Current Status of Carotid Interventions

2018 euro PCR

Role of CAS in 2018

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Potential conflicts of interest

Speaker's name: Piotr Musialek

Advisory Board/Consulting	InspireMD, Medtronic
Research Support	Abbott

Role of CAS in 2018

- **Indications**

Role of CAS in 2018

- Indications
- **Concepts and Tools**

Role of CAS in 2018

- Indications
- Concepts and Tools
- **Outcomes**

Role of CAS in 2018

- **Indications**

AHA Statistical Update

Heart Disease and Stroke Statistics—2016 Update

A Report From the American Heart Association

Table 14-2. Modifiable Stroke Risk Factors

Factor	Prevalence, %	PAR, %*	RR
Cigarette smoking			
Overall	19.8	12–14†	1.9
Men	22.3		
Women	17.4		
Hypertension		‡	8
Ages 20–34 y			
Men	13.4	99	
Women	6.2	98	
Ages 35–44 y			
Men	23.2	99	
Women	16.5	106	
Ages 45–54 y			
Men	36.2	100	
Women	35.9	103	
Ages 55–64 y			
Men	53.7	100	
Women	55.8	102	
Ages 65–74 y			
Men	64.7	100	
Women	69.6	101	
Ages ≥75 y			
Men	64.1	100	
Women	76.4	101	
AF (nonvalvular)			
Overall age, y			
50–59	0.5	1.5	4.0
60–69	1.8	2.8	2.6
70–79	4.8	9.9	3.3
80–89	8.8	23.5	4.5
Asymptomatic carotid stenosis	2–8	2–7§	2.0

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Men	13.4	99	
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Ages 35–44 y			
Men	23.2	99	
Women			
Ages 45–54 y			
Men	36.2	100	
Women	35.9	103	
Ages 55–64 y			
Men	53.7	100	
Women	55.8	102	
Ages 65–74 y			
Men	64.7	100	
Women	69.6	101	
Ages ≥75 y			
Men	64.1	100	
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50–59	0.5	1.5	4.0
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Asymptomatic carotid stenosis	2–8	2–7§	2.0

