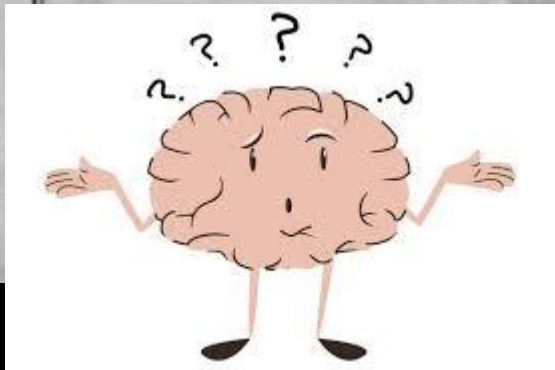
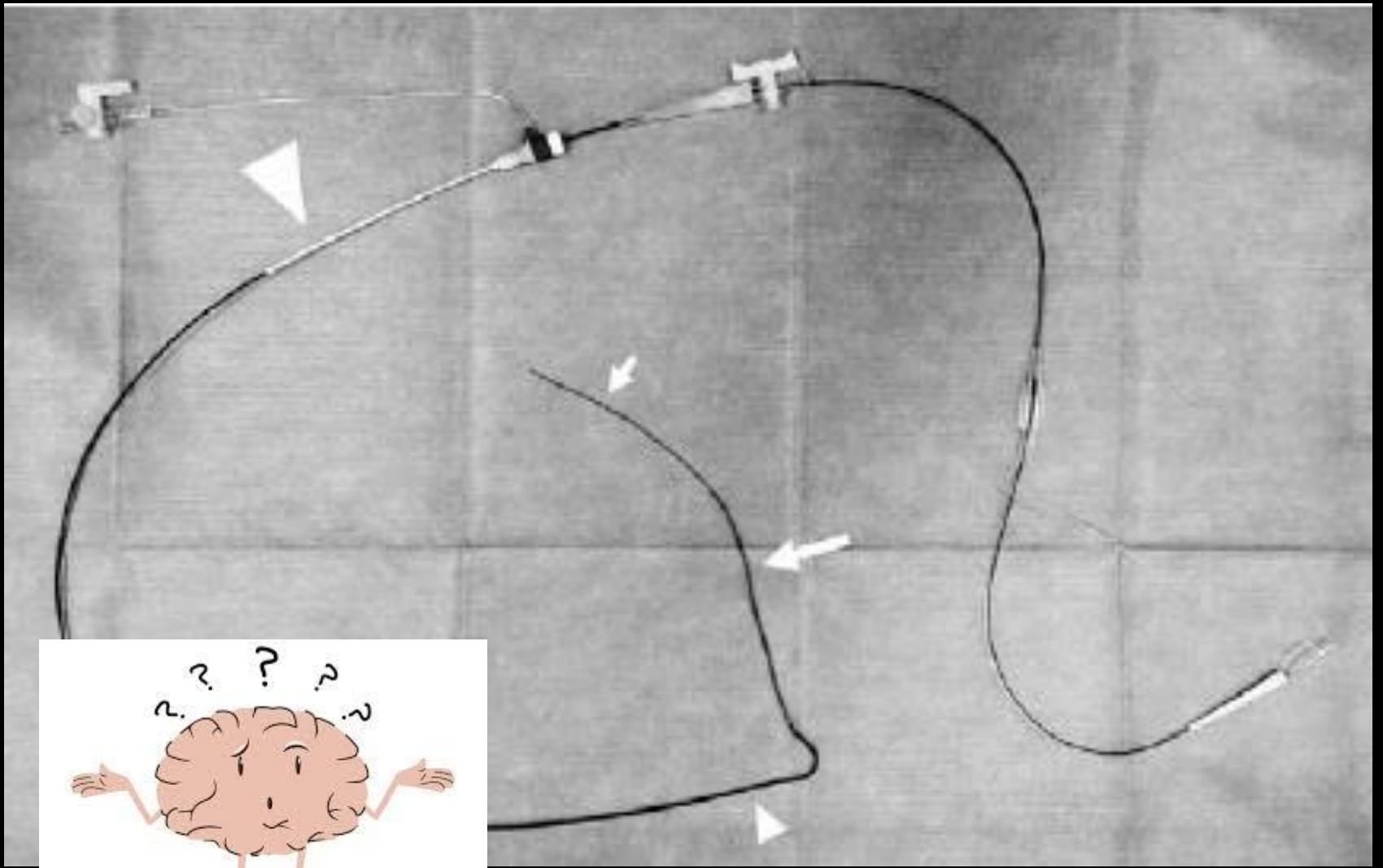


Introductory course of intraarterial thrombectomy for
large vessel occlusion stroke

