

# Thrombectomy Workshop

# Vascular Tortuosity

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Department**

**Assistant Professor**

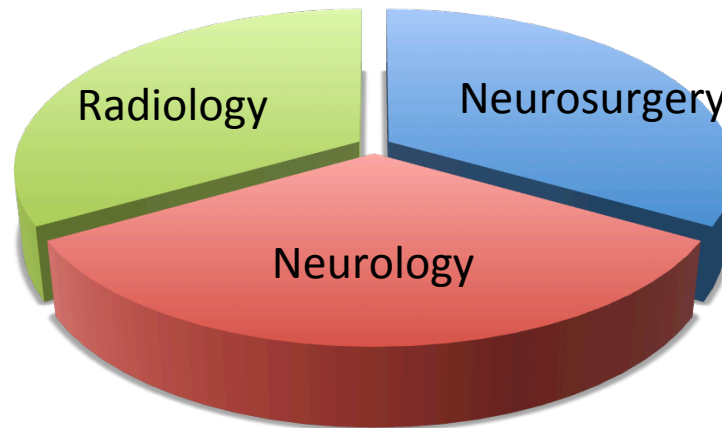
**陳敬昌**

**Chen, Ching-Chang**



# Acute Mechanical Thrombectomy

## IA Stroke Team



IA thrombectomy in LCGMH:

➔ 41 cases in 2015, 71 in 2016,  
83 in 2017, 97 till 2018-12

# For AIS, IA thrombectomy

- **Fast** build a **stable** catheter access because of time limitation
- Difficult catheter access during endovascular treatment of acute ischemic stroke is associated with worse clinical outcome

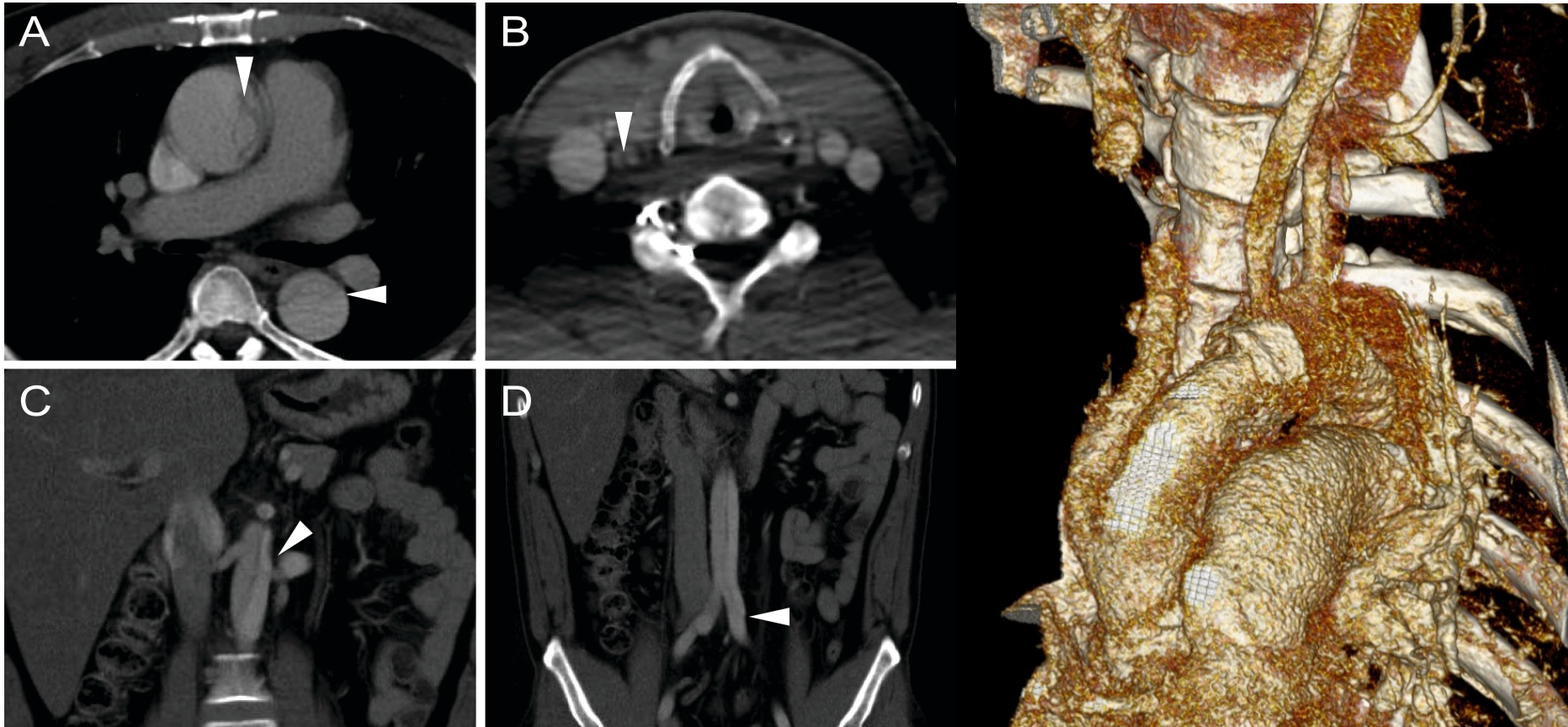
*Ribo M, Flores A, et al .  
J Neurointerv Surg. 2013;5 Suppl 1:i70-3.*

- Depend on **familiarity** of wire and catheters
- **Practice** again and again; do diagnostic angiography (DSA)

# Catheter access

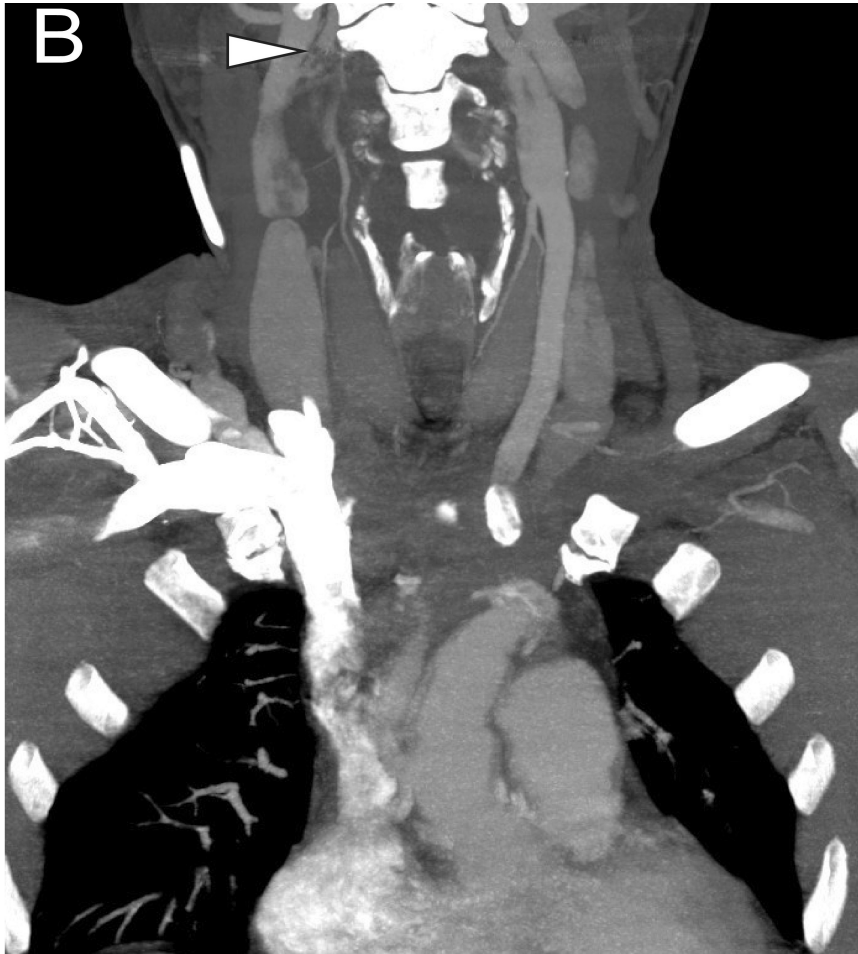
- **Femoral approach** whenever possible
  - ➔ Better angle of entry to arch vessels
  - ➔ Allows forming of complex curve catheter
- Brachial access
  - ➔ Require more advanced skills, limited catheter size
- Neck puncture
  - ➔ more complications: dissection, hematoma formation, sheath kinking

# Type A aortic dissection

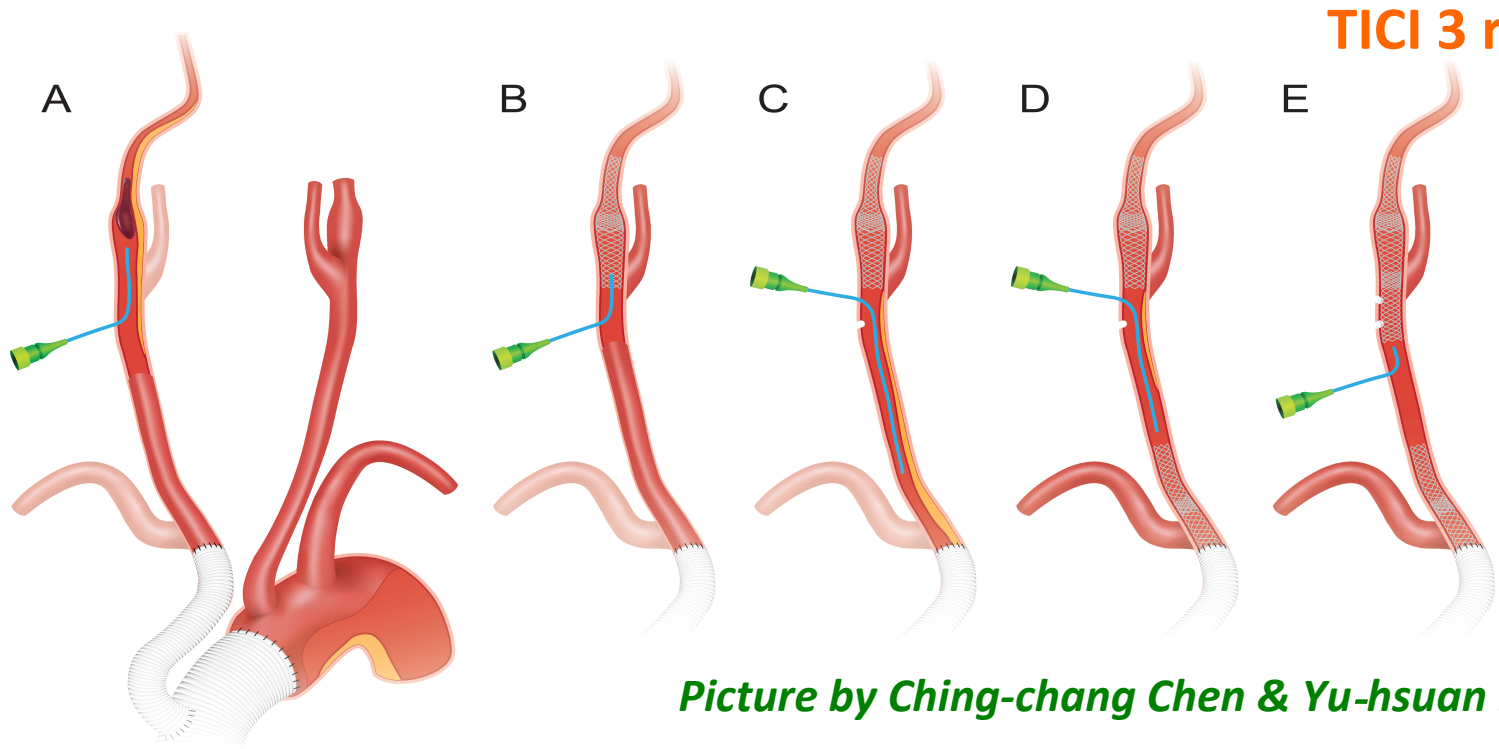
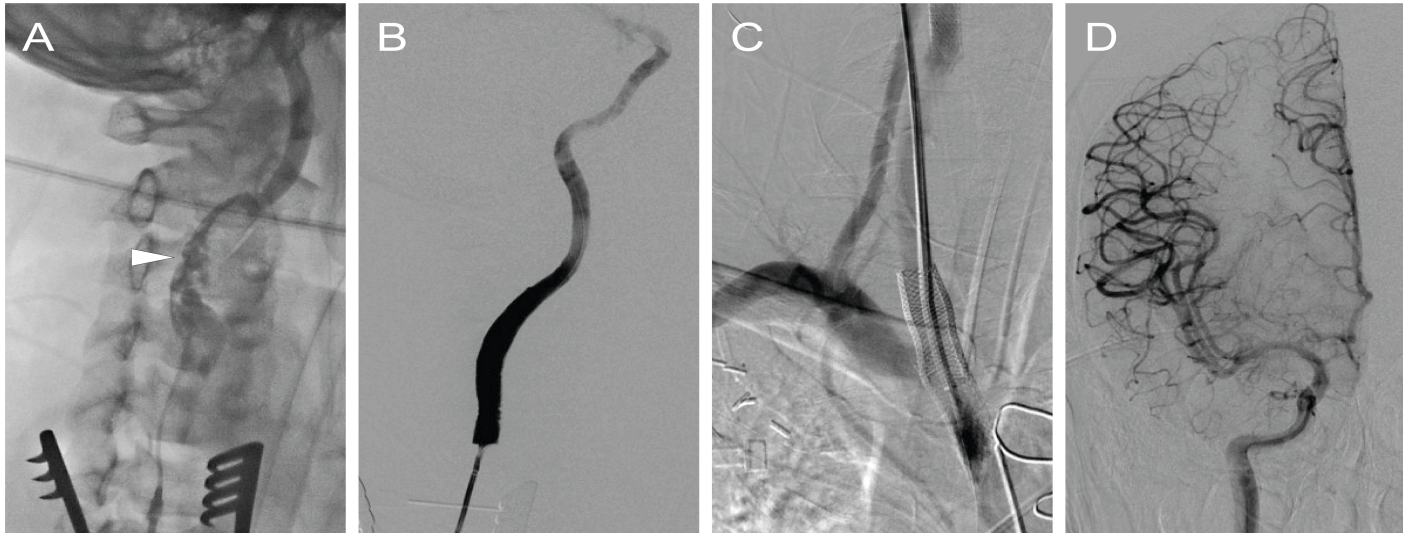