Atherosclerotic Carotid Stenosis

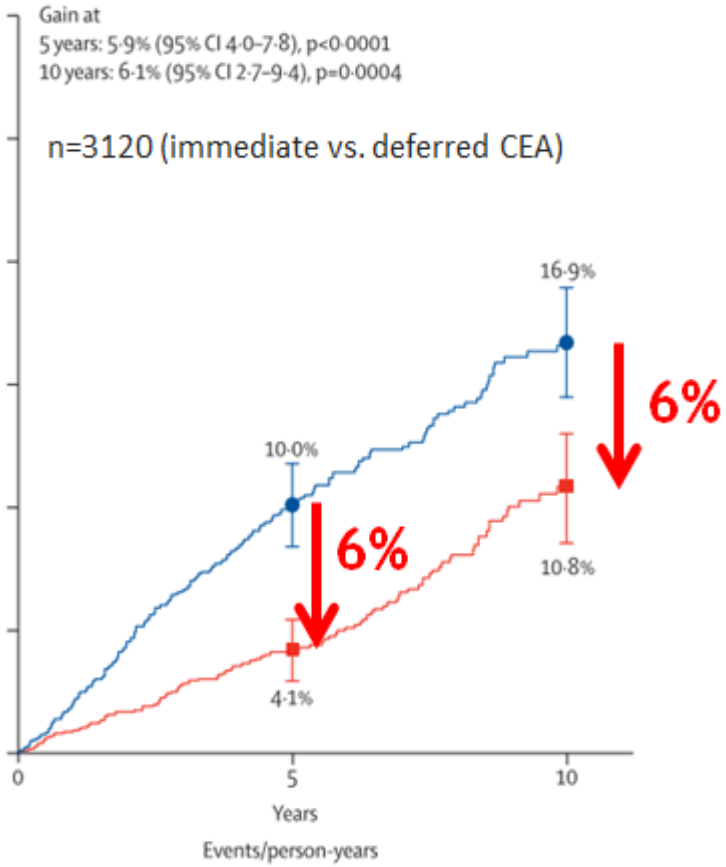
remains

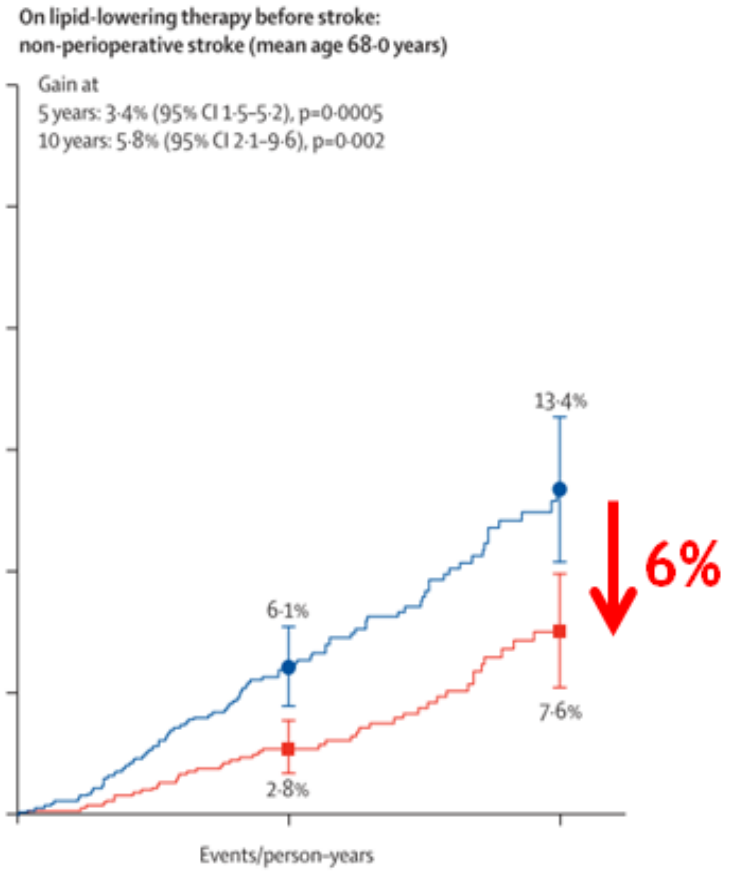
an important – and modifiable!

risk factor for

ischemic stroke

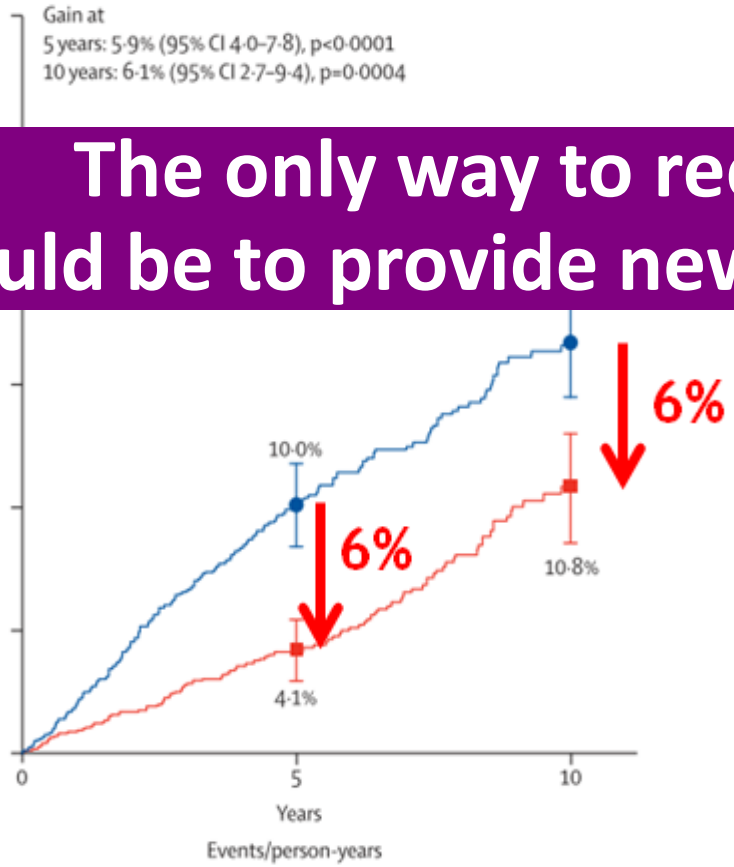
Stroke Reduction
with Carotid Revascularization