Sheath and guiding catheter in neuroangiography

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outline

- Principle of device specification
- Classification of neuroangiographic sheath/catheter
- Application in IAT

Scale

- French (F, or Fr)
- Inches
- Millimeter (mm)
- Gauge (Birmingham gauze, G)

1 Fr = 1/3 mm

1mm = 0.039 inches

18G venous catheter = 1.27mm OD

Characteristics of a device

- Length
- Inner diameter
- Outer diameter
- Tip shape
- Radiopacity

Length and hemostatic valve



Classification and toolkit

- Guidewire
- Diagnostic catheter
- Sheath
- Guide catheter
- Intermediate /reperfusion catheter
- Microcatheter

Basic principle

- Accommodate planned devices
- Provided enough support
- Smooth engagement
- As small size as possible
- cost

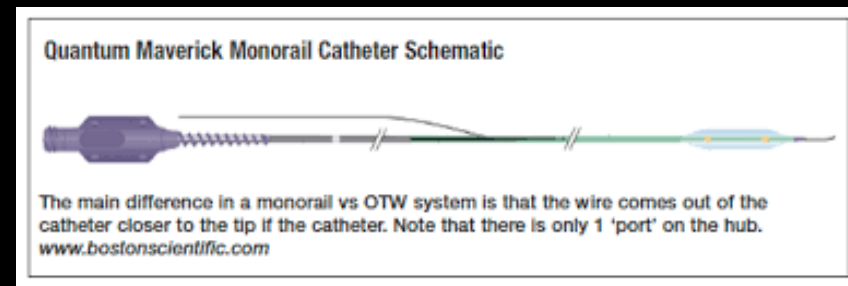
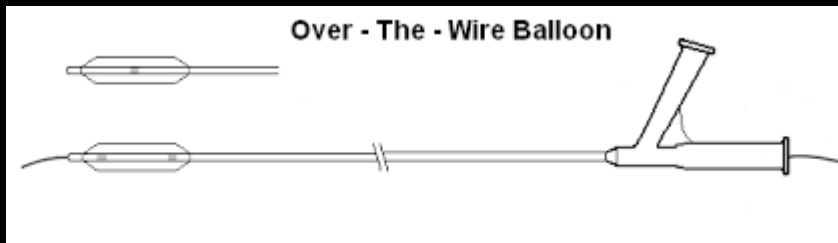
Example from text book

Catheter	Manufacturer	Length (cm)	Distal flexible zone (cm)	Outer diameter (French size)	Inner diameter (inches)
Berenstein large-lumen balloon guide	Boston Scientific	80		6 (11.5-mm diameter distal balloon)	0.042
Envoy® 5 Fr	Cordis	90 or 100		5	0.056
6 Fr				6	0.067
7 Fr				7	
Guider Softip™ XF 5 Fr	Boston Scientific	90 or 100	7	5	0.053 or 0.071
6 Fr				6	0.064
7 Fr				7	0.073
8 Fr				8	0.086
9 Fr				9	0.099
Neuron™	Penumbra	105 or 115	6 or 12	6 (5 distally)	0.053
Northstar™ Lumax® 6 Fr	Cook	90		6	0.060
7 Fr				7	0.073
8 Fr				8	0.086
9 Fr				9	0.099
Pinnacle® Destination® Guiding sheath 5 Fr	Terumo	90		Approx. 7.5	0.071
6 Fr				Approx. 8.5	0.083
Shuttle® Sheath 5 Fr	Cook	90		Approx. 6.5	0.074
6 Fr				Approx. 7.5	0.087
7 Fr				Approx. 8.5	0.100
8 Fr				Approx. 9.5	0.113