45 y/o male, neck and chest pain with cold sweating

# Left hemiplegia after patient awake

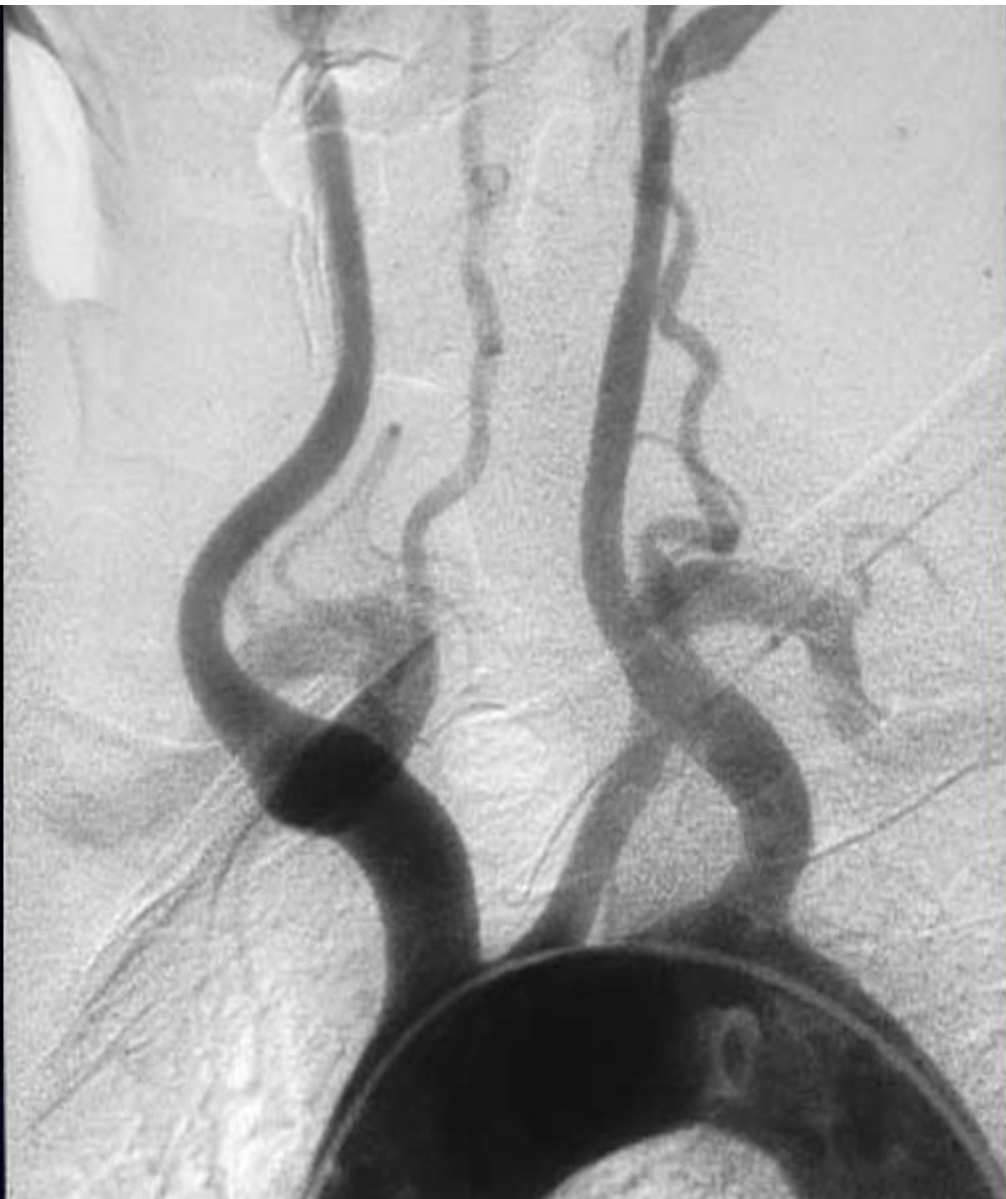


Right CCA occlusion up to the ICA (C2)



**TICI 3 result**

*Picture by Ching-chang Chen & Yu-hsuan Huang*



# Conventional Arch



# Aortic Arch Types

I



II



III



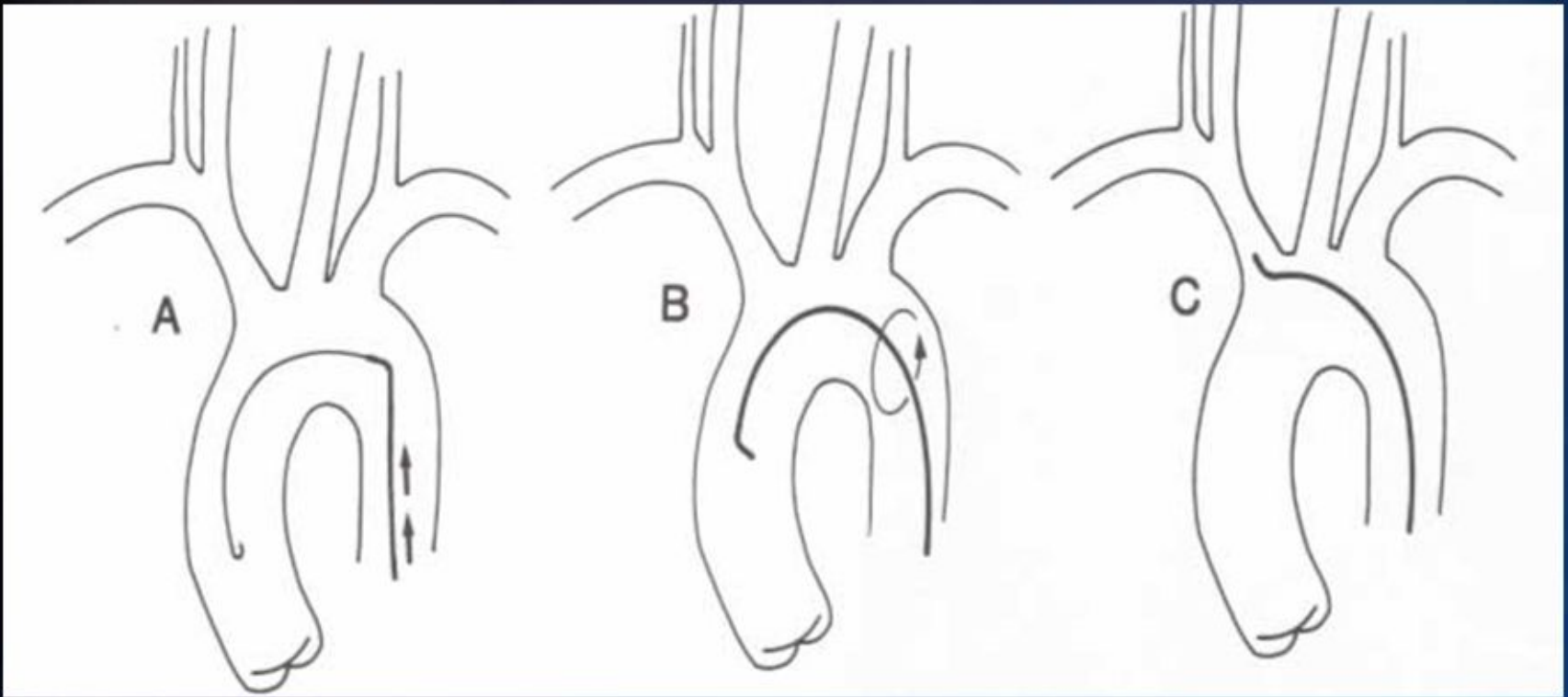
# Aortic Arch Angiography

- 65-70%: Usual pattern
- 20-25%: Bovine arch (left CCA from brachiocephalic)
- 3%: Separate origin of left vertebral artery
- 5%: Other various patterns, such as right subclavian from distal arch

# Aortic Arch Angiography

- Evaluate pre-angiography CTA (routine from aortic arch)
- Arch angiography
- 4 or 5 Fr. Pigtail catheter
- 30-40 degree LAO view
- To evaluate access to great vessels
  - ➔ type of arch
  - ➔ anatomic variants, vessels origins

# Flat Arch with H1 or VER (simple curve catheter)



# Complex Curve Catheter

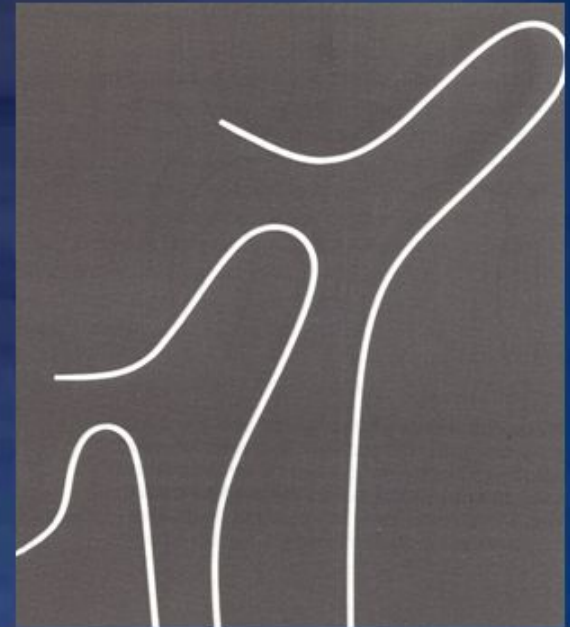


Simmons 1, 2, and 3  
curves



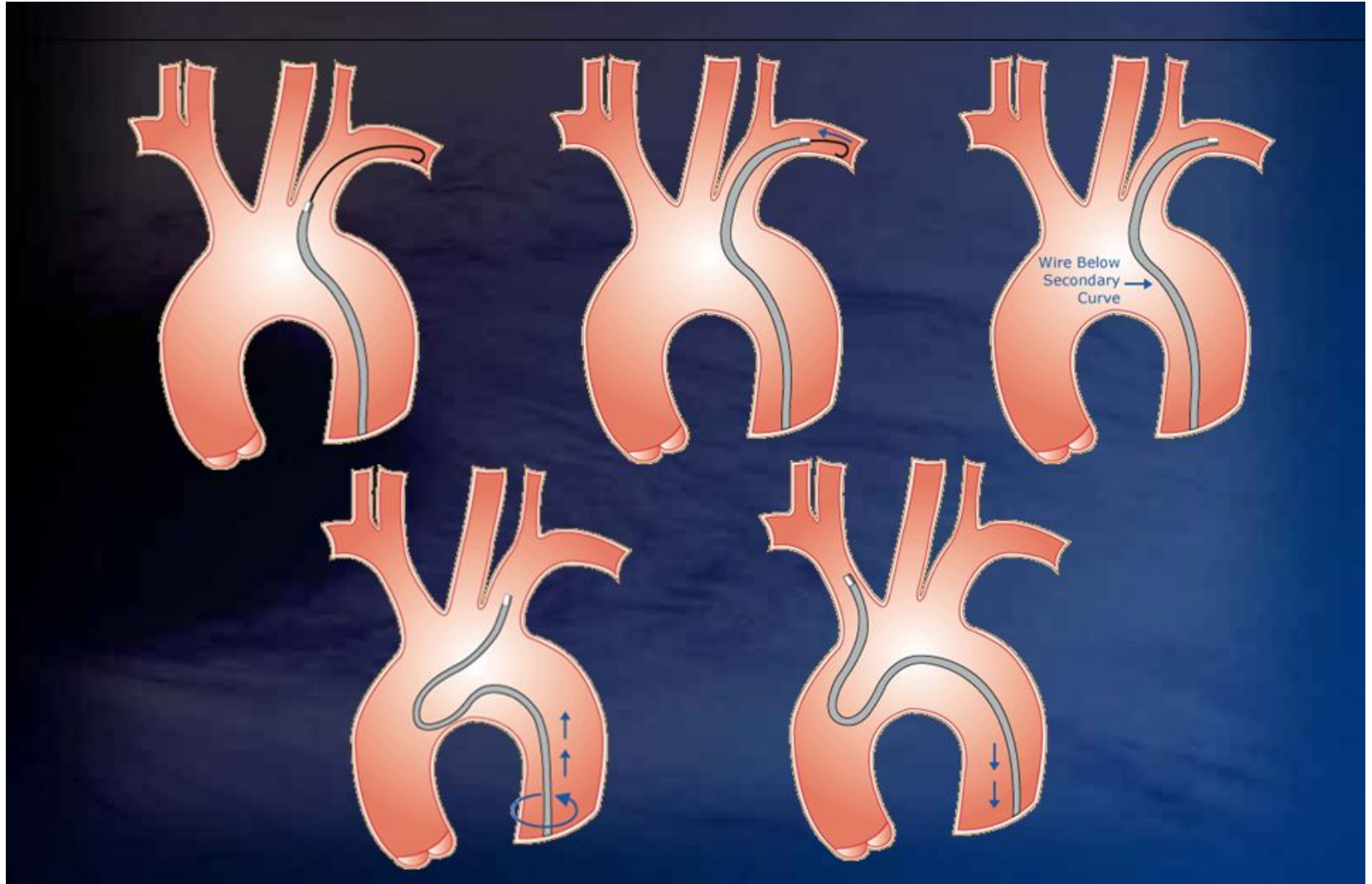
VTK

# Complex Curve Catheter



Vitek, Simmons 1,2,3 Catheters

# Engaging (form) a Simmons II catheter



# Complex Curve Catheter

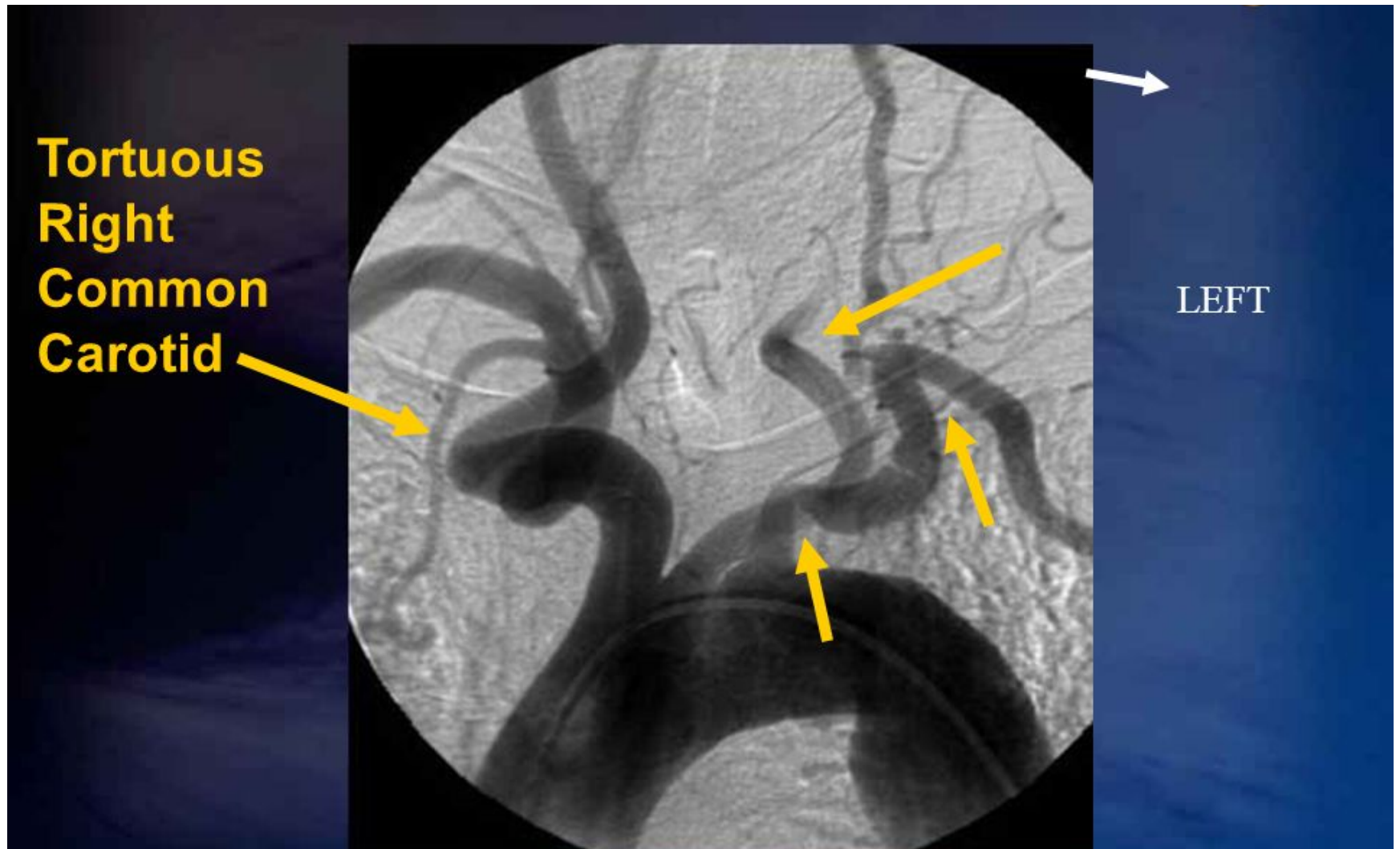
- Allow for access proximal displaced vessels (Type II/III arch or bovine arch)
- Can be formed by placing primary curve in the left subclavian artery and advancing the 2<sup>nd</sup> curve toward the ascending aorta
- Do not track well over the wires
- Sometimes need **exchange wires to change to simple curve catheter**