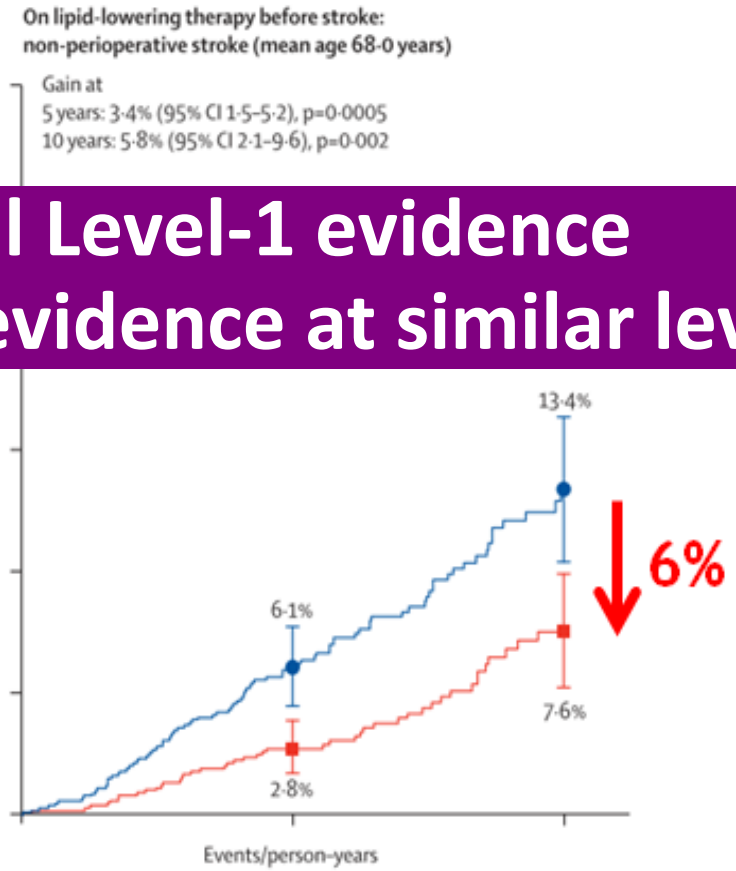




A. Halliday et al. (10-year ACST data) *Lancet* 2010

Stroke Reduction
with Carotid Revascularization





The only way to recall Level-1 evidence would be to provide new evidence at similar level

A. Halliday et al. (10-year ACST data) *Lancet* 2010

Optimized Pharmacotherapy is FUNDAMENTAL

but

there is **ZERO!** evidence today

to *claim* that

pharmacotherapy ALONE

protects sufficiently against stroke

in atherosclerotic carotid disease

Optimized Pharmacotherapy in FUNDAMENTAL

Current CAS studies…

there is NO evidence today

to *claim* that

pharmacotherapy ALONE

protects sufficiently against stroke

in atherosclerotic carotid disease

continue

to receive patients who develop symptoms

DESPITE OMT !

Cardiovascular Clinic Patients
are NOT ”average” Carotid Stenosis Subjects

Reviewed in

Musialek & Hopf-Jensen *J Endovasc Ther* 2017
Musialek, Hopkins, Siddiqui *Adv Intev Cardiol* 2017

Cardiovascular Clinic Patients are NOT "average" Carotid Stenosis Subjects

Fundamental Issue

"People" with Carotid Stenosis

Vascular Clinic Referral Patient	≠	**General Popu--lation Subject**
annual ipsilateral stroke risk 2.5-3.0%		**annual ipsilateral stroke risk ≈0.5%**

Reviewed in

Musialek & Hopf-Jensen *J Endovasc Ther* 2017
Musialek, Hopkins, Siddiqui *Adv Intev Cardiol* 2017