Guidewire and platform

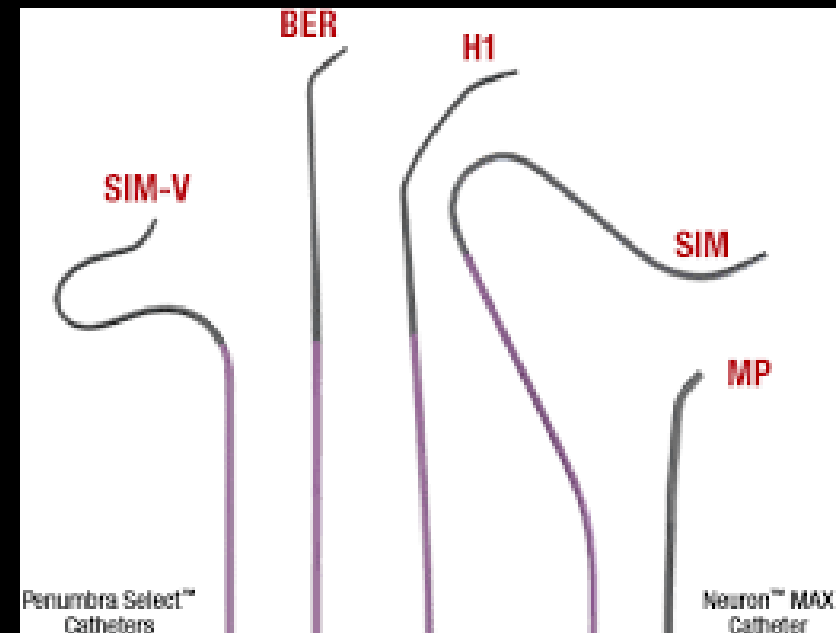
Use inches for diameter description

- 0.035/0.014 most common
- Over-the-wire/monorail



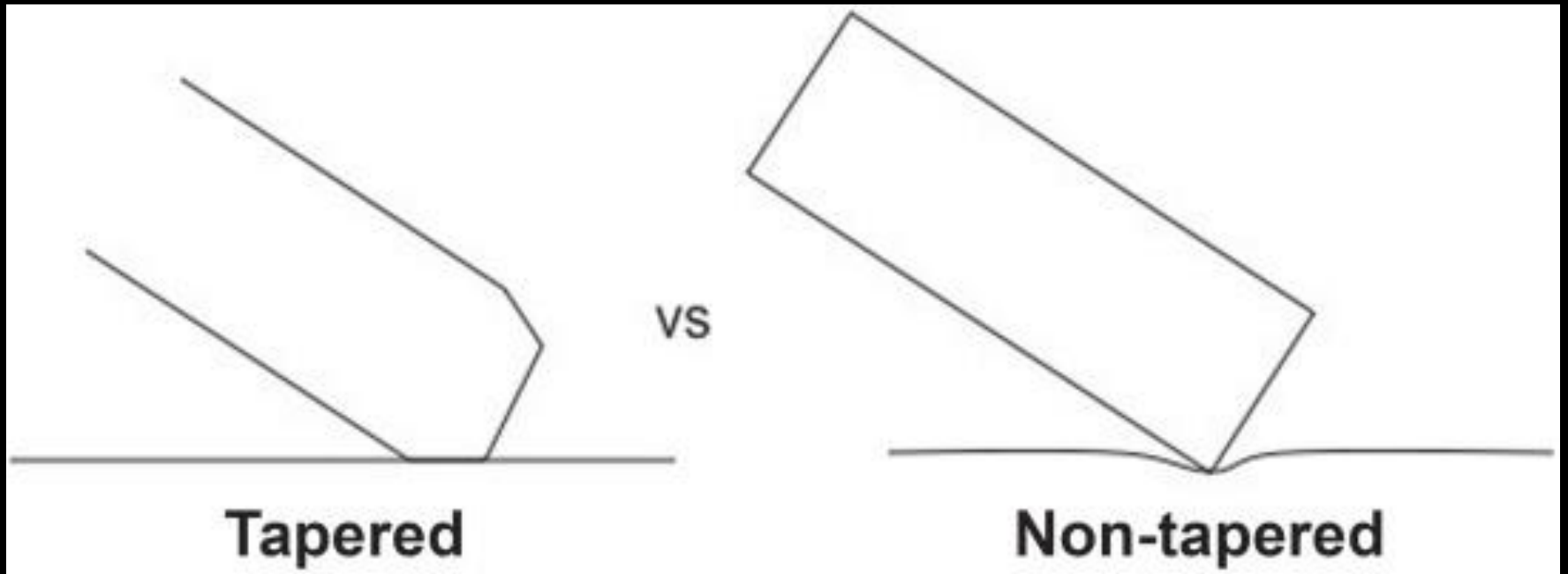
Diagnostic catheter

- Designed for diagnostic angiography
- Variable tip shape for easy engagement
- Size for outer diameter

