PARAMETERS AFFECTING THE RISK OF EMBOLIZATION DURING CAROTID STENTING

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Disclosures

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I have the following potential conflicts of interest to report:

[X] Consulting:
- Boston Scientific
- Abbott Vascular
- Johnson&Johnson/Cordis
- Merit Medical

Parameters potentially affecting embolism during CAS

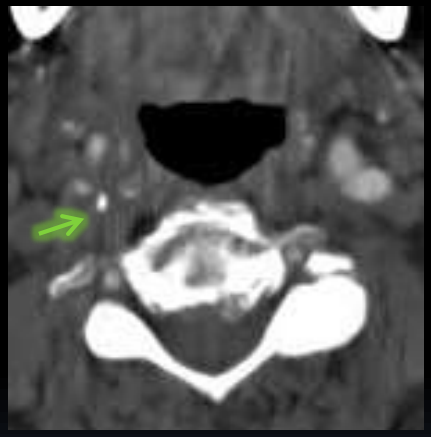
- Symptomatic stenoses
- High-grade stenoses
- Long stenoses
- Calcium load of stenoses
- Stent design

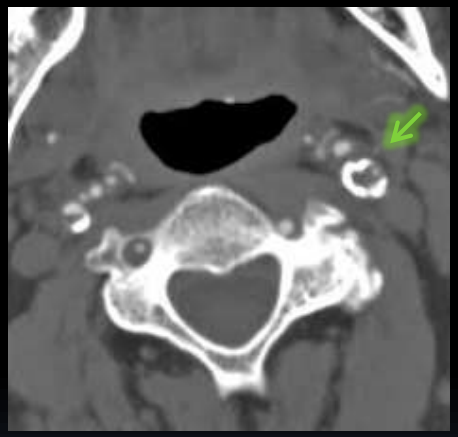
Prospective single center registry of 650 filter protected CAS procedures

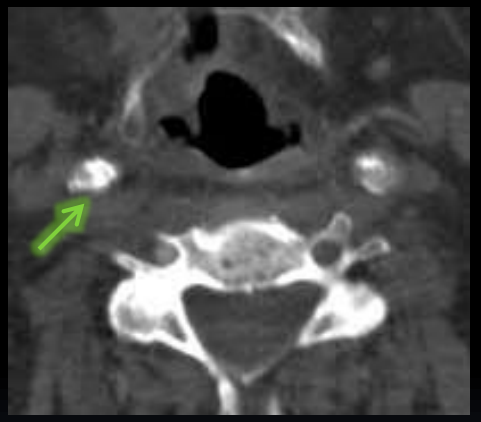
- 650 consecutive CAS patients during 2008-2018
- 100% filter protection
- 305 procedures excluded in this analysis
  - 257 no CTA available
  - 48 recurrent stenosis
- 345 CAS procedures included

- Grading of stenoses: 70-79 / 80-90 / >90%
- Length of stenoses: <5 / 5-10 / >10 mm
- Calcium load: <90 / 90-180 / 180-270 / >270 °

Grading of cacium load in CTA







<90 dg.

90-180 dg.

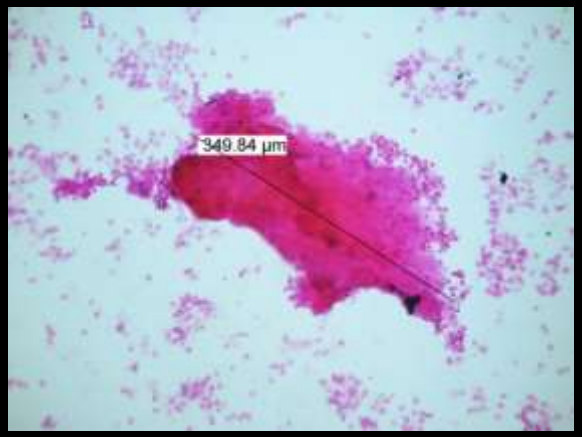
180-270 dg.

>270 dg.