CAS indications 2018

- Focus on treating ”symptomatic” patients is **not the pride** but rather failure of the system

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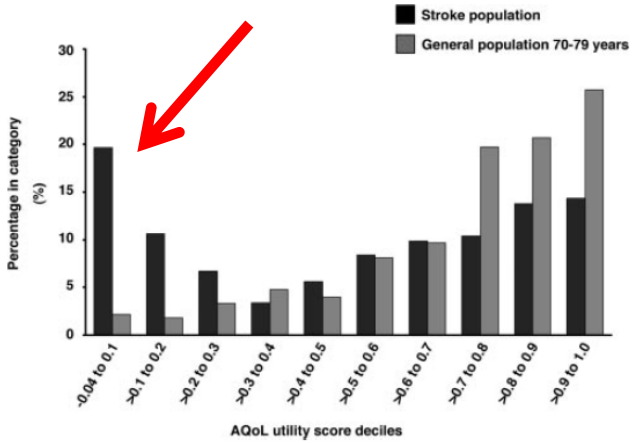

Figure 1. Distribution of AQoL utility scores among 5-year survivors and Australian general population aged 70–79 years.

Long-Term Outcome in the North East Melbourne Stroke Incidence Study

Predictors of Quality of Life at 5 Years After Stroke

Seana L. Paul, BSc (Hons); Jonathan W. Sturm, PhD; Helen M. Dewey, PhD; Geoffrey A. Donnan, MD; Richard A.L. Macdonell, MD; Amanda G. Thrift, PhD

Utility scores range from −0.04 (state worse than death) through 0.0 (death-equivalent) to 1.0 (full health). The AQoL is valid and reliable in stroke patients.[27] Furthermore, it is reliable when completed by

euro PCR 2016 LATE BREAKING TRIALS

Novel PARADIGM in carotid revascularisation: Prospective evaluation of All-comer peRcutaneous cArotiD revascularisation in symptomatic and Increased-risk asymptomatic carotid artery stenosis using CGuard™ Micronet-covered embolic prevention stent system

Piotr Musialek[1]*, MD, DPhil; Adam Mazurek[1], MD; Mariusz Trystula[2], MD, PhD; Anna Borratynska[3], MD, PhD; Agata Lesniak-Sobelga[1], MD, PhD; Malgorzata Urbanczyk[4], MD; R. Pawel Banys[4], MSc; Andrzej Brzychczy[2], MD, PhD; Wojciech Zajdel[5], MD, PhD; Lukasz Partyka[6], MD, PhD; Krzysztof Zmudka[5], MD, PhD; Piotr Podolec[1], MD, PhD

These people →

should have been treated *before* stroke,
not *after* stroke

Table 3. Evolution of neurological status in PARADIGM patients.

Patient number	≤24 hrs prior to CAS		48 hrs after CAS		30 days after CAS	
	NIHSS	Rankin	NIHSS	Rankin	NIHSS	Rankin
# 5	6	1	6	1	6	1
# 6	5	2	5	2	3	2
# 7	1	1	1	1	1	1
# 9	6	4	6	4	6	3
# 13	6	3	4	2	3	2
# 15	3	3	3	2	3	1
# 18	9	4	4	3	3	2
# 20	1	1	1	1	1	1
# 22	2	1	2	1	2	1
# 23	4	2	3	1	2	1
# 25	6	3	5	3	4	3
# 26	4	2	4	2	4	2
# 28	5	2	2	2	2	2
# 33	3	1	3	1	3	1
# 41	5	3	5	3	5	3
# 44	9	4	7	4	7	3
# 48	3	1	3	1	3	1
# 50	6	3	6	3	6	3
# 55	3	2	3	2	3	2
# 56	2	1	2	1	2	1
# 59	3	1	1	1	1	1
# 63	4	2	4	2	4	2
# 60	2	0	0	0	0	0
# 65	4	2	4	2	4	2
# 69	2	2	2	2	2	2
# 70	5	4	5	4	5	4
# 71	3	1	3	1	3	1
# 72	1	0	1	0	1	0
# 74	6	4	6	4	6	4
# 75	2	1	2	1	2	1
# 83	3	1	3	1	3	1
# 86	2	2	2	2	2	2
# 94	1	1	0	0	0	0
# 98	3	2	3	2	3	2
# 99	2	1	2	1	2	1
# 100	1	1	0	0	0	0
# 101	7	4	4	4	4	3

improvement; deterioration (none)

