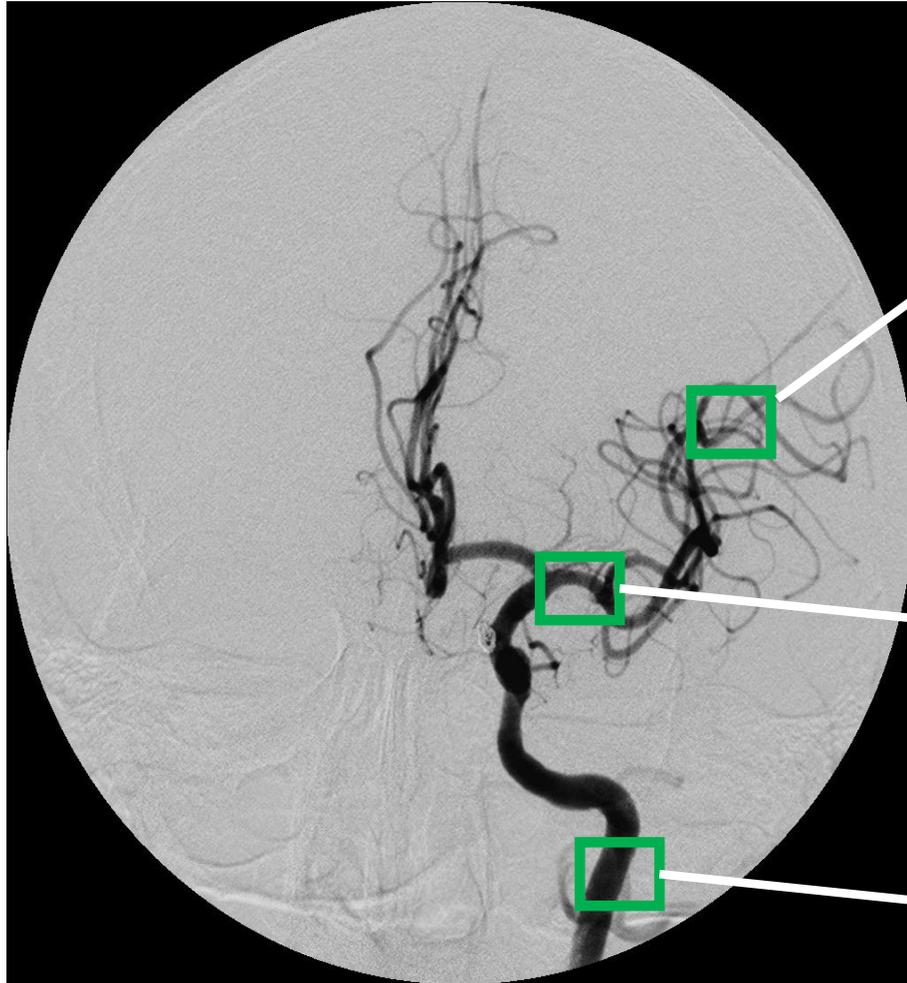
- Consider IA tPA 2-10 mg if considerable distal clot or significant vessel of eloquence (angular gyrus) on angiographic runs

TIMI Flow Grade

TIMI 0	Complete occlusion
TIMI 1	Penetration of obstruction by contrast but no distal perfusion
TIMI 2	Perfusion of entire artery but delayed flow
TIMI 3	Full perfusion, normal flow

mTICI grades	Definitions
Grade 0	No perfusion
Grade 1	Antegrade reperfusion past the initial occlusion, but limited distal branch filling with little or slow distal reperfusion
Grade 2a	Antegrade reperfusion of less than half of the occluded target artery previously ischemic territory (e.g., in one major division of the MCA and its territory)
Grade 2b	Antegrade reperfusion of more than half of the previously occluded target artery ischemic territory (e.g., in two major divisions of the MCA and their territories)
Grade 3	Complete antegrade reperfusion of the previously occluded target artery ischemic territory, with absence of visualized occlusion in all distal branches