Stent-Design

- Open cell:
  Precise Rx™ (J&J): n= 176)
- Closed cell:
  Carotid Wallstent™ (BSC): n= 124
- Micromesh:
  Caspar™ (MV/Terumo) , CGuard™ (InspireMD): n= 45

Analysis of embolic plaque material



Size of particles	Number of particles	Embolic plaque volume
>0 - </= 50 µm	17	17 x 50 µm= 850 µm
>50 - </= 100 µm	6	6 x 100 µm= 600 µm
>100 - </= 150 µm	4	4 x 150 µm= 600 µm
>150 - </=200 µm	8	8 x 200 µm= 1.600 µm
..... - </=.....		
- 1.950 - </=2.000 µm	1	1 x 2.000 µm= 2.000 µm

EPVI * = 850µm + 600µm + 600µm + 1.600µm + 2.000µm= 5.650µm

*** Embolic Plaque Volume Index**

Risk of stenosis morphology

Grade of stenosis	
	EPVI (µm) MW (range)
<80%*	1.721 (250-9.750)
80-90%*	4.494 (0-14.650)
>90%*	8.125 (300-15.950)
*p	<0.05

Length of stenosis	
	EPVI (µm) MW (range)
<5 mm*	2.090 (0-9750)
5-10 mm	3.662 (0-14.650)
>10 mm*	5.800 (100-15.950)
*p	<0.05

Calcium load	
	EPVI (µm) MW (range)
<90 dg.	4.825 (0-14.650)
>90 / <180 dg.	3.450 (0-12.050)
>180 / <270 dg.	680 (0-14.600)
>270 dg.	1.650 (100-13.350)
p	>0.05

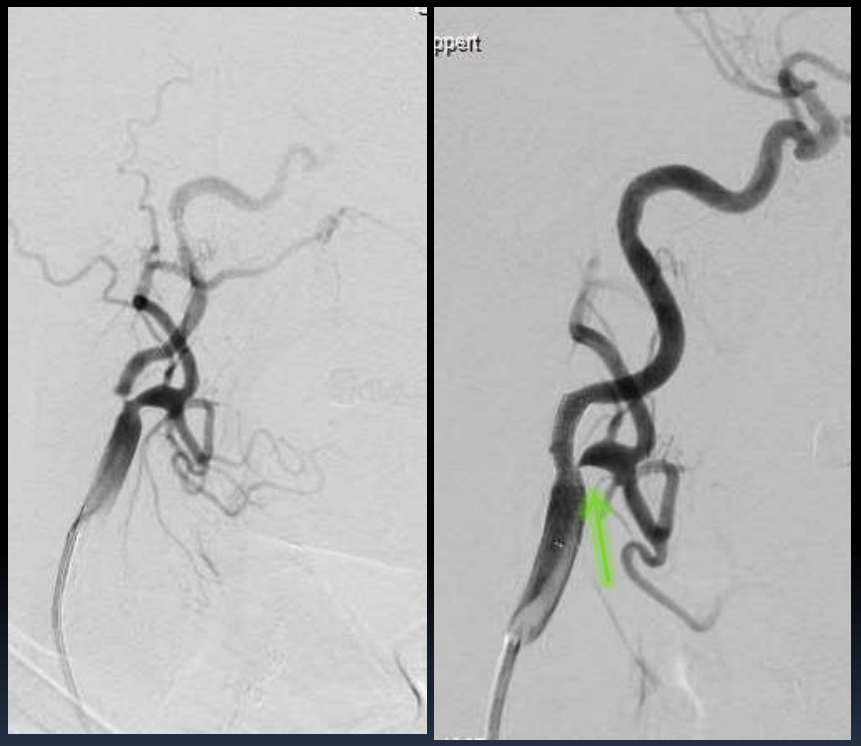
Risk of clinical activity & stent design

Clinical activity		
	n	EPVI (µm) MW (range)
symptomatic	121	6.270 (100-15.950)
asymptomatic	224	2.877 (0-13.050)
p		<0.05

Stent type	N	EPVI (µm) MW (range)	p
Open cell	150	9.450 (100-25.600)	
Closed cell	150	4.533 (0-15.950)	<0.05
Micromesh	45	250 (0-450)	<0.01