EuroIntervention 2016;12:e658-e670

Every symptomatic Carotid Stenosis …

Every
symptomatic
Carotid Stenosis …

… starts
as
asymptomatic

Until (and if ever) Prospective Risk Scores are Developed…

Until (and if ever) Prospective Risk Scores are Developed…

$CHADS_2$ Calculator for Atrial Fibrillation

Evaluates ischemic stroke risk in patients with atrial fibrillation

Criteria		Poss. Point
Congestive heart failure Signs/symptoms of heart failure confirmed with objective evidence of cardiac dysfunction	Yes No	+1
Hypertension Resting BP > 140/90 mmHg on at least 2 occasions or current antihypertensive pharmacologic treatment	Yes No	+1
Age 75 years or older	Yes No	+2
Diabetes mellitus Fasting glucose > 125 mg/dL or treatment with oral hypoglycemic agent and/or insulin	Yes No	+1
Stroke, TIA, or TE Includes any history of cerebral ischemia	Yes No	+2
Vascular disease Prior MI, peripheral arterial disease, or aortic plaque	Yes No	+1
Age 65 to 74 years	Yes No	+1
Sex **C**ategory (female) Female gender confers higher risk	Yes No	+1

Results:

Total Criteria Point Count: **0**

Reset Form

Stroke Risk per 100 Person Years/Warfarin Rx Interpretation

0 Points:	0.25 ON Rx; 0.49 NO Rx
1 Point:	0.72 ON Rx; 1.52 NO Rx
2 Points:	1.27 ON Rx; 2.50 No Rx
3 Points:	2.20 ON Rx; 5.27 NO Rx
4 Points:	2.35 ON Rx; 6.02 NO Rx
5-6 Points:	4.60 ON Rx; 6.88 NO Rx