Introduction: Time Density Curves

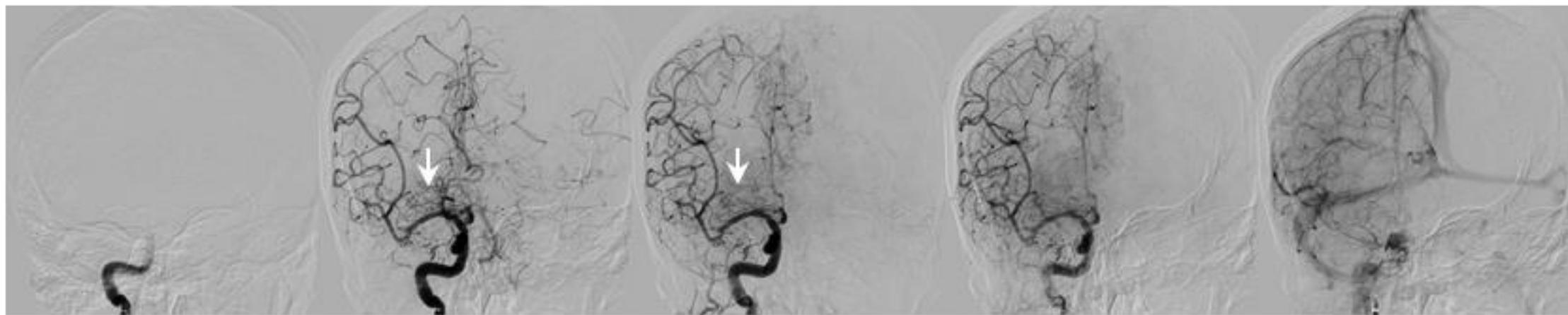


Frontal

Pre-Treatment



Post-Treatment

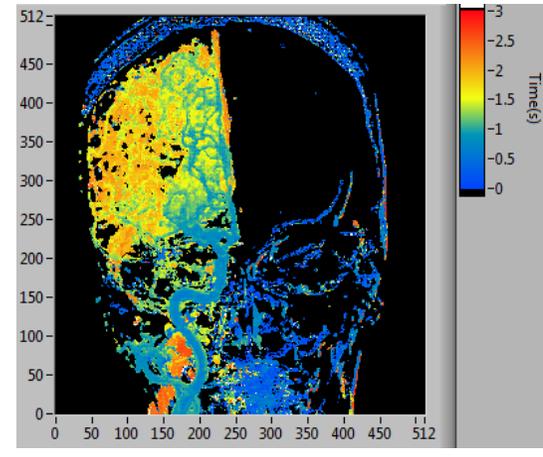
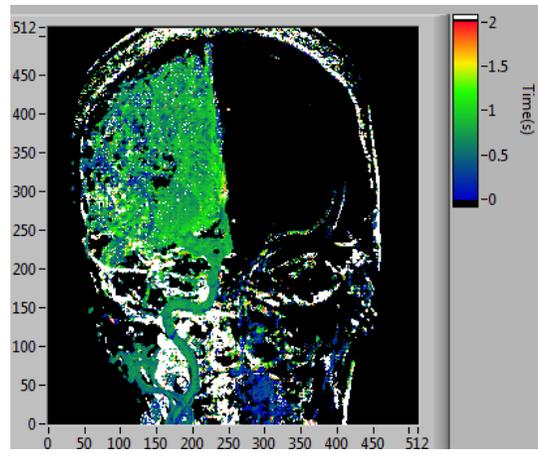
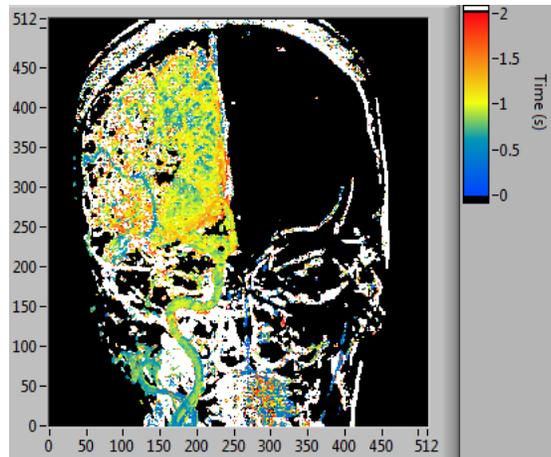


Mean Transit Time

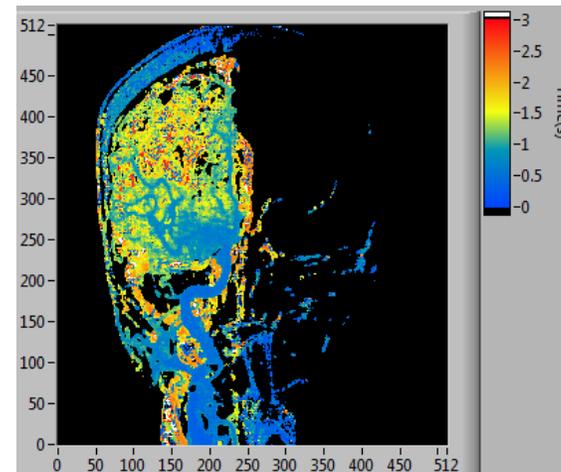
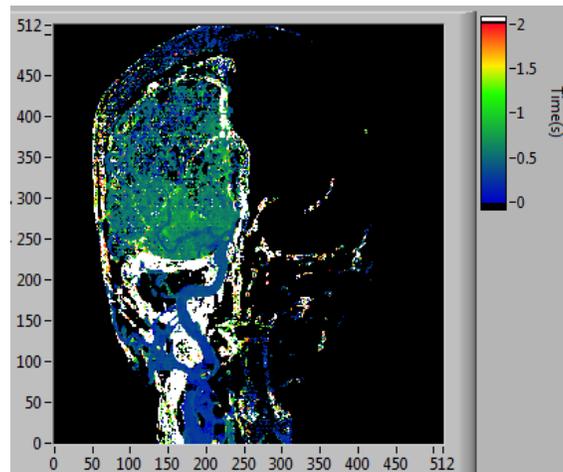
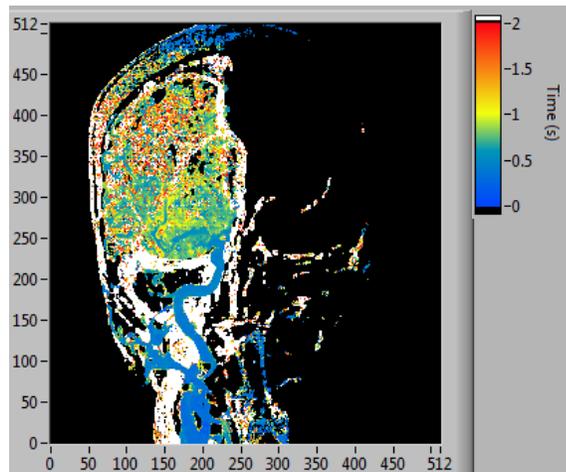
Time To Peak

Arrival Time

Pre-Treatment



Post-Treatment



Groin Closure

- 8 fr angioseal
- Perclose
- Roadmap if severe athero
- Watch out for high sticks, when in doubt access other size and do distal run with Omni.

Thank You

