Advances in Treatment for Vasospasm

Rob Taylor, MD

Stroke and Neurovascular Center of Central California
Santa Barbara Cottage Hospital, CA

12/29/2014
Minnesota
California
Low Emissions Vehicles
Evolution of the Eco-Dude
Evolution of the Eco-Dude
Eco-Dudes of the Future
Eco-Dudes of the Future
Eco-Dudes of the Future
Midwestern Eco-Dude
Disclosure Information
Robert Taylor, M.D.

I have disclosed too much already!!

Consulting – Boston Scientific
AHA/ASA Guideline Statements

1. Oral nimodipine should be administered to all patients with aSAH (Class I; Level of Evidence A).

- Cochrane Database Syst Rev. 2007;(3) CD000277

Connolly et al. Stroke 2012; 43:1711-37
AHA/ASA Guideline Statements

2. Maintenance of euvolesmia and normal circulating blood volume is recommended to prevent DCI. (Class I; Level of Evidence B)

AHA/ASA Guideline Statements

3. Prophylactic hypervolemia or balloon angioplasty before the development of angiographic spasm is not Recommended. (Class III; Level of Evidence B)

7. Cerebral angioplasty and/or selective intra-arterial vasodilator therapy is reasonable in patients with symptomatic cerebral vasospasm, particularly those who are not rapidly responding to hypertensive therapy. (Class IIa; Level of Evidence B)
TBA (transluminal balloon angioplasty) and IAVT (intra-arterial vasodilator therapy) may be beneficial and may be considered for PHCV (post hemorrhagic cerebral vasospasm)—that is, symptomatic with cerebral ischemia and refractory to maximal medical management (Class IIb, level B).
Clinical Trials

• Statins
  – Phase III trial - STASH (SimvasTatin in Aneurysmal Subarachnoid Hemorrhage) - Negative

• Endothelin-1 antagonists
  – Phase III trial - CONSCIOUS-1,2,3 (Clazosentan to Overcome Neurological iSChemia and Infarct OccUrring after Subarachnoid hemorrhage) - Negative

• Magnesium sulfate
  – Phase III trial - IMASH (Intravenous Magnesium sulfate for Aneurysmal Subarachnoid Hemorrhage) – Negative
Invasive Interventional Therapy (IIT)

What is it?
Involves the use of 2 modalities

1. Transluminal Balloon Angioplasty (TBA) – 150 publications

2. Intra-Arterial Vasodilator Therapy (IAVT) – 200 publications

Abruzzo et al. JNIS 2012;4:169-77
Transluminal Balloon Angioplasty (TBA)

- Noncompliant balloon
  - Gateway (Stryker)
  - Maverick (Boston Scientific)

- Compliant balloon
  - Hyperglide, Hyperform (ev3/Covidien)
  - Scepter C, XC (Microvention)
  - Transform Compl/Scompl (Stryker)
  - Ascent (Codman)
Noncompliant Balloon

- M1, basilar – 2 mm x 9 mm or 15 mm
- M2, A1 - 1.5 mm x 9 mm
- Potential disadvantage
  - Underdilate → more likely to have recurrent vasospasm
Compliant Balloons
Hyperform/Hyperglide Balloon

- Hyperform 4 mm x 7
- Hyperglide 3, 4, 5 mm x 10, 15, 20 mm
- Single lumen catheter
- 0.010” wire
- Around since 2001/2002
- Potential disadvantages
  - Single lumen
  - Blood can get in the tip
  - Slow deflation
  - Instability
Scepter C, XC (Microvention)

- 4 mm x 11 mm,
- 4 mm x 10, 15, 20 mm
- Dual lumen
- 0.014 inch wire
- Potential advantages
  - Dual lumen - wire exchange, reshaping
  - Better stability with inflation
  - Deliver coils or Onyx
Transform (Stryker)

- 3 x 5 mm, 4 x 7, 10 mm
- 3, 4, 5 mm x 10, 15 mm
- Dual lumen
- 0.014 inch wire
- Potential Advantages
  - Dual lumen - wire exchange, reshaping
  - Stability
  - Faster inflation/deflation
Ascent (Codman)

- 4 mm x 7, 10, 15 mm
- Dual lumen
- 0.014 inch wire
- Potential advantages
  - Dual lumen
  - Stability
  - Deliver coils, Onyx
TBA Complications