Until (and if ever) Prospective Risk Scores are Developed…

- we have the duty to use **published risk criteria**

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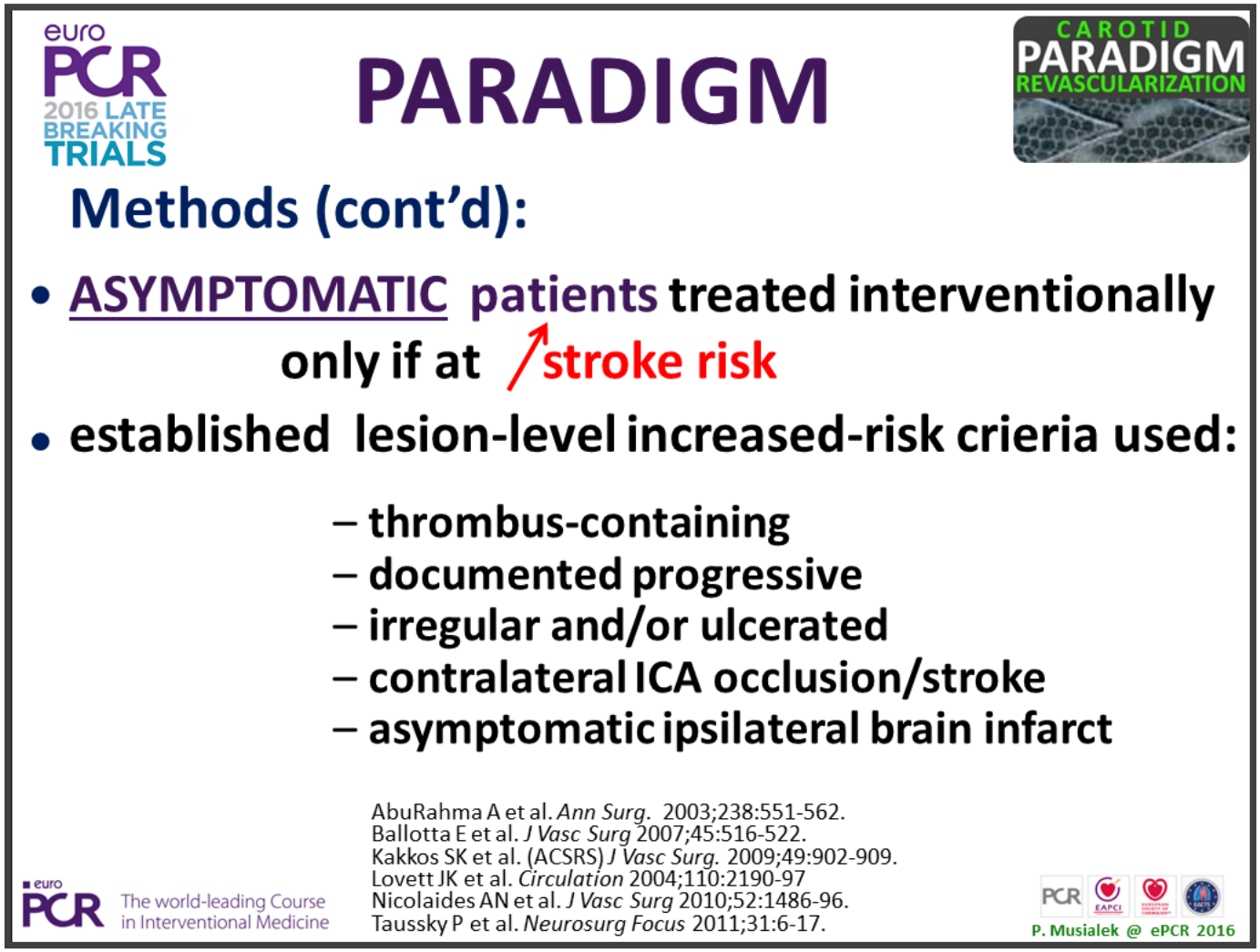


2018 euro PCR

How asymptomatic is "asymptomatic" carotid stenosis?

Resolving fundamental confusion(s)—and confusions yet to be resolved

Piotr Musiałek[1], Iris Q. Grunwald[2,3]

1 Department of Cardiac and Vascular Diseases, Jagiellonian University Medical College, John Paul II Hospital, Kraków, Poland
2 Neuroscience and Vascular Simulation, Anglia Ruskin University, Chelmsford, United Kingdom
3 Southend University Hospital NHS Foundation Trust, Westcliff-on-Sea, United Kingdom

symptoms vs. sign(s) of cerebral ischemia

eg. "asymptomatic" infarct(s),
retinal function,
cognitive function, etc.