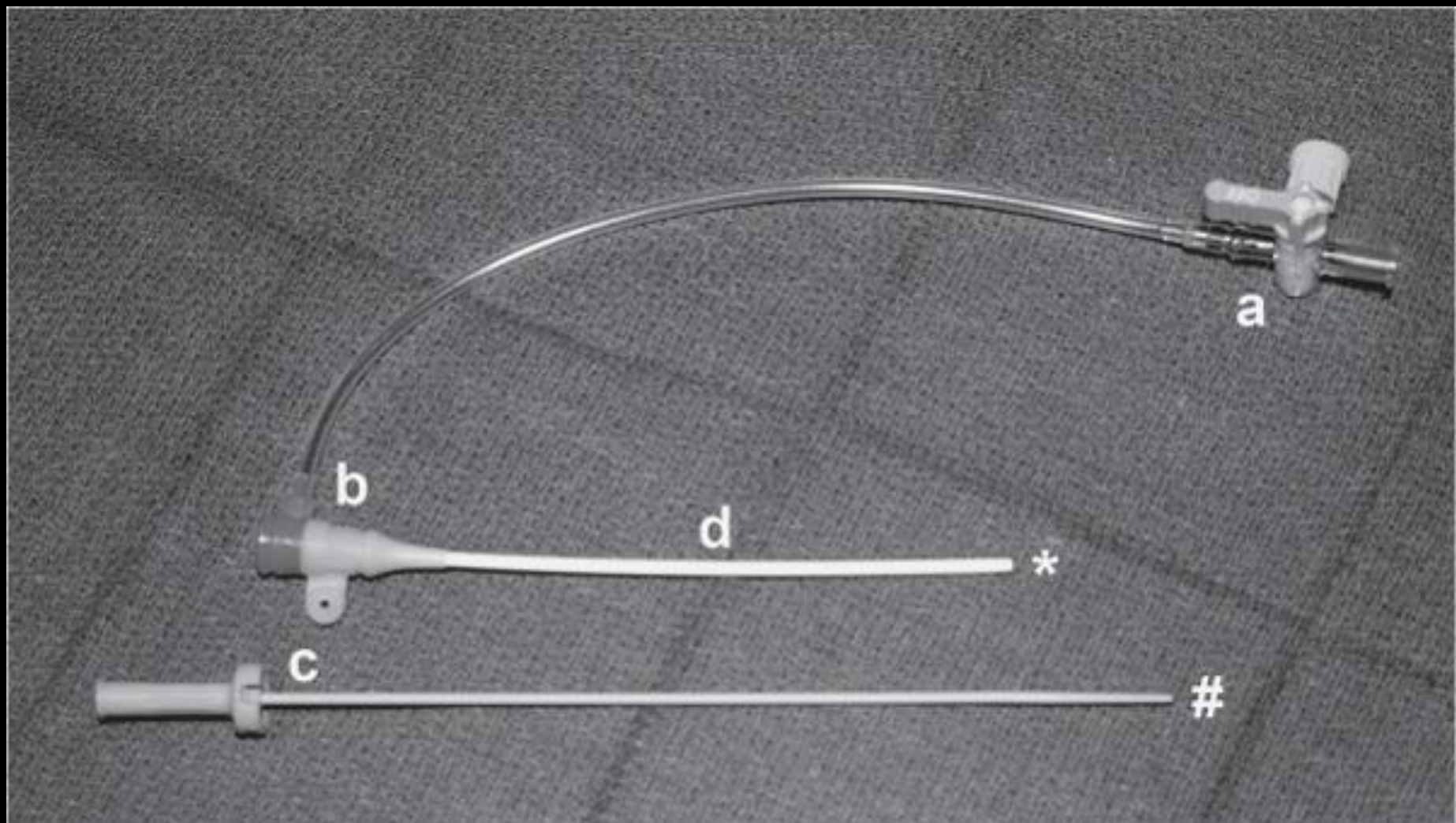


Sheath

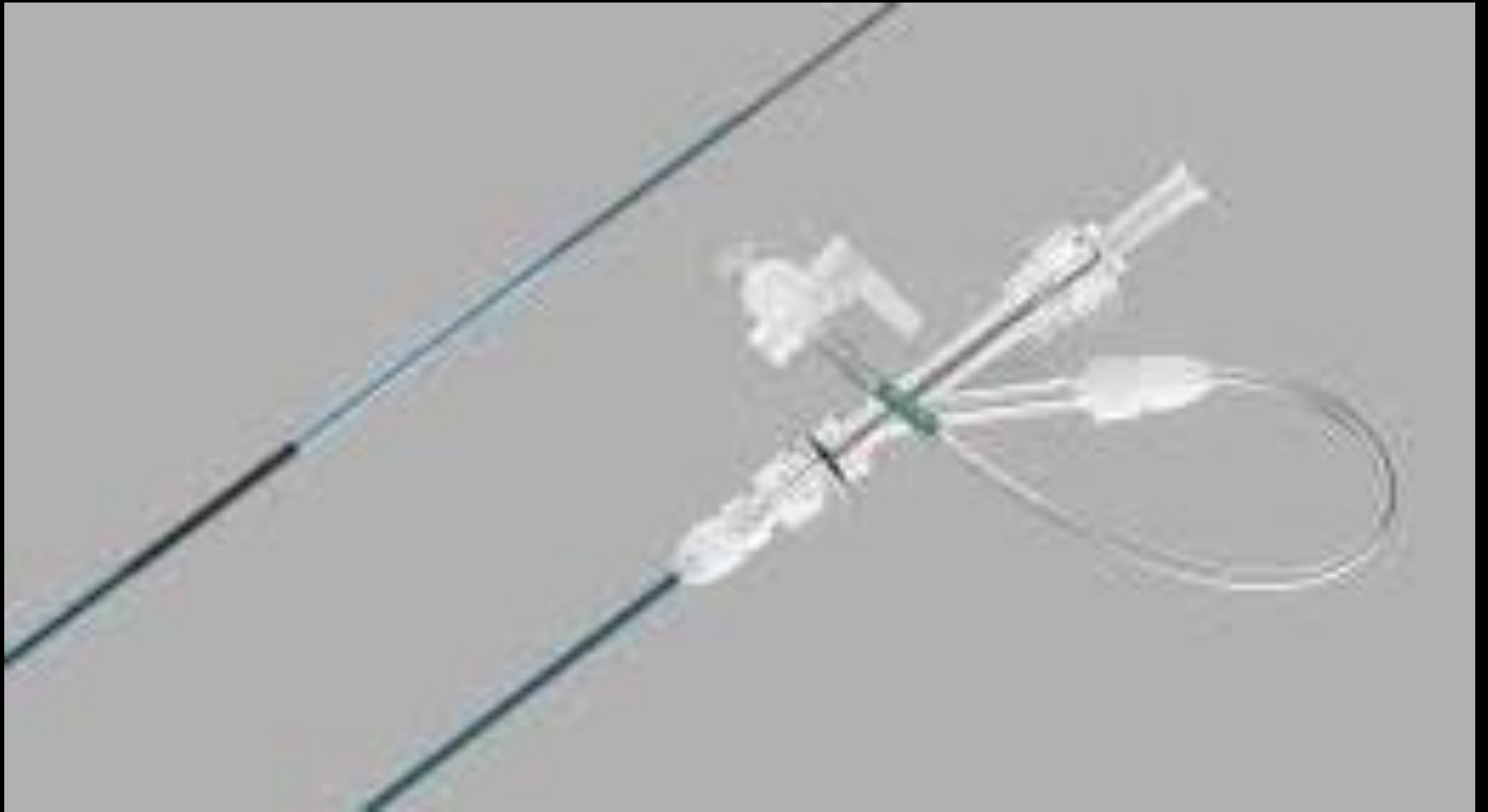
- To accommodate catheter
- Use French for accommodated catheter size
- Short/Long



Once you see a introducer, it is a sheath.



Sheath: COOK shuttle