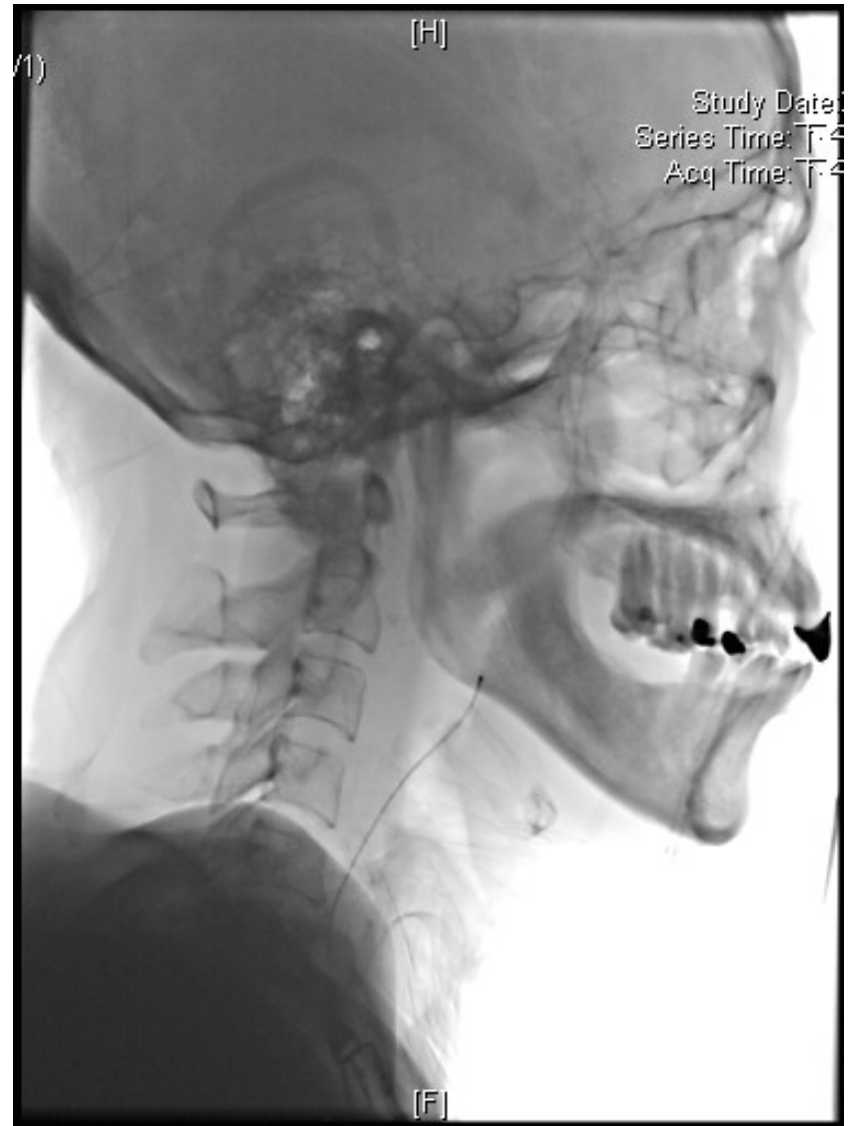


# Carotid artery

- Catheter engage at innominate or left CCA
- Use roadmap of carotid bifurcation
- Stiff 0.035 guide wire advanced into **distal CCA or ECA** (as distal as possible but do not cross the diseased segment)
- Fix the wire, **rotation and advance the catheter over the wire**

# Usual not only the arch





# Techniques for torturous vessels

- Stiff wire/stiff guide technique
- Coaxial catheters technique
- Tip steam-shaping of the reperfusion catheter
- Stent anchor or balloon anchor technique

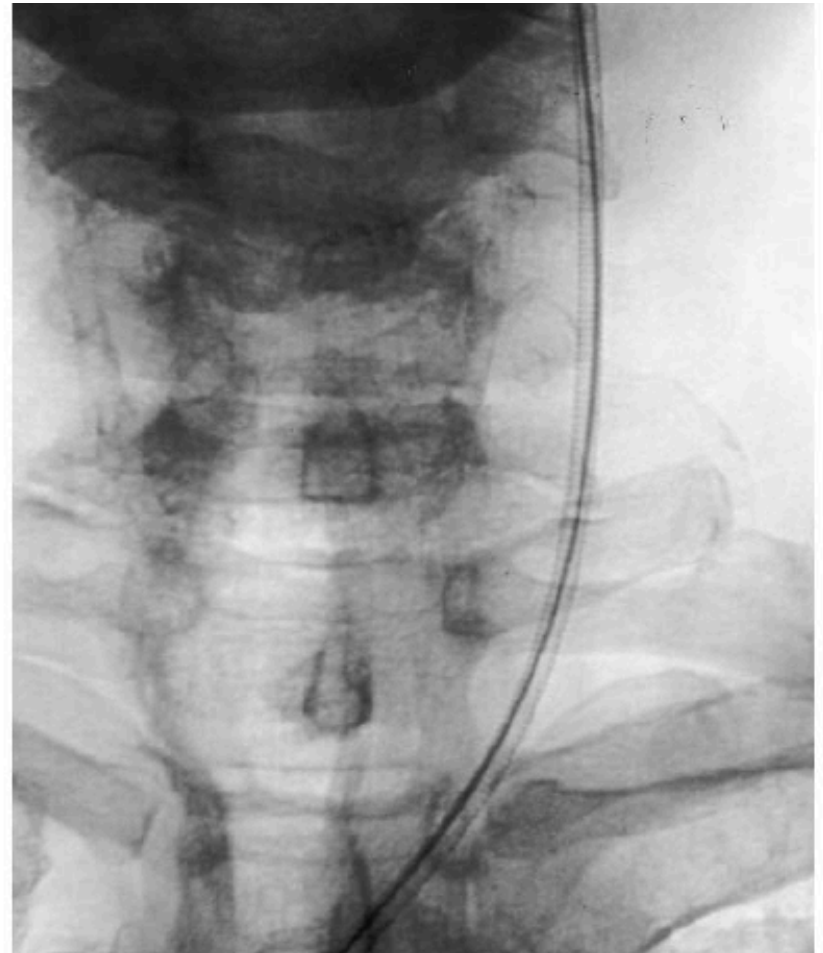
# 粗細 vs. 遠近, 鐵道 vs. 列車

- 細：可以走的遠，支撐力差  
粗：支撐力佳，但無法走遠
- Guide wire: 0.035/0.038
- Microwire: 0.014/0.010
- Guide catheter: Shuttle, Balloon guide cath.
- Intermediate catheter: Neuron 088, Navien 058/072, Neuron 070/053
- Reperfusion catheter: ACE (Penumbra), Sofia
- Microcatheter: 0.017, 0.021, 0.023, 0.027

# Tortuous or redundant VA

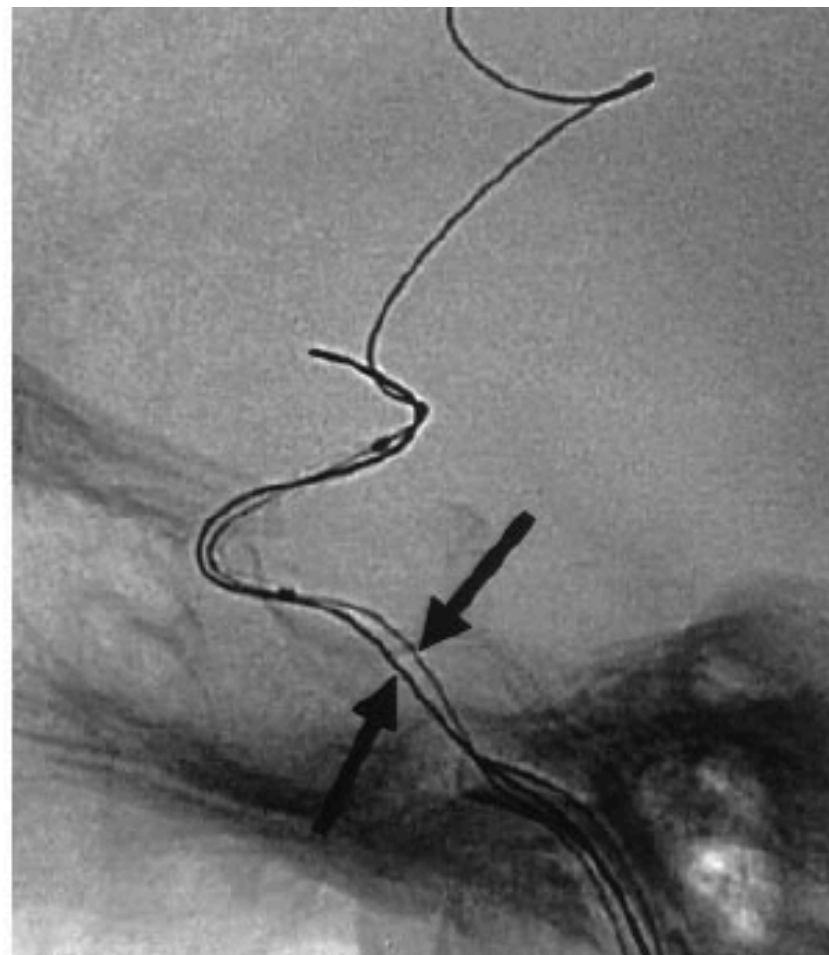
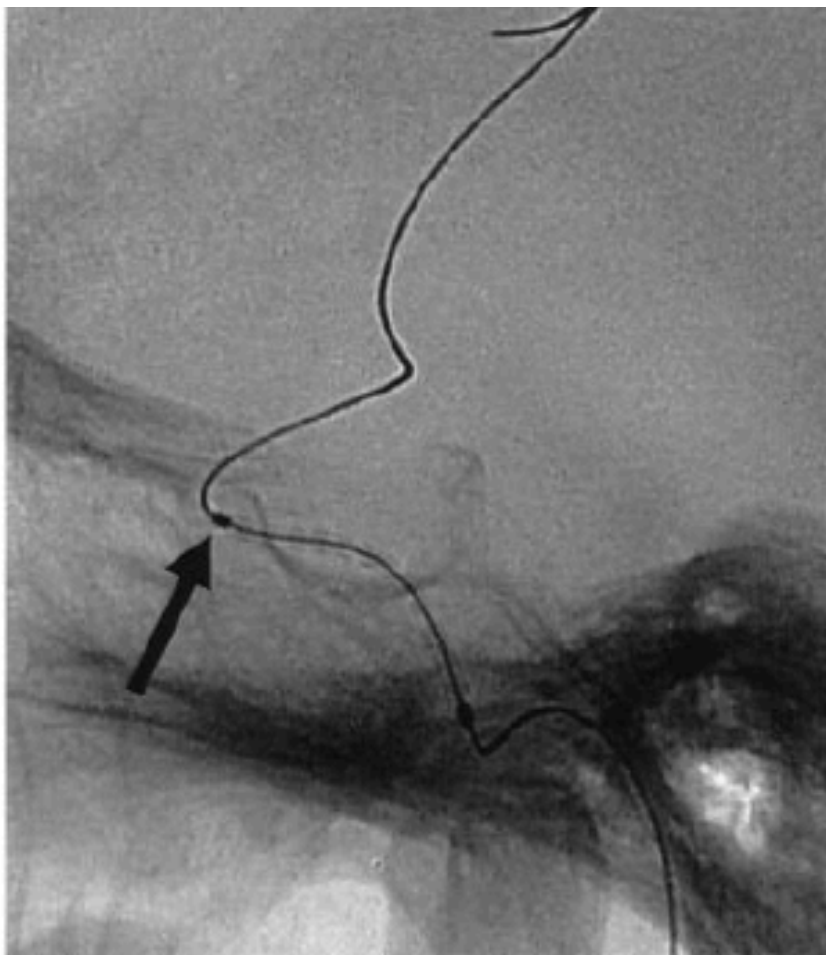
- 0.35 wire cross the tortuous vessel
- Rotation and advance of the stiff wire; upright the artery
- Guide catheter advance over the wire

