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

1 mm = 0.039 inches

18G venous catheter = 1.27 mm 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
<table>
<thead>
<tr>
<th>Catheter</th>
<th>Manufacturer</th>
<th>Length (cm)</th>
<th>Distal flexible zone (cm)</th>
<th>Outer diameter (French size)</th>
<th>Inner diameter (inches)</th>
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<tbody>
<tr>
<td>Berenstein large-lumen balloon guide</td>
<td>Boston Scientific</td>
<td>80</td>
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<td>6 (11.5-mm diameter distal balloon)</td>
<td>0.042</td>
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<tr>
<td>Envoy® 5 Fr</td>
<td>Cordis</td>
<td>90 or 100</td>
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<td>5</td>
<td>0.056</td>
</tr>
<tr>
<td>6 Fr</td>
<td></td>
<td>6</td>
<td></td>
<td>0.067</td>
<td></td>
</tr>
<tr>
<td>7 Fr</td>
<td></td>
<td>7</td>
<td></td>
<td>0.067</td>
<td></td>
</tr>
<tr>
<td>Guider Softip™ XF 5 Fr</td>
<td>Boston Scientific</td>
<td>90 or 100</td>
<td>7</td>
<td>5</td>
<td>0.053 or 0.071</td>
</tr>
<tr>
<td>6 Fr</td>
<td></td>
<td>6</td>
<td></td>
<td>0.064</td>
<td></td>
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<td>7 Fr</td>
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<td>0.073</td>
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<td>8 Fr</td>
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<td>8</td>
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<td>0.086</td>
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<tr>
<td>9 Fr</td>
<td></td>
<td>9</td>
<td></td>
<td>0.099</td>
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<tr>
<td>Neuron™</td>
<td>Penumbra</td>
<td>105 or 115</td>
<td>6 or 12</td>
<td>6 (5 distally)</td>
<td>0.053</td>
</tr>
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<td>Northstar™ Lumax® 6 Fr</td>
<td>Cook</td>
<td>90</td>
<td></td>
<td>6</td>
<td>0.060</td>
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<tr>
<td>7 Fr</td>
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</tr>
<tr>
<td>9 Fr</td>
<td></td>
<td>9</td>
<td></td>
<td>0.099</td>
<td></td>
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<tr>
<td>Pinnacle® Destination® Guiding sheath 5 Fr</td>
<td>Terumo</td>
<td>90</td>
<td></td>
<td>Approx. 7.5</td>
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<td>Approx. 8.5</td>
<td>0.083</td>
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<td>Shuttle® Sheath 5 Fr</td>
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<td>Approx. 9.5</td>
<td>0.113</td>
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</table>
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 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

  Use inches for inner diameter
  Soft and flexible tip

  Neuron: 070, 053
  Navien: 072, 058
  Revive: 056, 044
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.

**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.

**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.

**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