Sheath: Terumo Destination

and trackability

- To facilitate more challenging procedures

Coil-reinforced tubing with PTFE inner layer

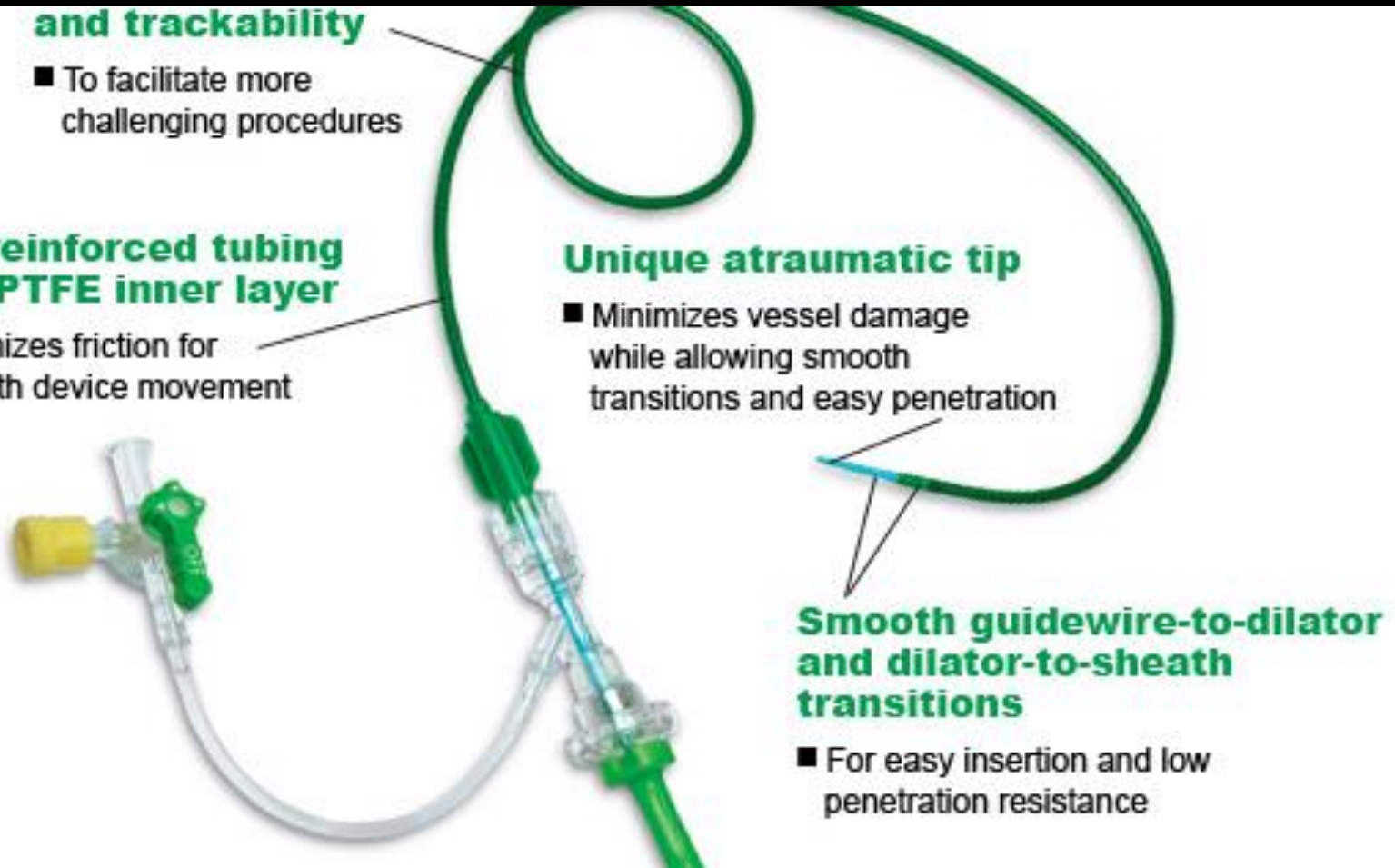
- Minimizes friction for smooth device movement