# Stiff wire/stiff guide



*Donald A, Kyle A, et al .  
AJNR. 2003 Feb. 24:275-278.*

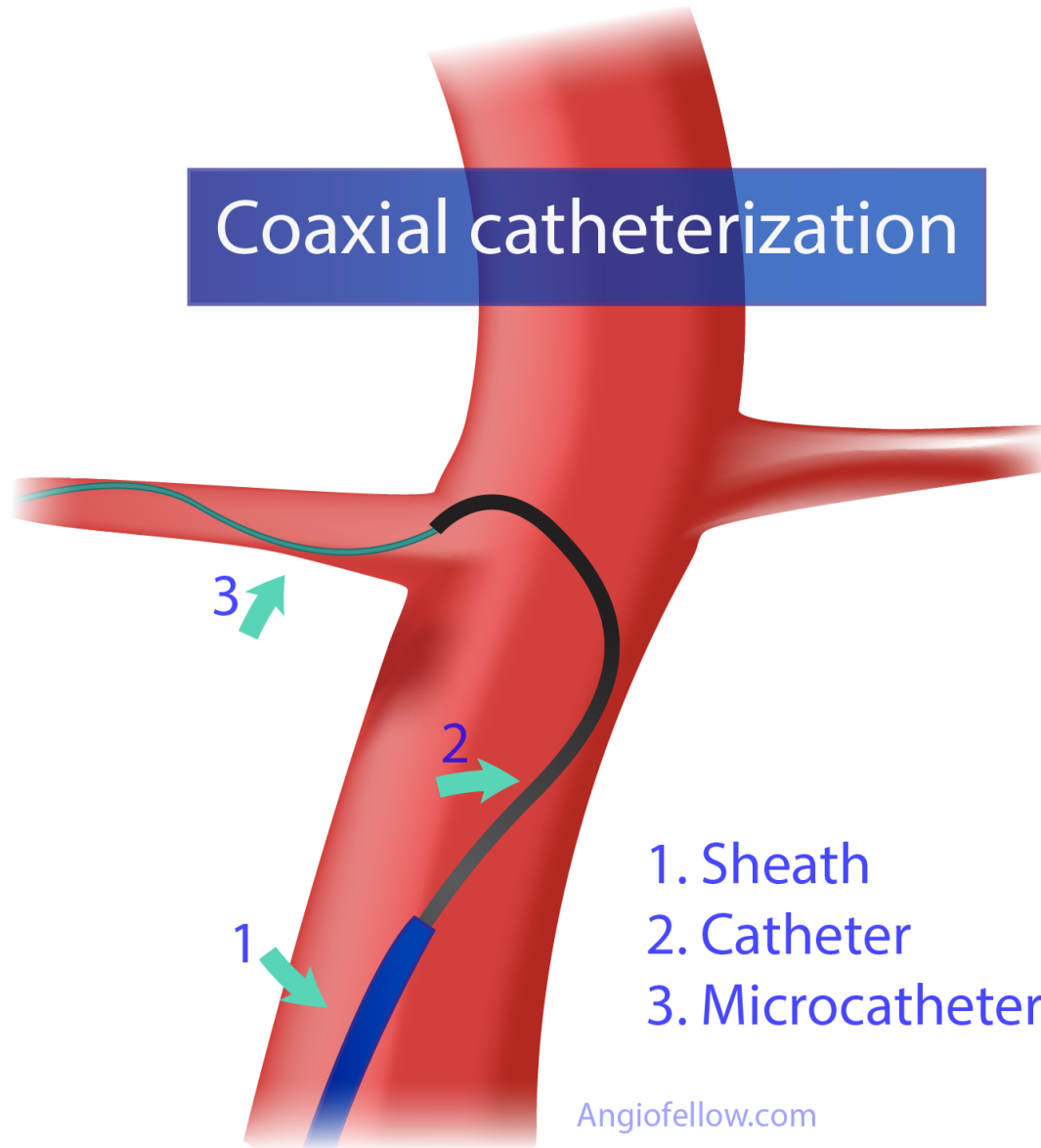
# double wire technique



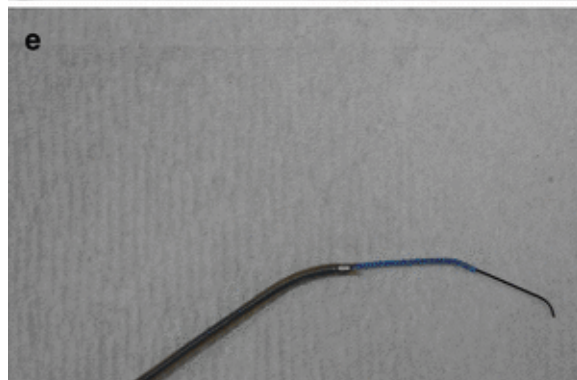
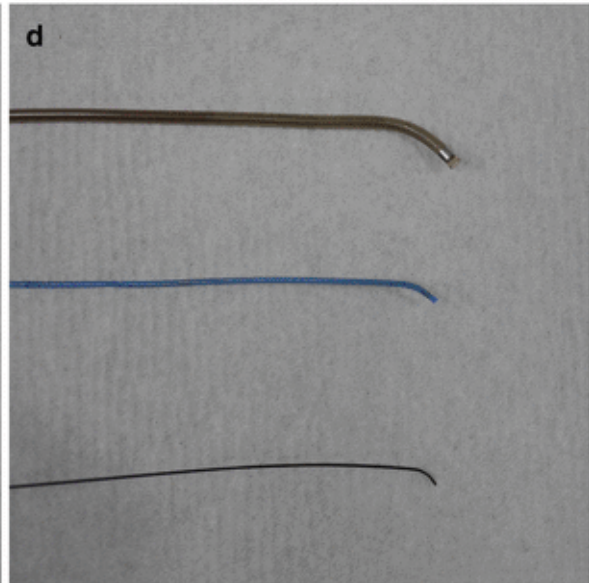
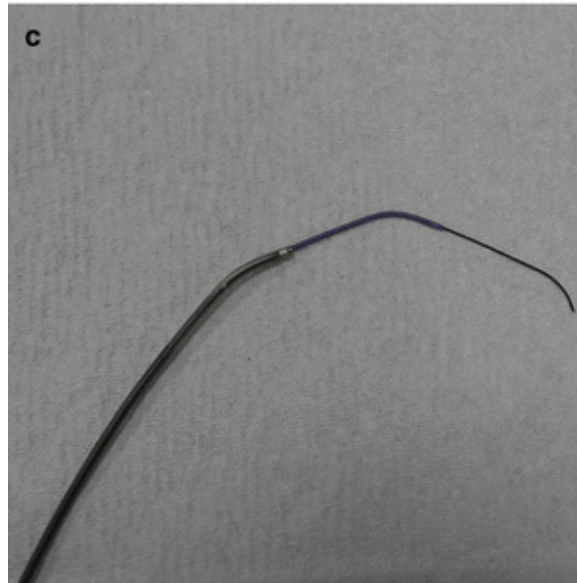
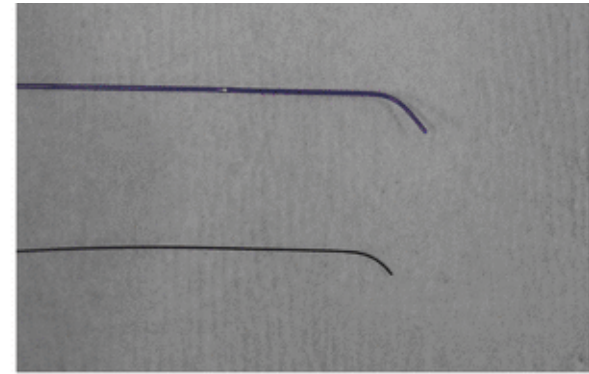
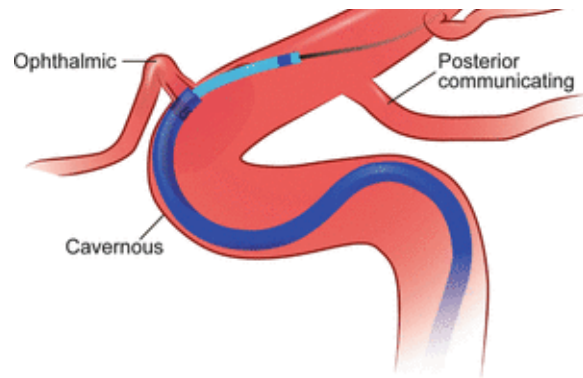
*Lee TH, Choi CH, et al .  
AJNR. 2005 Jun/July. 26:1375-1380.*