- Up to 5% major complications
  - Vessel Ruptures ~1%
  - Thromboembolic, 4-5%
  - Displacement of surgical clip
  - Reperfusion injury

TBA Nuances

• Need a baseline angiogram for comparison
• PTA leads to more sustained result
• Nicardipine prior to PTA may lead to nonsustained result
• Consider low dose verapamil prior to PTA
• Work distal to proximal
• Procedural risk goes up with critical vasospasm
Intra-Arterial Vasodilators

- Papaverine – efficacious, but neurotoxic
- Magnesium – no clear effect
- Milrinone – vasodilation, increase HR, little BP effect, positive inotrope
- Nimodipine – vasodilates in some cases, difficult to obtain
Intra-Arterial Vasodilators

- **Verapamil** (2-30 mg) 0.1-1 mg/ml
  - L-type calcium channel antagonist
  - Little hemodynamic effect, AV node
  - 29% clinical improvement

- **Nicardipine** (2.5-25 mg) 0.1-1 mg/ml
  - L-type calcium channel antagonist
  - May have a large hemodynamic effect
  - 42% clinical improvement, higher with higher doses

Dabus et al. Intervent Neurol 2013;2:30-51
Clinical Effectiveness May Depend on Many Variables

- Rapid diagnosis and treatment <2 hours
- Correct diagnosis
- Treatment protocol
After a total 40 mg of intra-arterial nicardipine infusion (3 vascular territories injected).
Right internal carotid artery (ICA) injection, lateral projection demonstrates severe vasospasm of the supraclinoid ICA after SAH.
Pitfalls

- Detecting and treating symptomatic vasospasm in a timely fashion
- Missing distal vasospasm on angiogram
- Over or under rating the vasospasm severity
- Over or under treating for vasospasm
Vasospasm Grading Scale

- % Luminal diameter narrowing
  - Mild - 0-25%
  - Moderate - 26-50%
  - Severe - 51-75%
  - Critical - >75%

Abruzzo et al. JNIS 2012;4:169-77
Case

• 56-year-old man presents with a Hunt and Hess grade IV, Modified Fisher Class IV SAH from a ruptured left pericallosal artery aneurysm.

• Cerebral edema, high ICPs, aspiration pneumonia, intubated, sedated

• Hospital day 10, ACA mean velocities are 200 cm/sec
Ways to detect vasospasm

- Transcranial Doppler
- Perfusion imaging
- CTA, MRA, routine angiogram
- Licox monitor
- Microdialysis
I would

- A. Vasodilator from guide catheter
- B. Vasodilator into ACA selectively
- C. Angioplasty with noncompliant balloon
- D. Angioplasty with compliant balloon
- E. Both angioplasty and vasodilator
Vasospasm Treatment
Novel and Alternative Therapies

- **NeuroFlo catheter**
  - FDA approved, HDE
- **Intrathecal therapies**
  - Nicardipine
  - rt-PA
1. Location of renals and diameter of aorta determined via simple aortogram.

2. NeuroFlo inserted to proper depth and infrarenal balloon inflated to reduce luminal area by 70%.

3. Suprarenal Balloon inflated to reduce luminal area by 70%; balloons remain inflated for 45 minutes.

4. Perfusion of the ischemic penumbra region is increased.
Intrathecal Nicardipine

• Cisternal drain

• Shibuya et al. Acta Neurochir 1994
  – Case control study
  – 50 Fisher grade III SAH pts, 91 similar controls
  – 2 mg Nicardipine 3 times/day for average of 10 days
  – Symptomatic vasospasm decreased by 26%

• Suzuki et al. Neurosurg Rev 2001
  – 177 consecutive Hunt/Hess I-III, Fisher III pts
  – 4 mg every 12 hrs days 3-14
  – Symptomatic vasospasm 5.7%, 4-6 fold reduction
Conclusions

- Clinical response to IIT in symptomatic cases depends on many factors
- More consistency with imaging interpretation of vasospasm
- More consistent treatment protocols
- IIT has been reported efficacious in clinical series but not yet a randomized controlled trial
- No guideline statement on treating severe vasospasm prior to symptoms
Thank You!