Side effects of micromesh stenting

Covering of ulcerated plaques



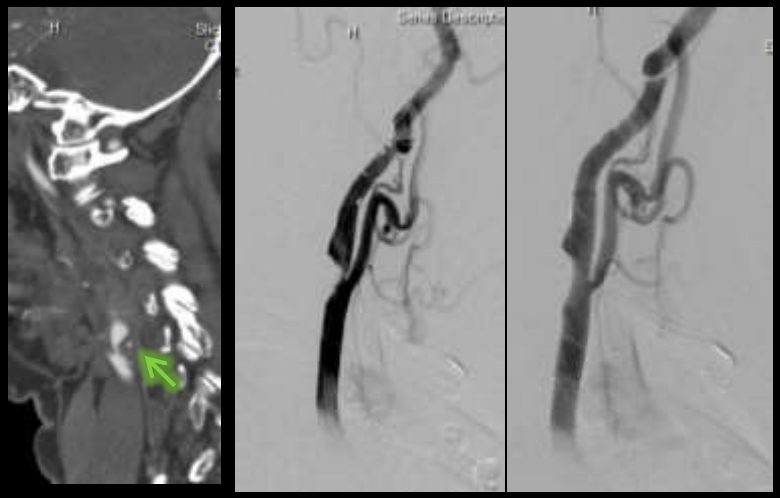
external carotid stenosis

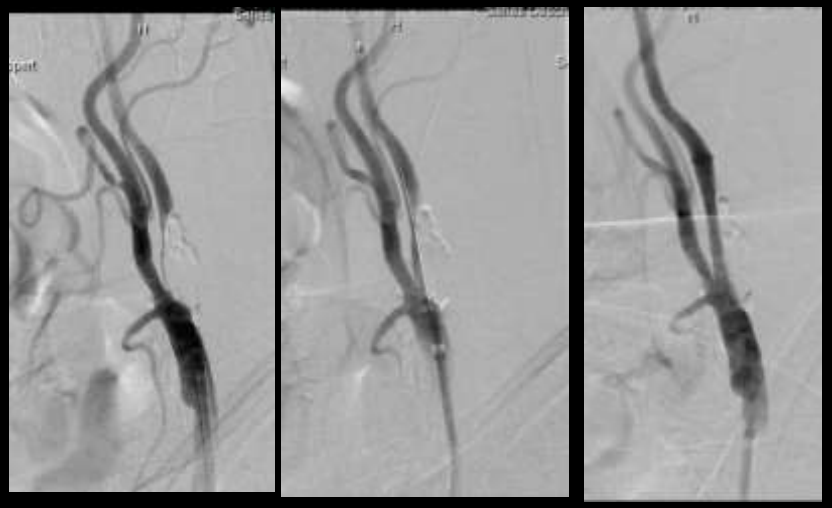
Low volume embolism: EPVI 0-500 µm

asymptomatic
EPVI: 100 µm
Stent: closed cell

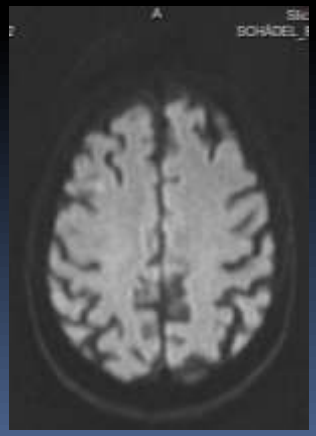
asymptomatic
EPVI: 0 µm
Stent: micromesh

High volume embolism: EPVI 5.000-16.000 µm





symptomatic
80-90%
5-10mm
<90 dg. calcified
Stent: closed cell
EPVI: 14.650 µm



symptomatic
right ICA closed
>90%
>10mm
high grade calcifed
EPVI: 15.950 µm
Stent: closed cell

Conclusions

- Embolic plaque volume during CAS has typical risk factors and can be estimated but not predicted.
- High embolic plaque volume is associated with symptomatic, long, soft plaque stenoses.
- Combinations of these factors cause high risk procedures.
- Using micromesch stents plaque embolism is reduced compared to open and closed cell stents.

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