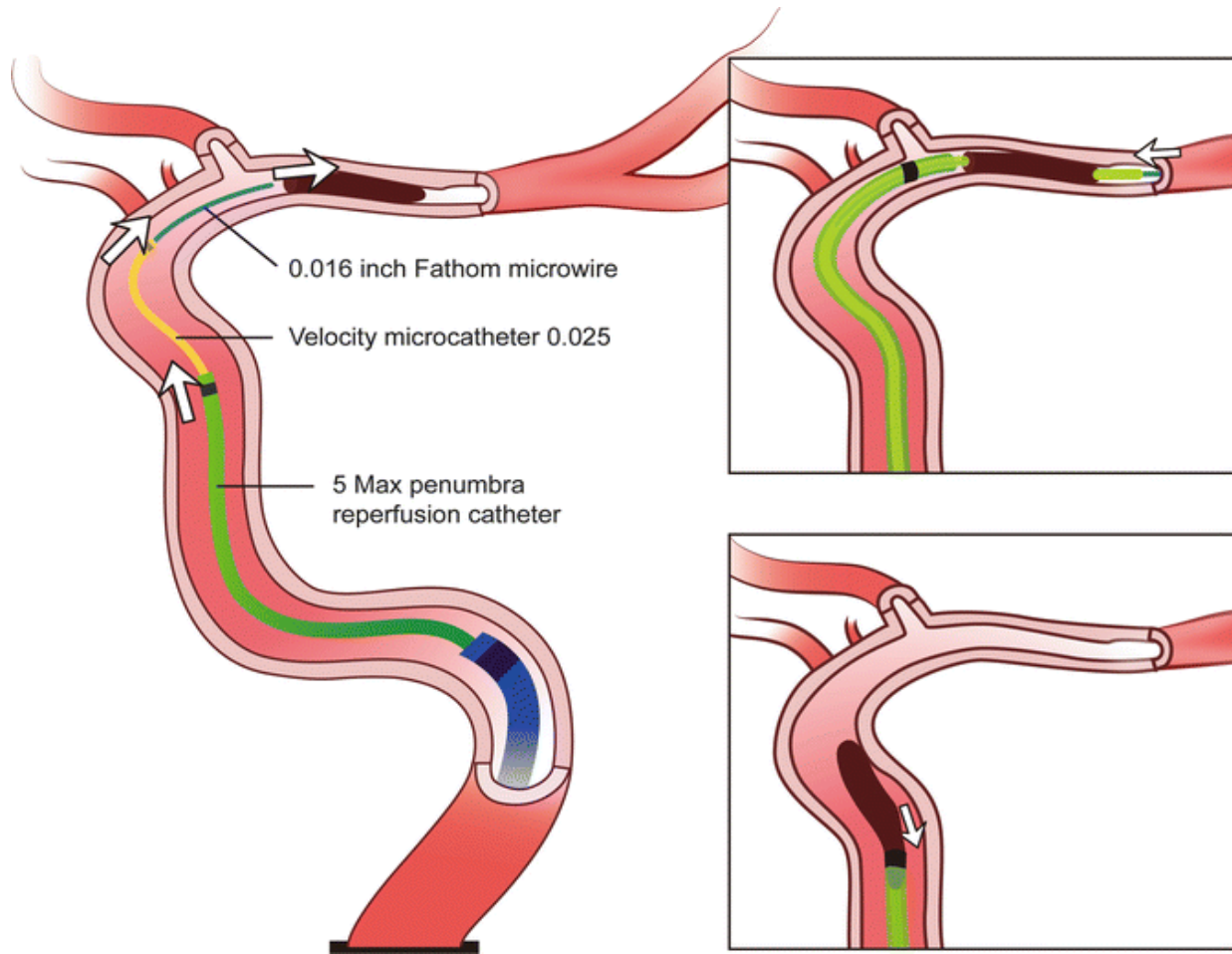
# Coaxial catheterization



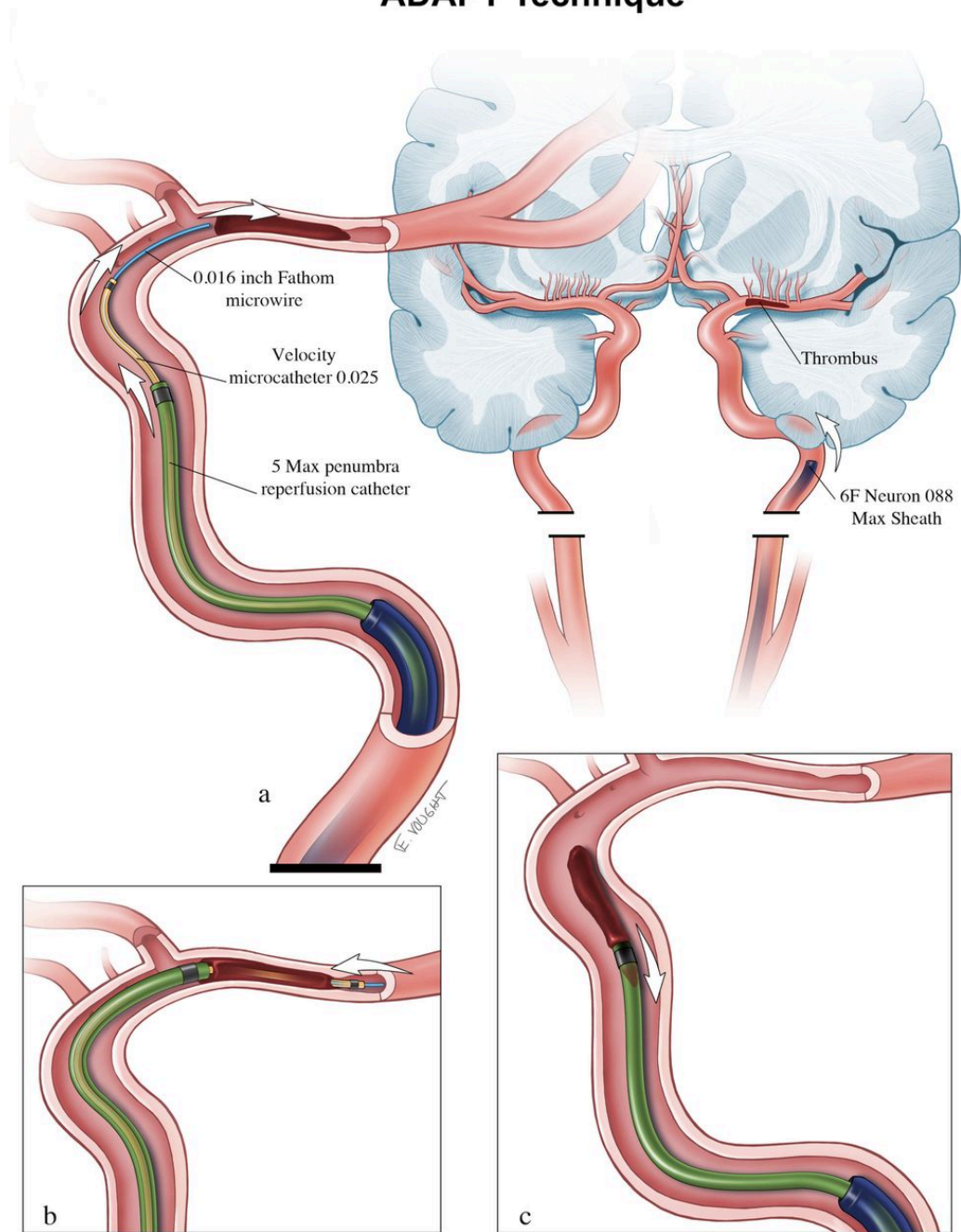
# Coaxial Catheters technique



# Coaxial Catheters

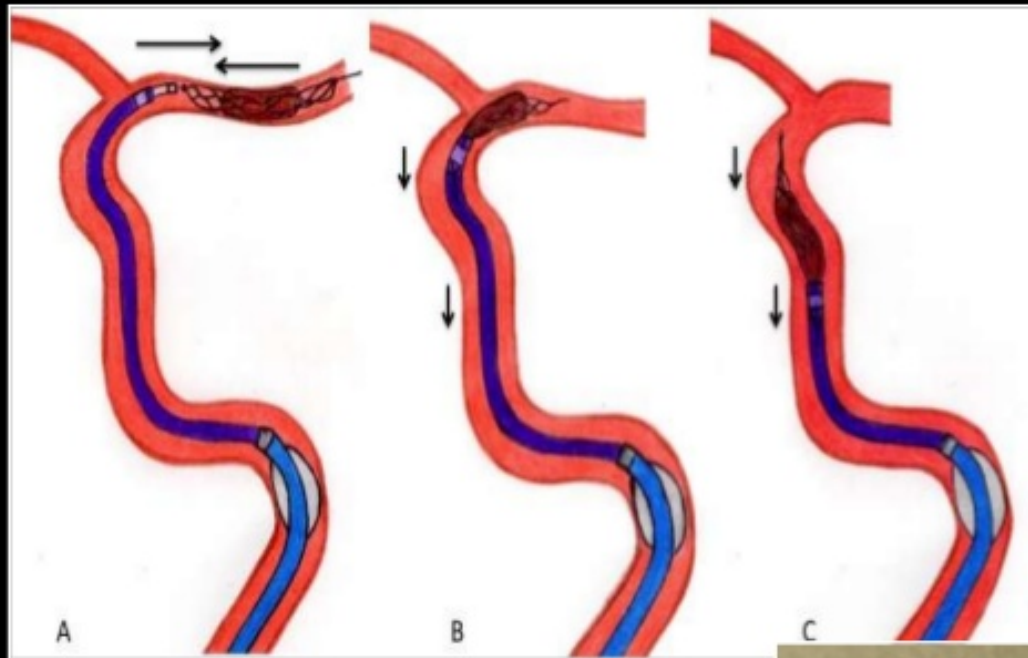


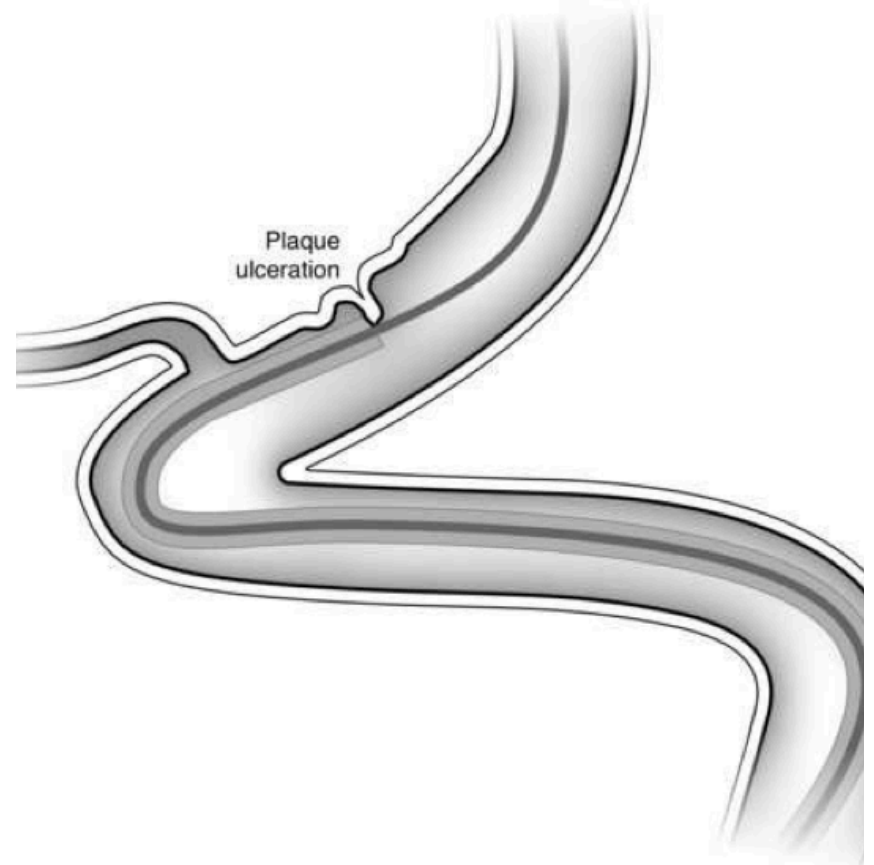
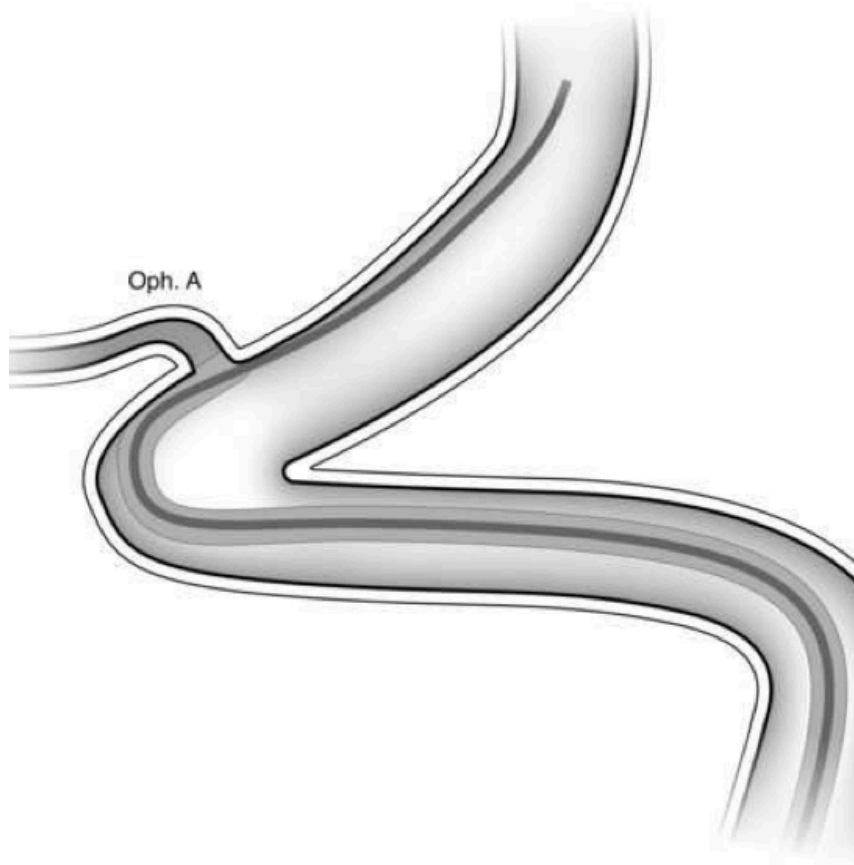
# ADAPT Technique



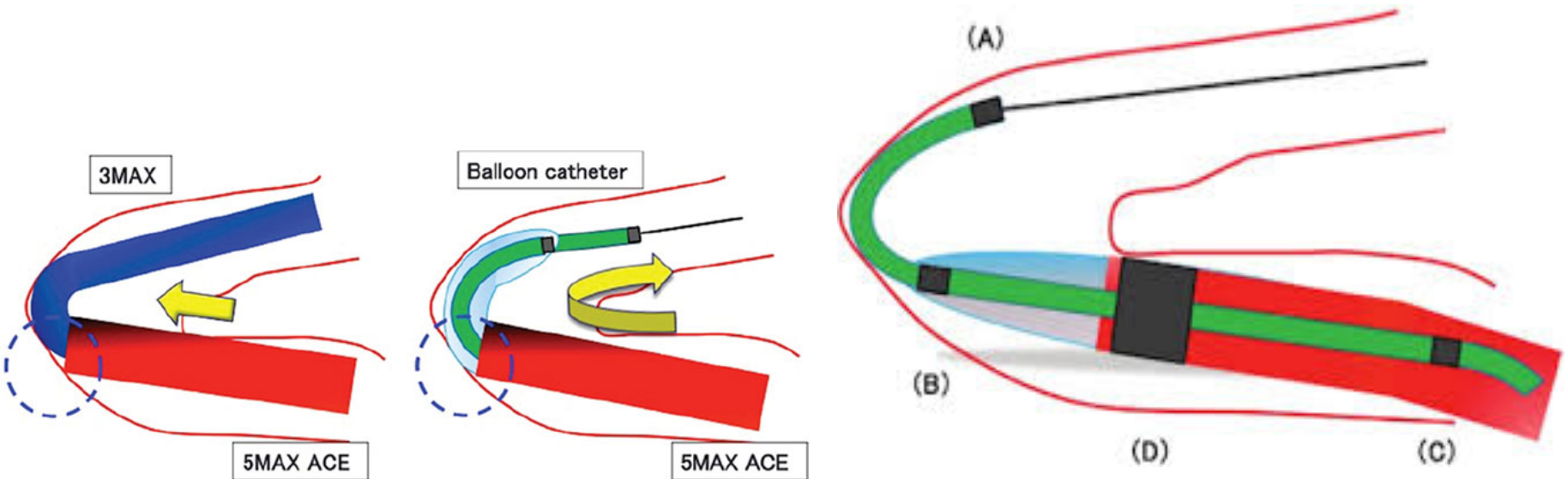
# Coaxial for stent retriever (Solumbra)

## ARTS (SOLUMBRA) (Aspiration-Retriever Technique for Stroke)





# Coaxial system with a compliant balloon catheter for navigation of the reperfusion catheter



*J Neurosurg. 2017 Apr;126(4):1334-1338*  
*Takahira K, Kataoka T2, Ogino T, Endo H, Nakamura H.*



# SOFIA<sup>®</sup> Plus

Aspiration Catheters



5MAX<sup>™</sup>

4MAX<sup>™</sup>

3MAX<sup>™</sup>

**ACE<sup>™</sup>**  
**68**

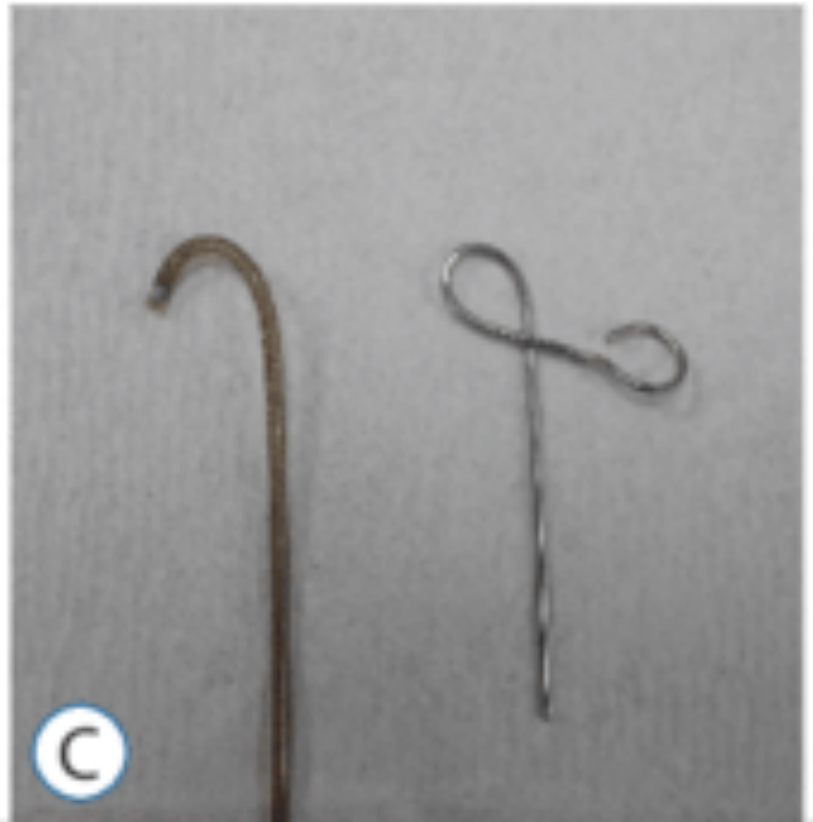
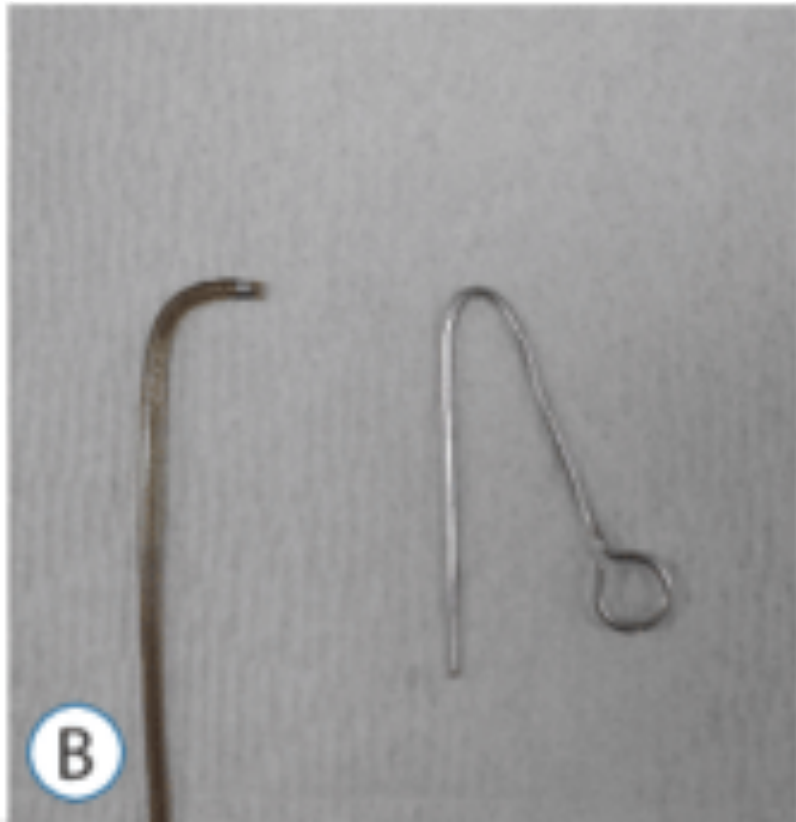


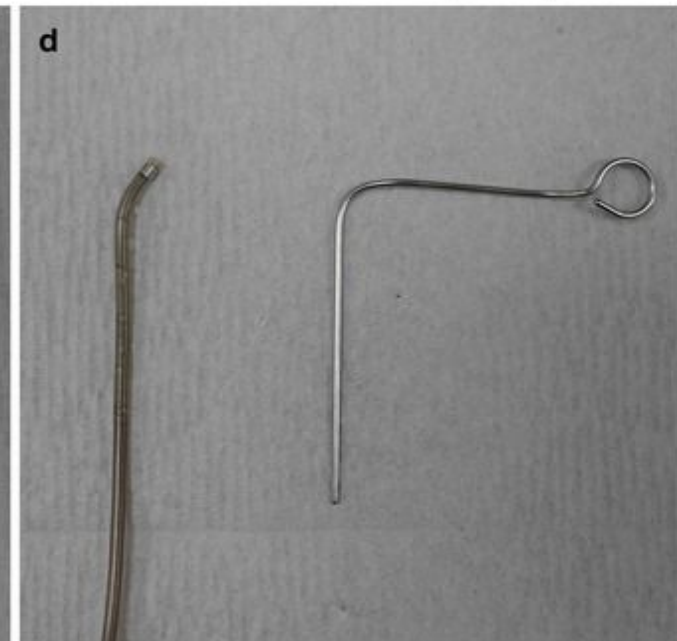
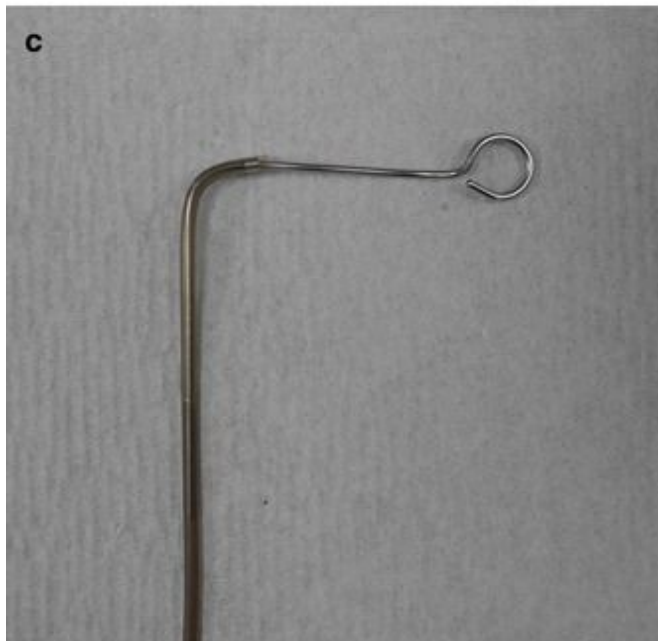
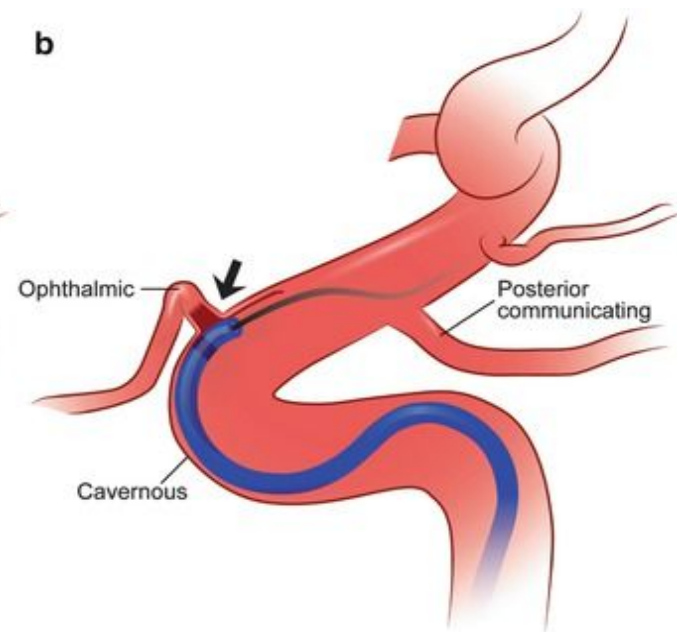
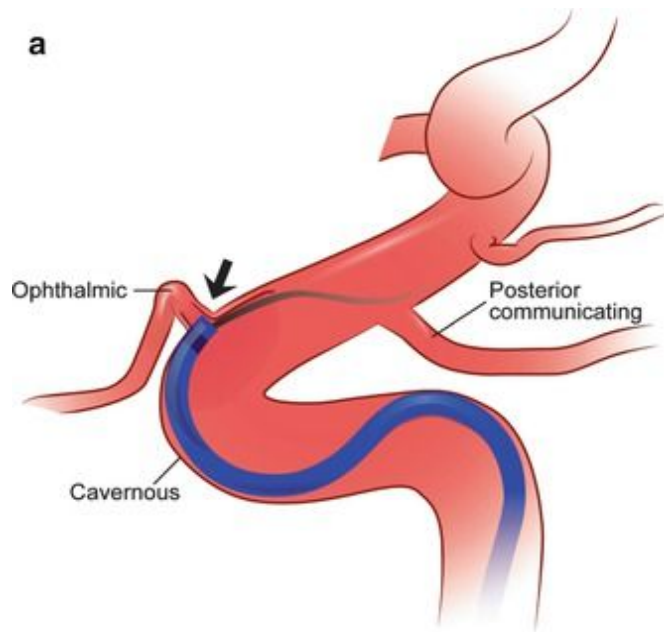


