What is the Significance of Asymptomatic Emboli during Carotid Procedures

They cannot be Good

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship Company
Consulting Fees/Honoraria Cordis, Boston Scientific, Abbott Vascular
Medrad Inc., Access Closure
Major Stock Shareholder/Equity Northwind inc, Boston Scientific, Neuro Intervention tech.
Royalty Income Covidian Inc., Setagon

Asymptomatic emboli 2

Micro Emboli Risk

- Excessive microemboli loads at the MCA result in decreased flow with possible ischemic TIA
- TIAs resolve when increased flow is returned following revascularization (microembolic washout)
- Micro emboli occur during balloon dilatation and stenting. Prominent source aortic arch and carotid bifurcation.

Cerebral Microemboli

There is growing evidence for cognitive impairment when microemboli enter cerebral circulation

- DWI Suggests Solid and Gaseous microemboli were increased in patients with ipsilateral ischemic stroke.
- Emboli numbers during Carotid intervention should be reduced to a minimum
- 22% of patients had developed new lesions 24 hrs afterCAS

Skjelland, m Stroke, 2009
Micro emboli Asymtomatic  80% Stenos Rt Carotid

DWI (b = 1000) of the brain before (A) and 1 day after (B) stent placement of the right carotid artery.

M. Rosenkranz et al. AJNR Am J Neuroradiol 2006

Micro ischemic asymptomatic emboli
- Whether these silent ischemic lesions cause permanent cognitive lesions or transient ischemia, is now being questioned.
- These embolic ischemic particles visible on DWI-MRI post and peri procedure CAS can't be good. Clinical effects are dependant on volume and size of embo

Particle analysis in 20 filters
- Microscopic emboli composition
  - Fibrin conglomerates
  - Old thrombus
  - Trapped erythrocytes
  - Necrotic core
  - Inflammatory cells
  - Endothelial cells
  - Foam cells
  - Cholesterol clefts
  - Calcified deposits
  - Fresh thrombus

Asymptomatic  72 yr male
with Critical stenosis of lt. Internal Carotid and lt. vertebral. Refused surgery because relative. Had CEA with rich healing cranial Nerve injury and swallowing Dysfunction. CMS refused Payment. Hospital charge would be around 25,000 $. After lengthy appeal was covered.
Diffusion Weighted MRI

Asymptomatic pre and post CAS. Silent ischemic infarct?

Before After CAS

Filter Wire - Animation

Boston Scientific EPI

COVIDIEN EV3 SPYDER
Filter Issues As A Cause For Stroke

Nov 6, is 50% more efficient than Accunet

Capture Efficiency 147um Size Particles

Would that have made a difference in crest

Accunet

Total Capture Efficiency

Capture Efficiency

Particles Lost

CAS and CEA pre and post MRI

Single center study

161 pts, 60 CEA and 61 CAS

- New lesions post MRI
  - CAS: 42%; 2 strokes
  - CEA: 11%; 2 strokes
- CAS higher particle lesion volume and defects
- More persistent at 6 mnth vs. CEA
- Lesion volume and size; Cognitive or TIA related?
- Trials sample size statistically small

Multicenter Registry – 32 centers

- New DWI lesions
  - CAS: 37%
  - CEA: 10%
  - Close cell stent: 31%
  - Open cell stent: 51%
- DWI brain lesions clinically becoming a major issue
  - Can’t be good but how bad?
  - Is DAPT indicated if platelets, fibrin or clot source

Here’s my take home message

Microemboli have to be taken more seriously

Post procedure DWI may be necessary with continued follow up for cognitive defects or stroke

This could be a major issue in CREST II

Silent Cerebral Ischemia Detected by Diffusion-Weighted MRI After CEA

A Preoperative brain DWI of a 74-year-old woman with an asymptomatic high-grade carotid stenosis on the right side. B, Postoperative brain DWI demonstrating a single new hypointensity in the perifocal subcortical temporal region (arrow), which was highly suggestive of a perioperative microembolic event.
Cerebral Microemboli

- Cognitive impairment may not be immediate
- Neural psychological outcomes increased risk of silent stroke and cognitive impairment
- Continuous microemboli to the brain will lead to progressive impairment of cognitive function


- 57 Patients with carotid stenosis greater than 70% with TCD of the MCA flow during the procedure
- 2 TCD showed increase of microemboli 8 times greater in CAS versus CEA
- Cerebral protection devices to reduce this microembolic number

Orlandi, G., Arch. Neuroradiol 2005

How can we improve?

- Less particle release with integrated filter during stent deployment and late embolization due to stent or strut flexation.
- No compromise on Easy Handling, eg. French size,...

Closed Cell Hybrid Stent

The Purpose of Micronet Technology

- Biostable mesh technology
- Designed to trap and seal thrombus
- Designed to prevent embolization
- Designed to stabilize plaque and prevent migration

Greater to stabilize Plaque but does not capture emboli less than 600 µm

600µm mesh in closed cell stent
Plaque prolapse can occur in 37% with conventional stents
Closed cell  17%
Open cell   61%
Hybrid cell 30%
  Prolapse between struts leads to emboli

C Guard Cabernet Trial
Embolic protection using micronet. Nitinol covered with PET. Procedural success 100%; complications 0%; new ischemic lesions in 37%; DWI in 30 days showed resolution in most.

Schofer, JACC 2015

RCT of covered vs. bare metal stents. DWI follow-up 6 months; less microemboli,
Trial stopped after 38% restenosis with mesh covered stents

Schillinger, M 2006

Ideal pore size – stents
C Guard 165u       Closed cell 1050u
Roadsaver 375u     Open cell 1900 u
Gore 500u

Closed cell frame

500 u pore size nitinol mesh
GORE
Open cell nitinol frame. Closed cell 500u PTE mesh on frame permanently bound heparin on all surfaces.

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