Unique atraumatic tip

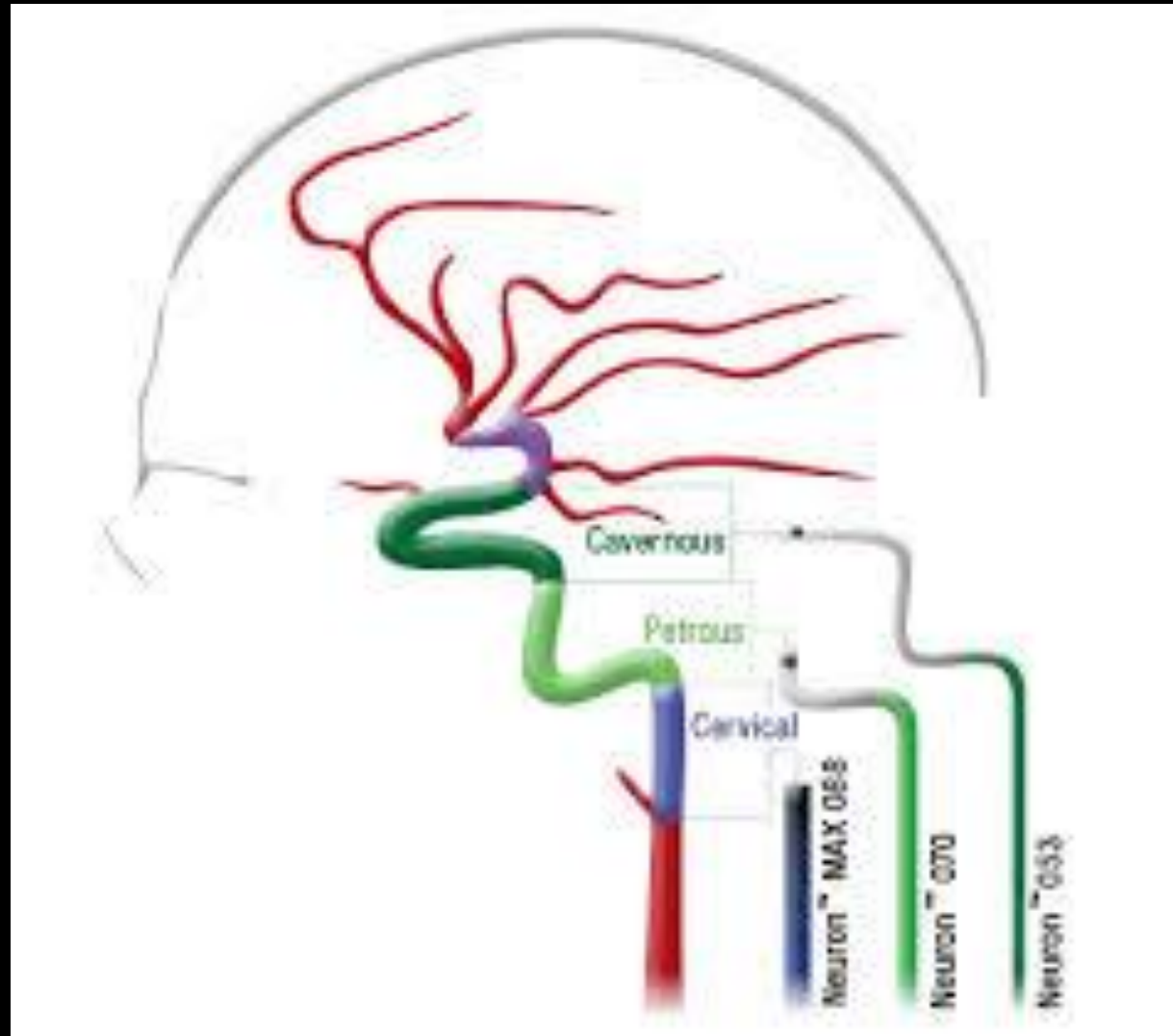
- Minimizes vessel damage while allowing smooth transitions and easy penetration