# Sofia



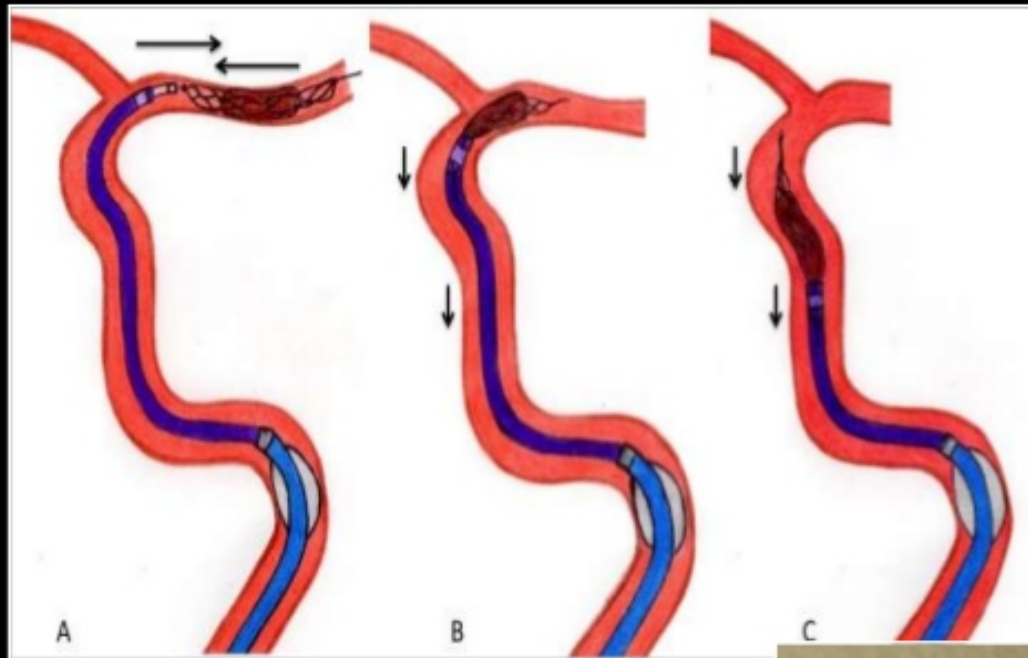
# Shape the catheter tip





# Coaxial for stent retriever (Solumbra)

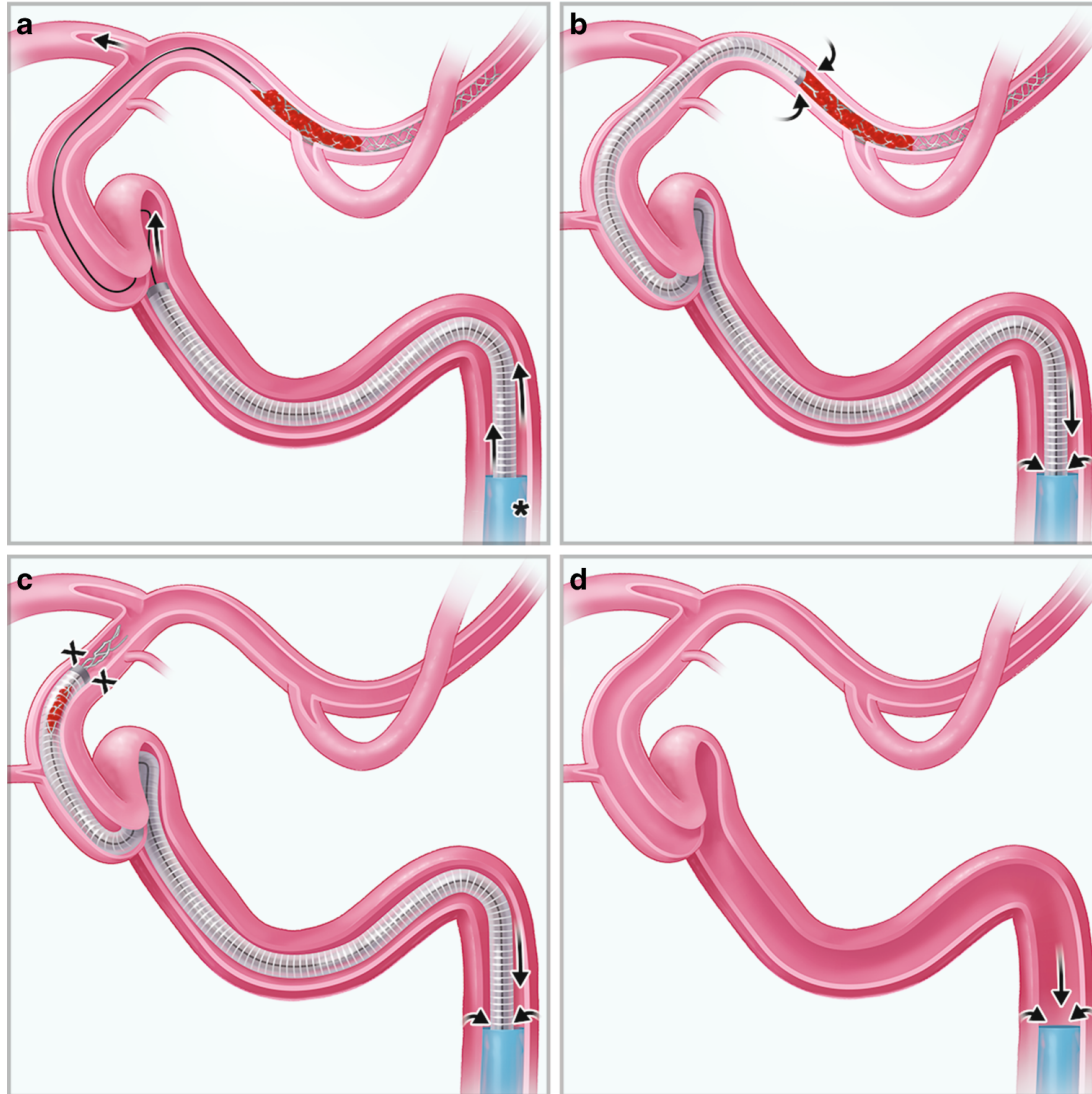
## ARTS (SOLUMBRA) (Aspiration-Retriever Technique for Stroke)



# Stent Anchor Technique with Stent Retriever (Solumbra)

- Microcatheter, coaxially with a reperfusion catheter (5MAX ACE) or an intermediate catheter (Neuron or Navien)
- The microcatheter navigate through the clot; A stent retriever was then delivered through the microcatheter to engage the clot
- The stent should be pulled slowly until the whole system returns to the central position of the lumen
- Reperfusion or intermediate catheter should be advanced along the stent and stent sheath

# Stent Anchor

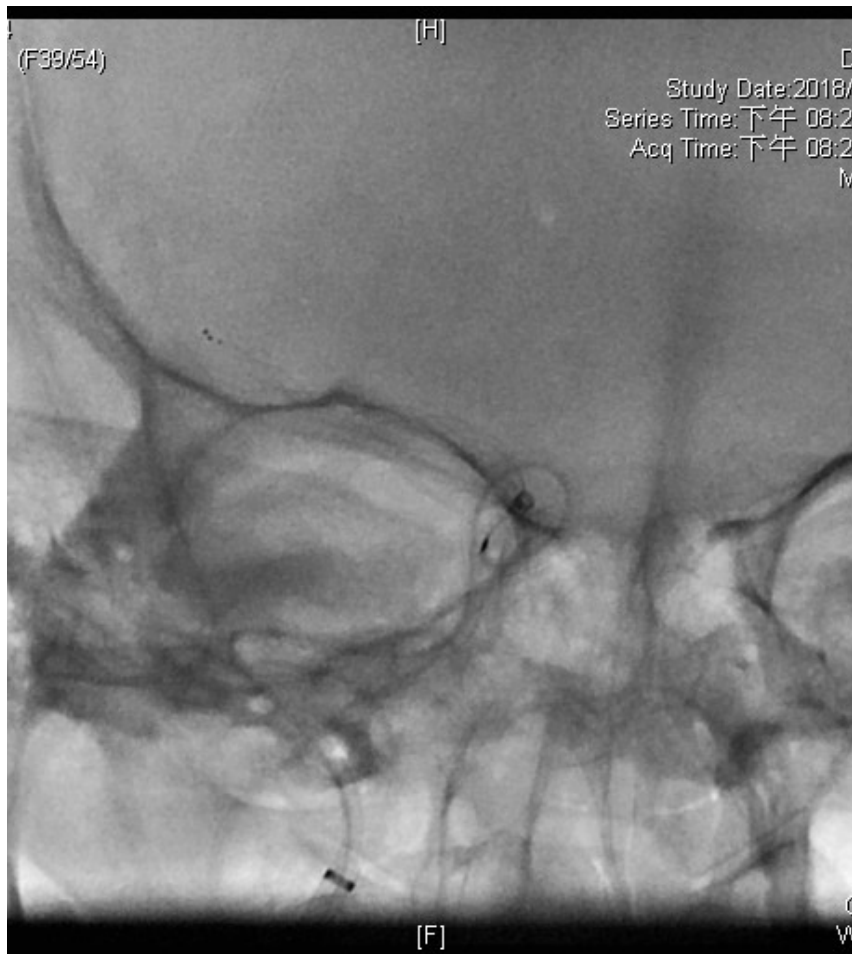


81 y/o, female, onset 1 hour, NIHSS:8









# Solumbra once, TICI 2B, mRS: 1



# 55 y/o male, post lung lobectomy day2, NIHSS: 26



# Balloon Anchor Technique

ORIGINAL RESEARCH

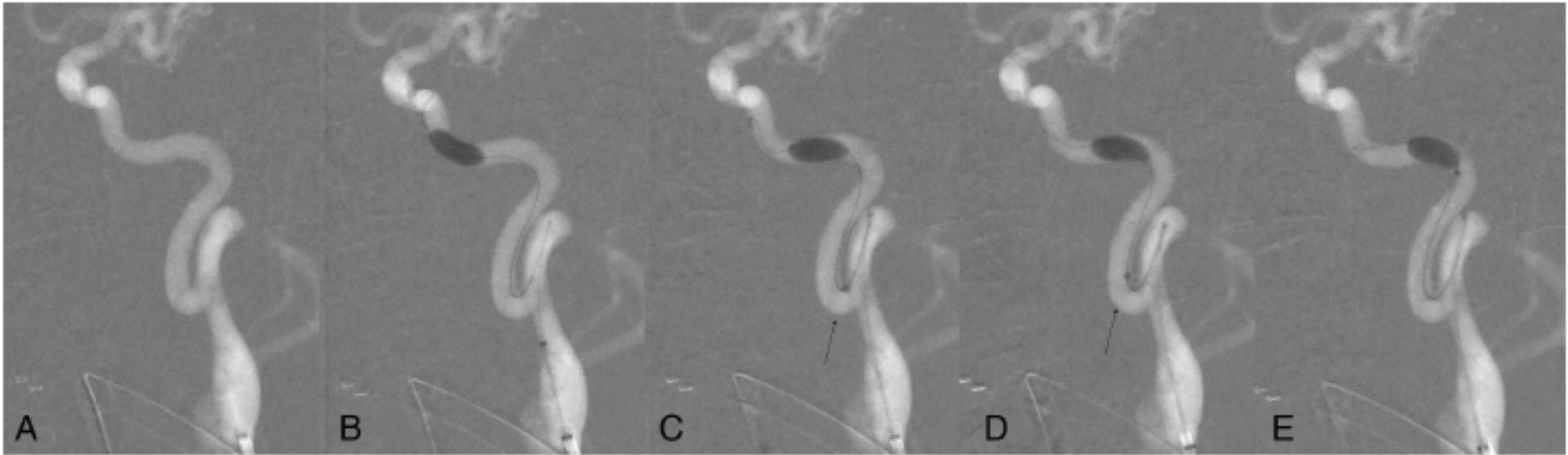
Balloon-assisted guide catheter positioning to overcome extreme cervical carotid tortuosity: technique and case experience

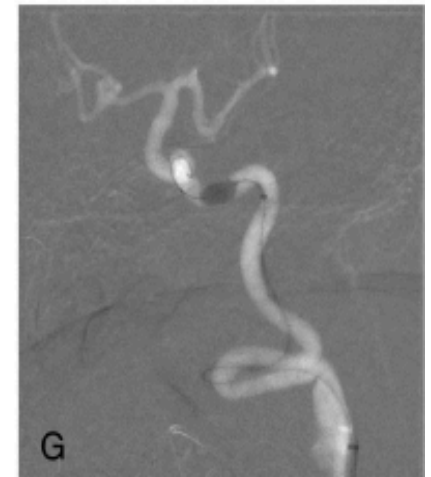
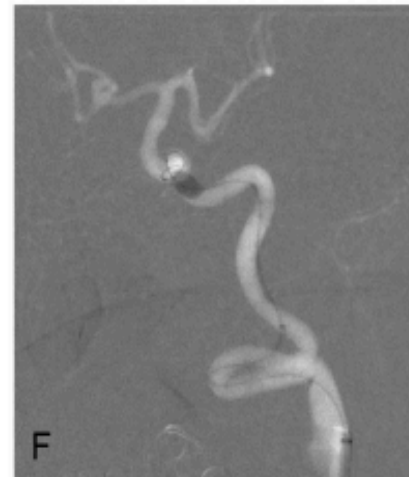
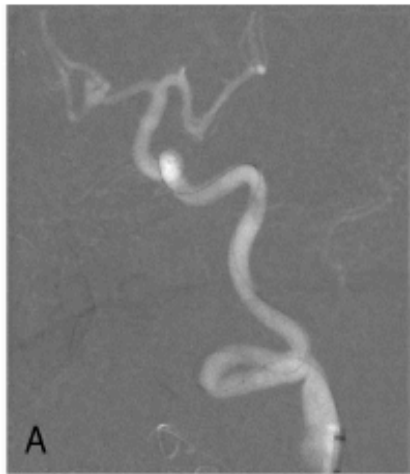
Lissa Peeling, David Fiorella

*Peeling L, et al .  
J Neurointerv Surg. 2014;6 129-1333.*

# Balloon Anchor Technique

- Hyper-compliant balloon:  
Hyperform / Hyperglide (ev3)  
Scepter C / Scepter XC (Microvention)



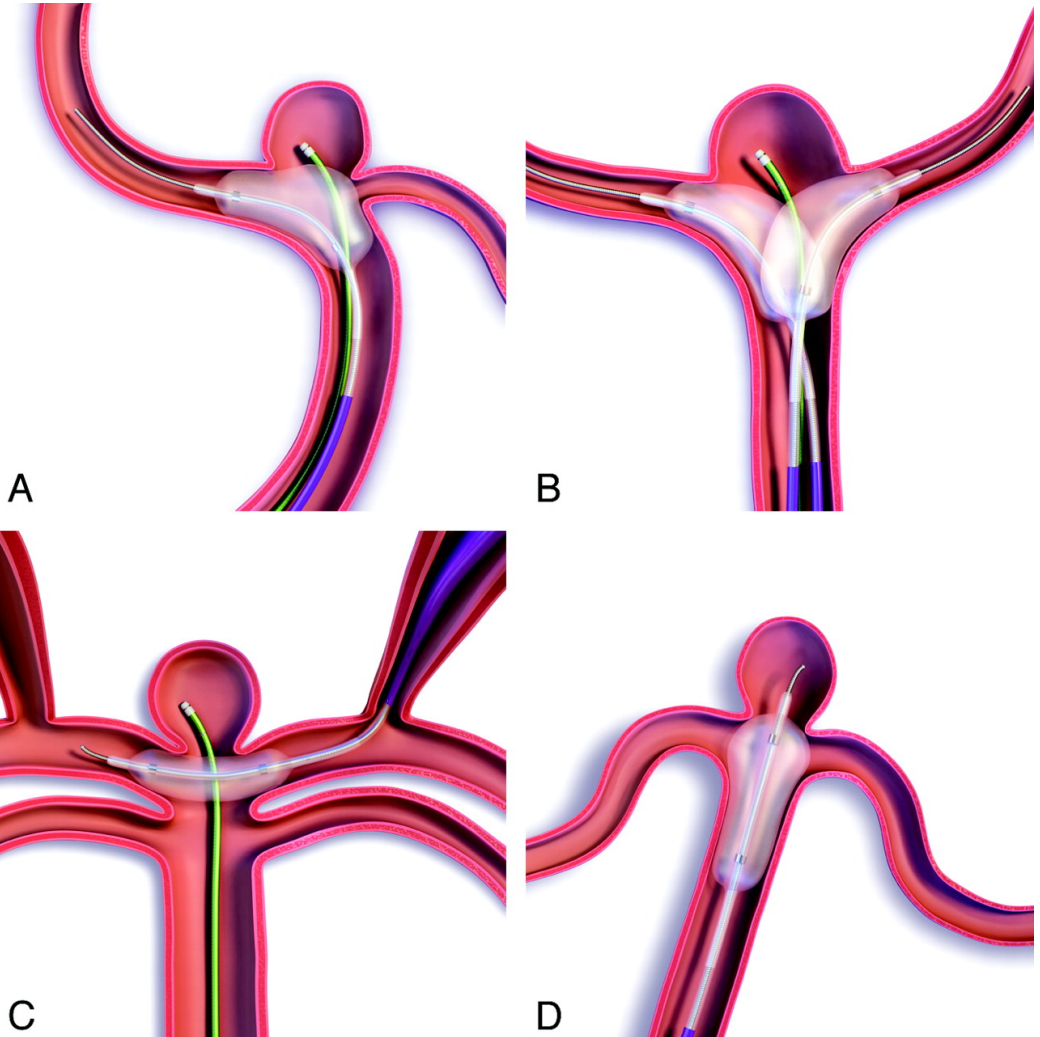


*Peeling L, et al .  
J Neurointerv Surg. 2014;6 129-1333.*

# Technique With Compliant Balloon Catheter

- Coaxially compliant balloon catheter (Scepter XC) + reperfusion or intermediate catheter
- To the distal internal carotid artery (ICA) or proximal middle cerebral artery (MCA), or ECA
- Balloon was carefully inflated to engage the vessel wall to increase friction.
- The Scepter should be pulled slowly until the whole system returns to the central position of the lumen
- Reperfusion or intermediate catheter should be advanced along the balloon catheter avoiding the obstacles at the convexity side, such as, the orifice of the ophthalmic artery, atherosclerotic plaque, or plaque ulceration

# Compliant balloon: Scepter C or XC



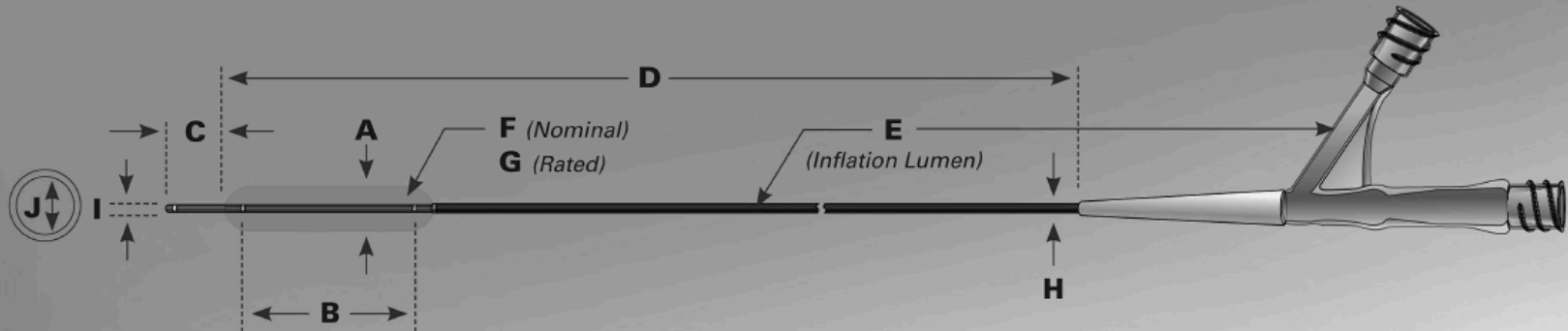


# Scepter C Balloon

## Scepter C™

Occlusion Balloon Catheter

Product Code	A Balloon Diameter	B Balloon Length	C Tip Length	D Catheter Working Length	E Inflation Lumen Dead Volume	F Balloon Inflation Volume (Nominal)	G Balloon Inflation Volume (Rated)	H Proximal Shaft Outer Diameter	I Distal Tip Outer Diameter	J Inner Lumen Diameter
BC0410C	4.0mm	10mm	5mm	150cm	0.40cc	0.14cc	0.22cc	2.8F	2.1F	0.0165 in
BC0415C	4.0mm	15mm	5mm	150cm	0.40cc	0.18cc	0.22cc	2.8F	2.1F	0.0165 in
BC0420C	4.0mm	20mm	5mm	150cm	0.40cc	0.22cc	0.22cc	2.8F	2.1F	0.0165 in

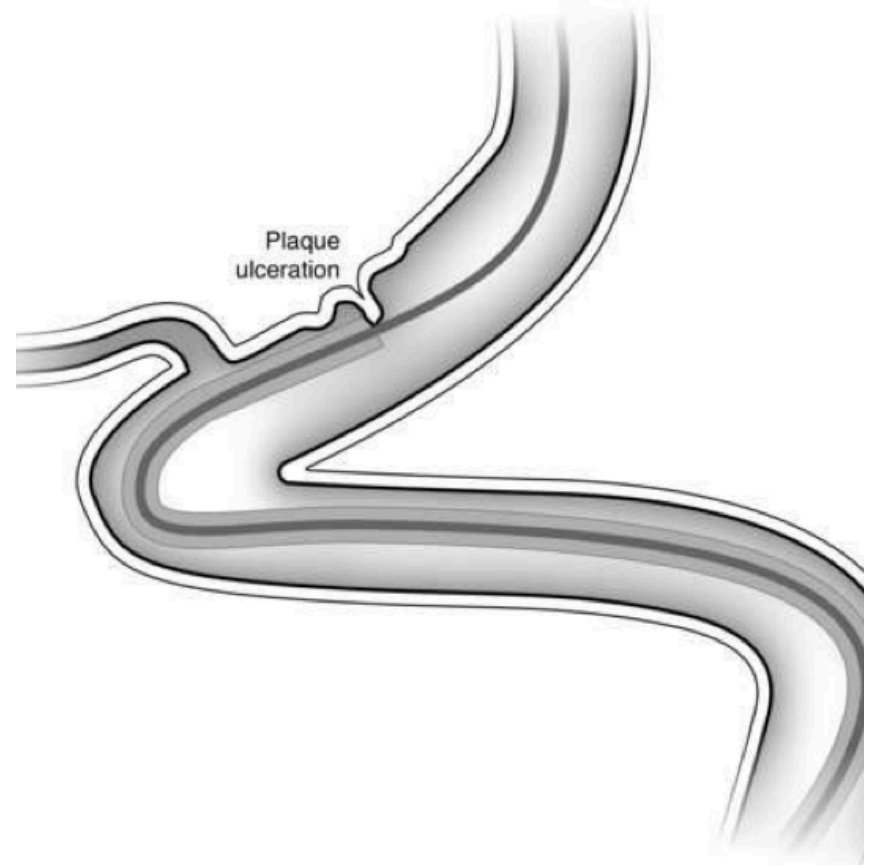
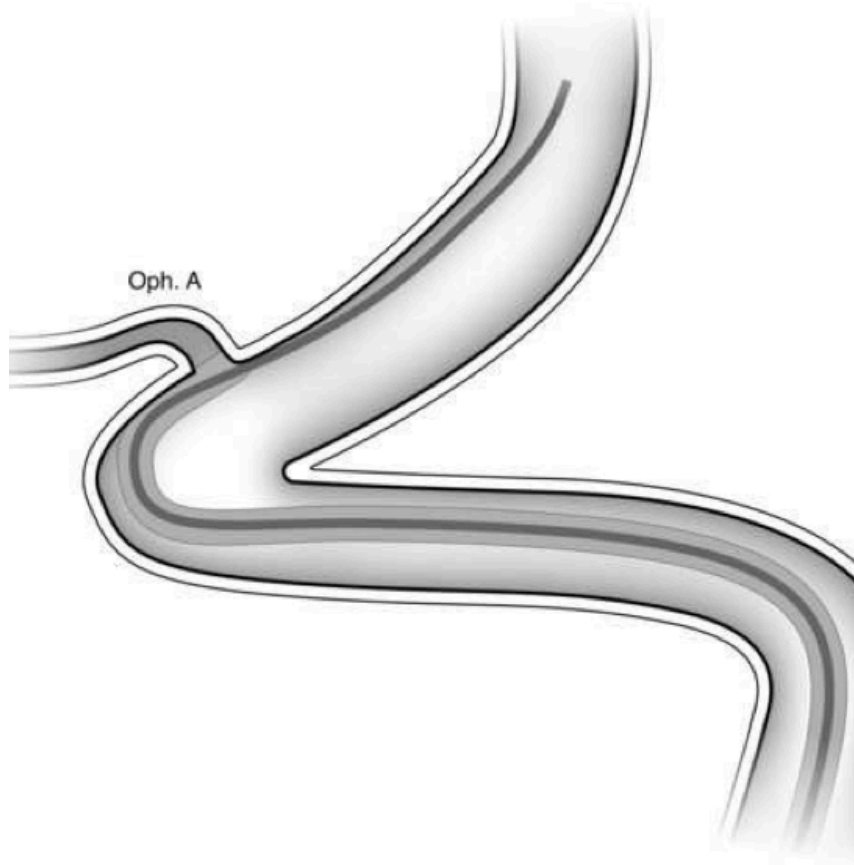


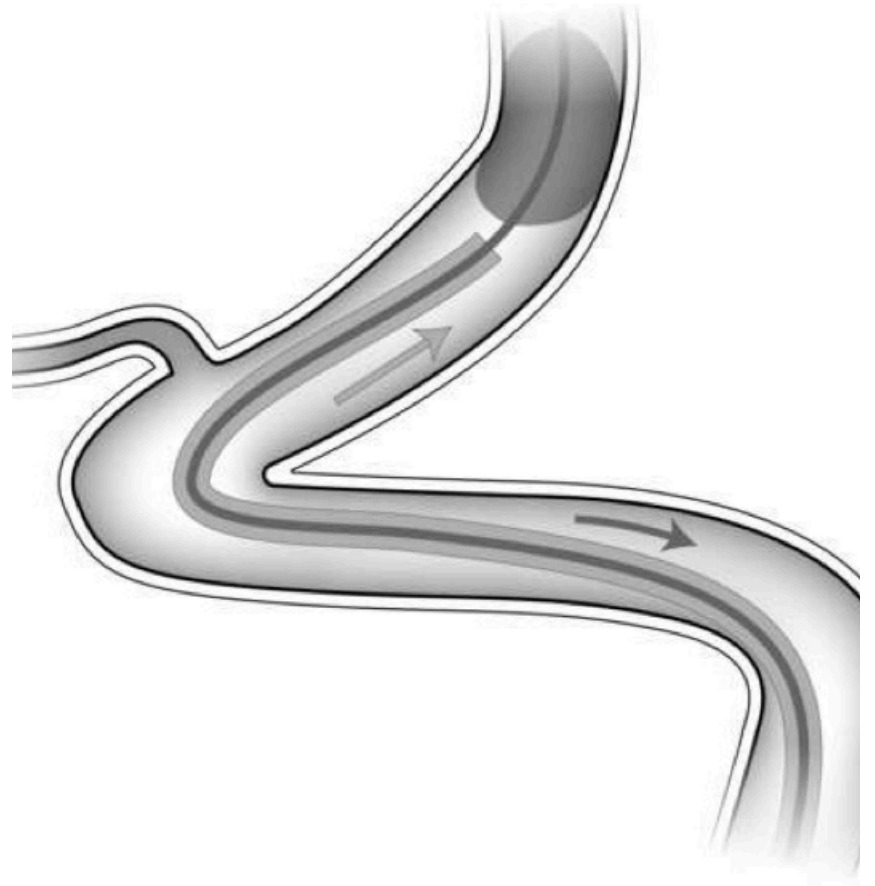
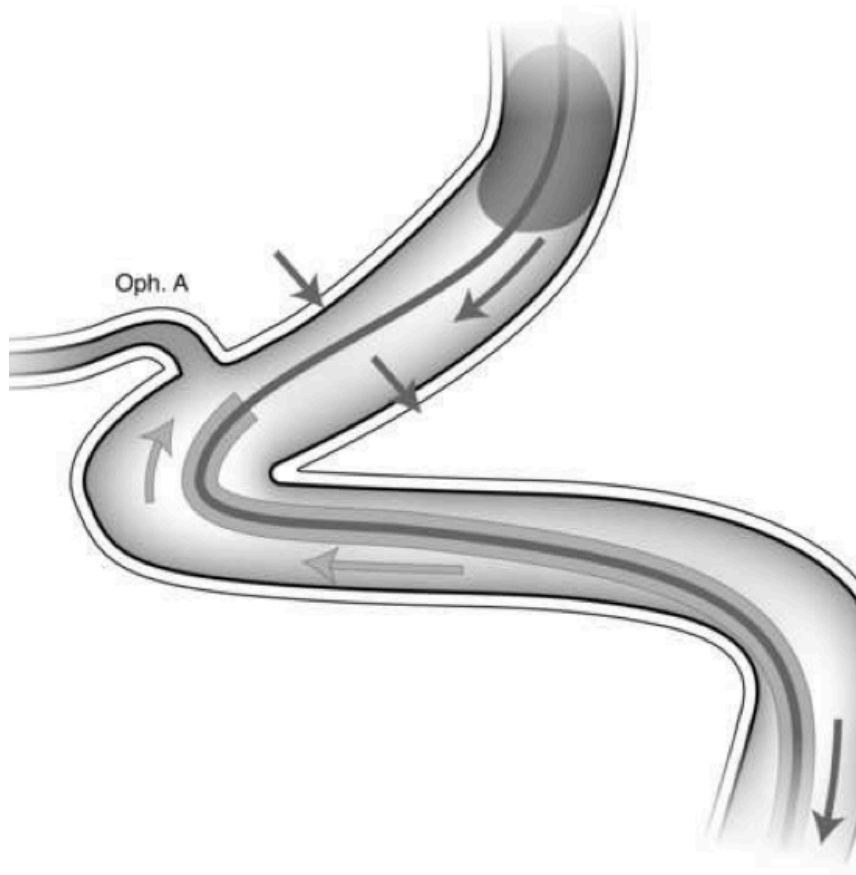
Heit JJ, et al.  
*J NeuroIntervent Surg* 2015;7:56–61.