Smooth guidewire-to-dilator and dilator-to-sheath transitions

- For easy insertion and low penetration resistance



Neuron sheath/guiding catheter



Neuron™ MAX 088 Large Lumen System

Neuron™ MAX 088
Large Lumen Intracranial Access System

Extending Neuron to a large lumen access system
to better support complex therapy delivery

Penumbra 

Guiding catheter

- Use French for outer diameter description
- Stiffer than diagnostic catheter, usually with larger inner diameter as well

Guiding catheter: Envoy MP



Balloon guide catheter (BGC)

- Design for ICA flow arrest
- Adjunct in IAT
- Size for OD



Intermediate catheter

- Advancement in neurovascular technique

Neuron: 070, 053

Navien: 072, 058

Revive: 056, 044

Use inches for inner diameter

Soft and flexible tip

Navien™ Intracranial
Support Catheter



Reperfusion catheter

- Can be considered as kind of intermediate catheter
- \$\$\$
- Use inches for inner diameter



Microcatheter

- Use French for outer diameter
- In IAT, need to consider SR accommodation
- Distal segment length
- Commonly different in proximal/distal OD

APPLICATION

Power of tower

- Sheath + guiding/delivery catheter

Additional support

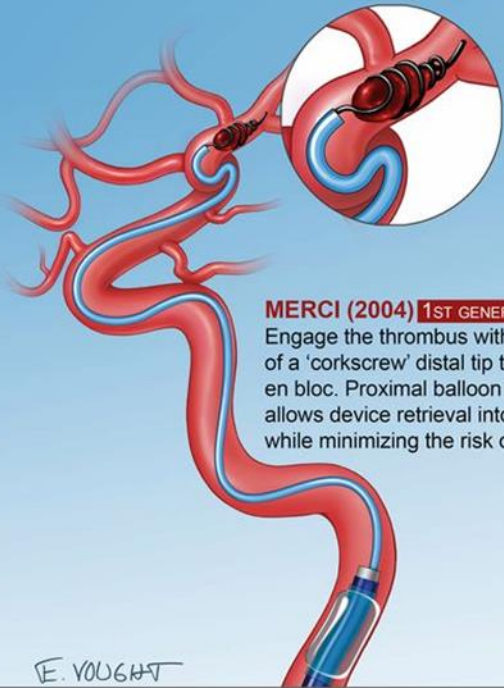
Adequate lumen

Minimize exchange



Device selection in IAT: principle

- Very good support, especially for tortuous extracranial vessel
 - Large enough for clot-retriever device
- triaxial is principle

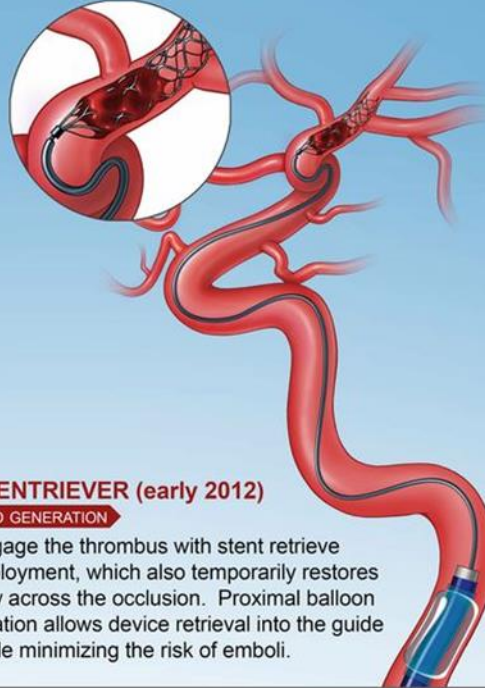


MERCI (2004) 1ST GENERATION

Engage the thrombus with deployment of a 'corkscrew' distal tip then remove en bloc. Proximal balloon inflation allows device retrieval into the guide while minimizing the risk of emboli.

E. VOUGHT

2004 2009

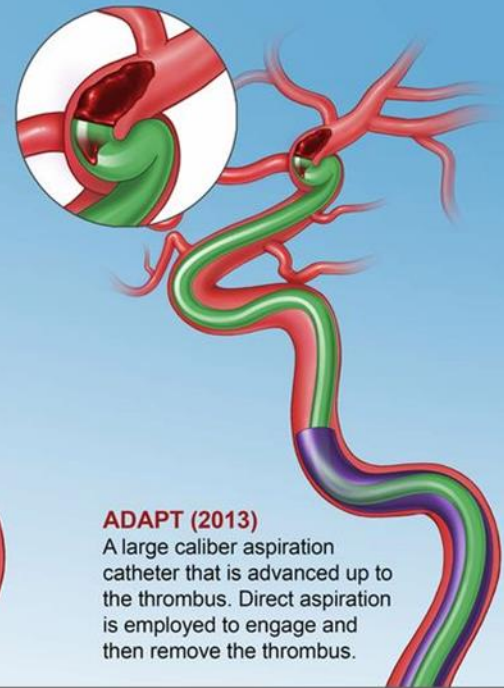


STENTRIEVER (early 2012)

3RD GENERATION

Engage the thrombus with stent retrieve deployment, which also temporarily restores flow across the occlusion. Proximal balloon inflation allows device retrieval into the guide while minimizing the risk of emboli.

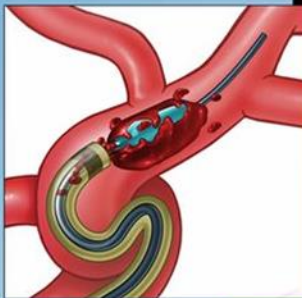
2010 2012



ADAPT (2013)

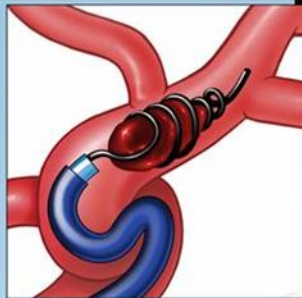
A large caliber aspiration catheter that is advanced up to the thrombus. Direct aspiration is employed to engage and then remove the thrombus.

2013



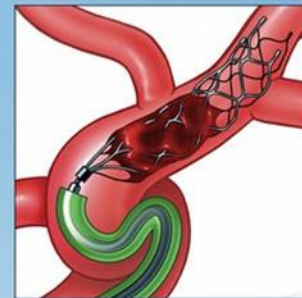
PENUMBRA (2009) 2ND GENERATION

The penumbra aspiration system involves maceration of the thrombus with a separator under direct aspiration to prevent showering of fragments. Once the catheter system is delivered to the target vessel, ongoing clot maceration is performed without the need to re-access.



DAC (2010)

The DAC is positioned immediately adjacent to the thrombus and aspiration is applied to minimize emboli and optimize the vectors during pulling of the device.



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.

Triaxial system

- Long sheath/BGC
- Intermediate catheter/reperfusion catheter
- microcatheter

Our working horse in suction method

- Long sheath/BGC
 - > Neuron 088 90cm
- Intermediate catheter/reperfusion catheter
 - > penumbra ACE 068 (or 60) 132cm
- microcatheter
 - > Excelsoir XT 27 150cm

Possible choice in SR user

- Long sheath/BGC
 - > neuron 088 90cm
- Intermediate catheter/reperfusion catheter
 - > navien 058 125cm
- Microcatheter
 - > Marksman 3Fr. 150cm
- Stent retriever
 - > Solitaire SR

Tetraaxial system?

→ power of tower

Consider 8Fr. Sheath in addition to 6Fr guiding when:

1. Massive clot in extracranial ICA and intend to use neuron 088 for suction
2. Excessive tortuosity in arch/CCA to provide additional support

Special concern

- Length of intermediate catheter
 - Too long for microcatheter navigation?
- Diameter of microcatheter
 - Too large for intermediate/reperfusion catheter?
- Angioplasty or stenting device ?
 - Length and platform possible for sheath/intermediate catheter?

Take home message

- Understand the characteristics and common used description in neuroangiographic device
- Read product brochure carefully before you use
- Suggest to build triaxial system device in your IAT formula and know the alternative and additional toolkit