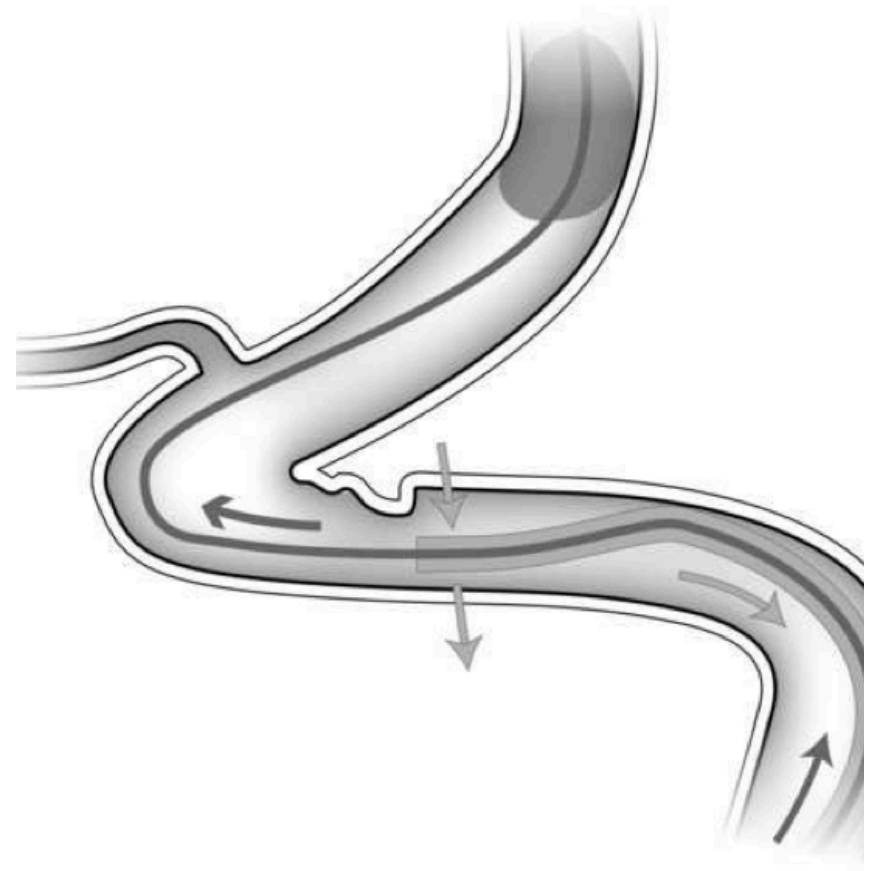
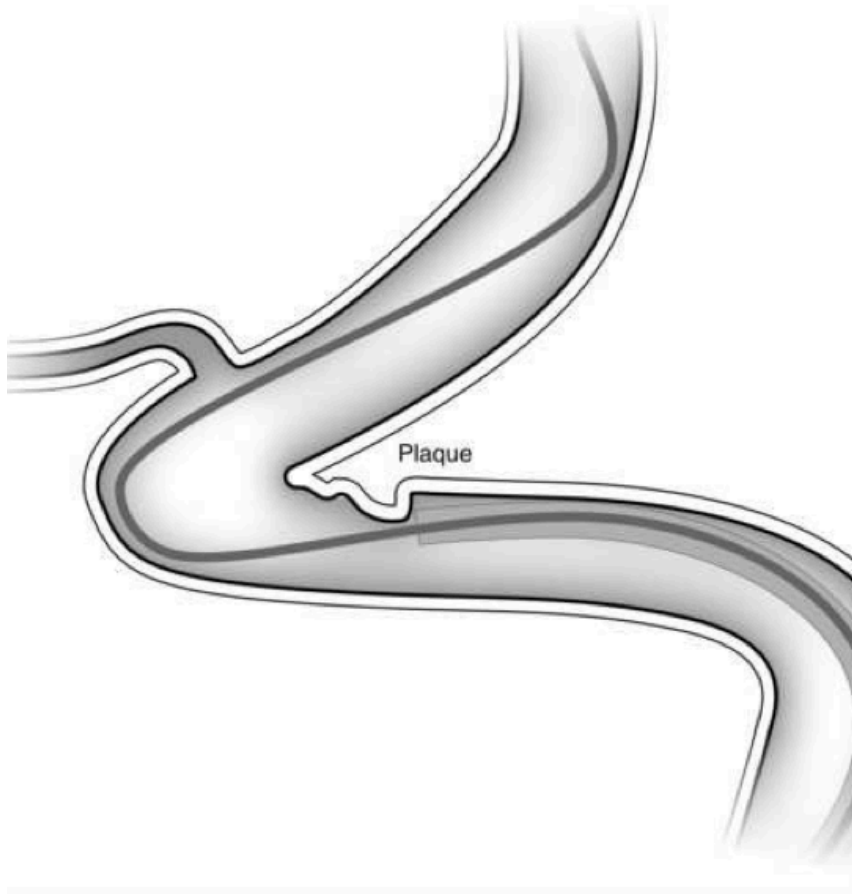
# Scepter XC Balloon

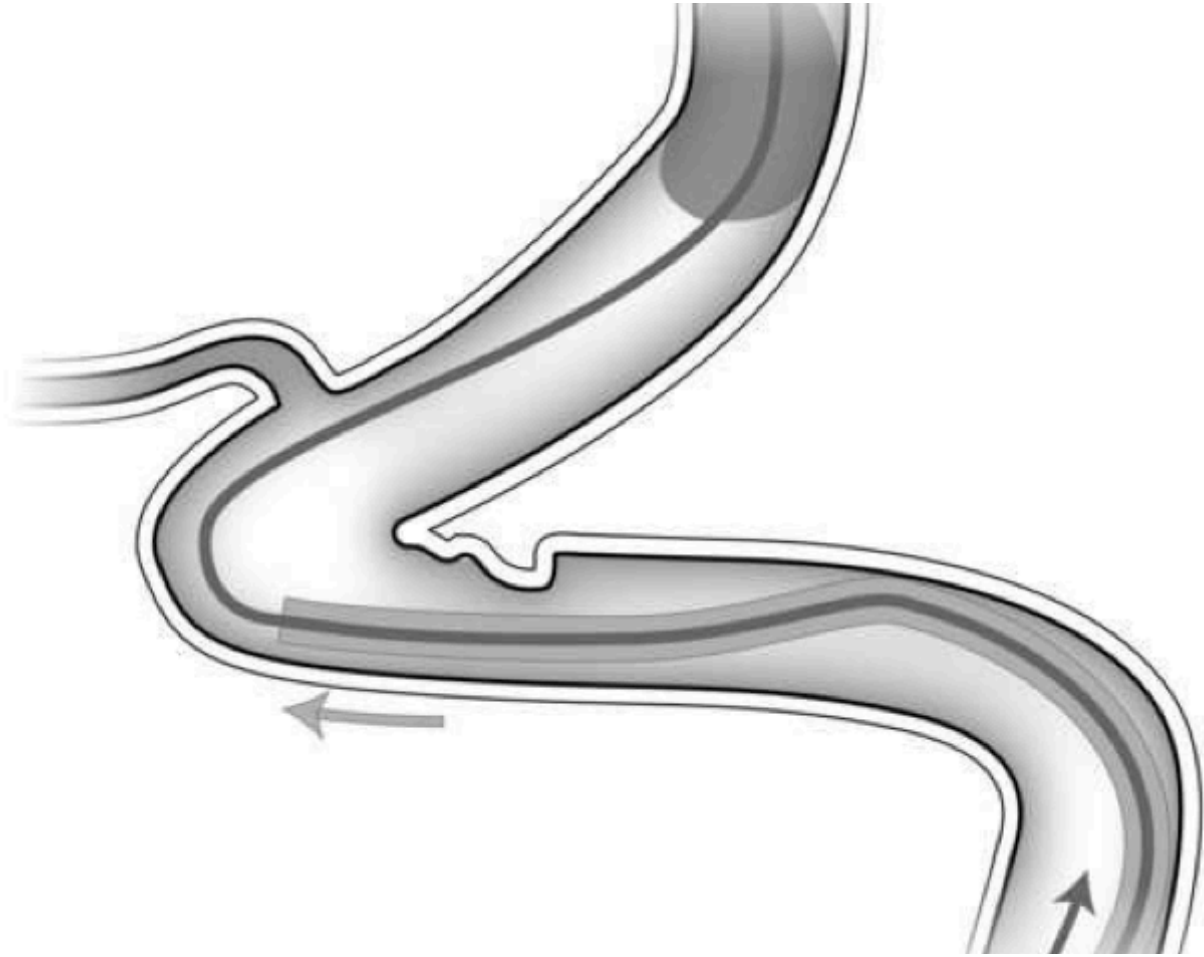
- Dual coaxial lumen, low inflating pressure-compliant
- The trackability, stability, and extra compliant balloon design; facilitate safe and successful balloon remodel technique and angioplasty
- Accommodate a larger 0.014 inch microwire; provide significant stability during navigation of tortuous vessels and distal advancement

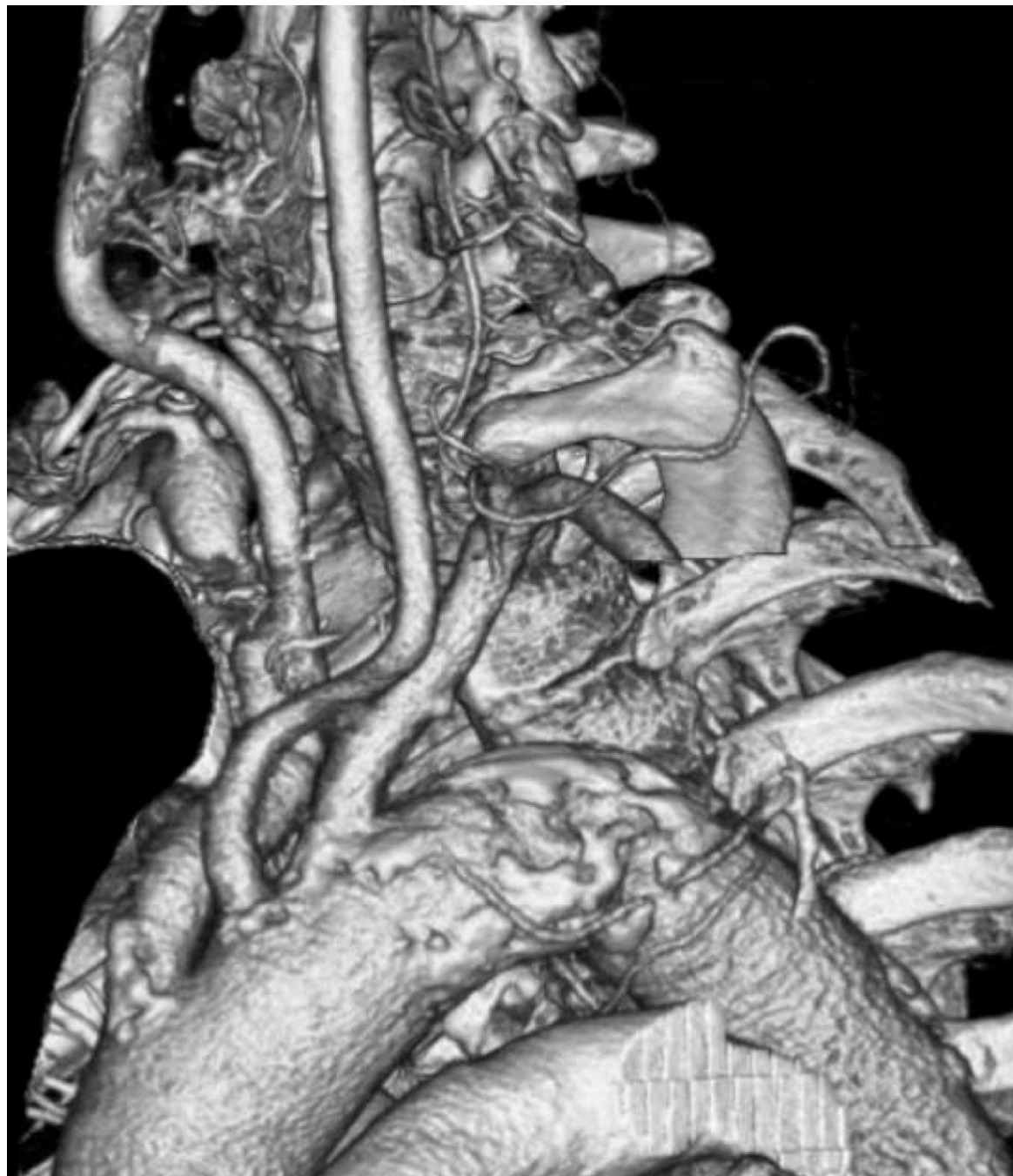
*Heit JJ, et al.  
J NeuroIntervent Surg 2015;7:56–61.*











# Balloon anchor in ECA





# Aspiration once



# Anchor Tracking (ANTRACK) Technique

OXFORD  
ACADEMIC

OPERATIVE  
NEUR  SURGERY  
THE SURGEON'S ARMAMENTARIUM

- **The ANTRACK technique: employing a compliant balloon or stent retriever to advance a large-bore catheter to an occlusion during thrombectomy procedures in acute stroke patients.**

*Chuan-Min Lin, Yi-Ming Wu, Chien-Hung Chang,  
Ching-Chang Chen, Alvin Yi-Chou Wang*

*Operative Neurosurgery 2018 Dec 10*

# Summary (1) : Aorta

- Femoral approach whenever possible
- Evaluate CTA: 先想好可能會遇到的困難，事先準備適合的catheters
- Arch angiography
- Primary or 2<sup>nd</sup> Simmons curve, exchange wires to change to simple curve catheter
- Stiff guide wire into distal CCA or ECA (as distal as possible), rotation and advance the catheter over the wire
- Double wire or balloon anchor technique

# Summary (2) : ICA / VA

- Roadmap
- Coaxial (tri-axial) multiple catheters
- Shaping the tip of the intermediate or reperfusion catheters
- Solumbra: Intermediate catheter to distal ICA, deployed the stent, use stent anchor
- Balloon anchor

# Take home message

- 熟悉器材才能使過程加速，也更安全
- 不斷練習 !!!
- 從diagnostic angiography 開始
- 
- 先熟悉自己習慣操作的器材，方法和順序，設法讓成功率上升
- 設定停損點； Do no harm !!



**Thanks for Your  
Attention**