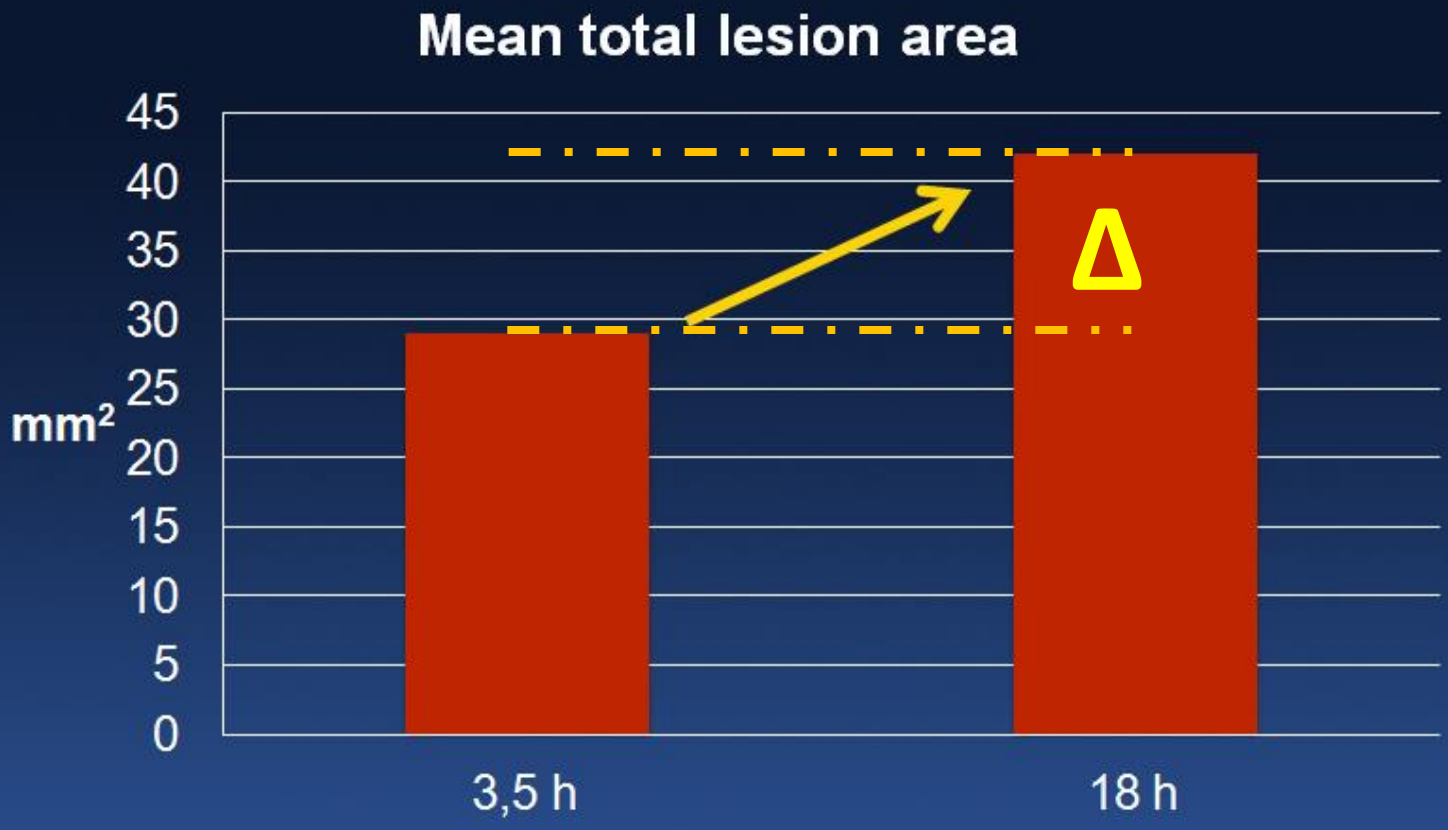
What is the meaning of "symptomatic" in relation to CS? The English language, in contrast to many others, differentiates between "symptoms" and "signs." A symptom is an indication of disease perceived by the patient and reported by the patient. Symptoms of CS-associated cerebral ischemia include ipsilateral TIA or clinical stroke.[2,10] A sign is an observable physical phenomenon indicative of the presence of a pathology or disease. Signs are detected by the physician through clinical examination and accessory investigations. A clinically-silent cerebral infarct ipsilateral to CS is a sign, not a symptom, and the patient is, strictly speaking, "asymptomatic." In such patients, however, there is evidence for an increased risk of further, clinically symptomatic, brain injury likely to occur in the absence of an intervention.[2,8] While the definition of stroke includes an episode of clinically manifest neurological dysfunction,[10] according to the same guidelines, the term "stroke" may be also used for brain infarction in the absence of clinical symptoms.[10] According to some authors, patients with TIA or stroke become automatically "asymptomatic" from the point of 6 months after the event onwards.[3,9,11] Further confusions arise from the fact that different studies have used different time points to change the "symptomatic"/"asymptomatic" label, such as 1, 3, 4, or 12 months.[12] More accurate terms have been proposed, such as "recently symptomatic" and "remotely symptomatic."[12] The above, and other, inconsistencies greatly confuse physicians, leading to different approaches to the same patient type by various specialties or in various medical centers or countries.

Role of CAS in 2018

- **Concepts and Tools**

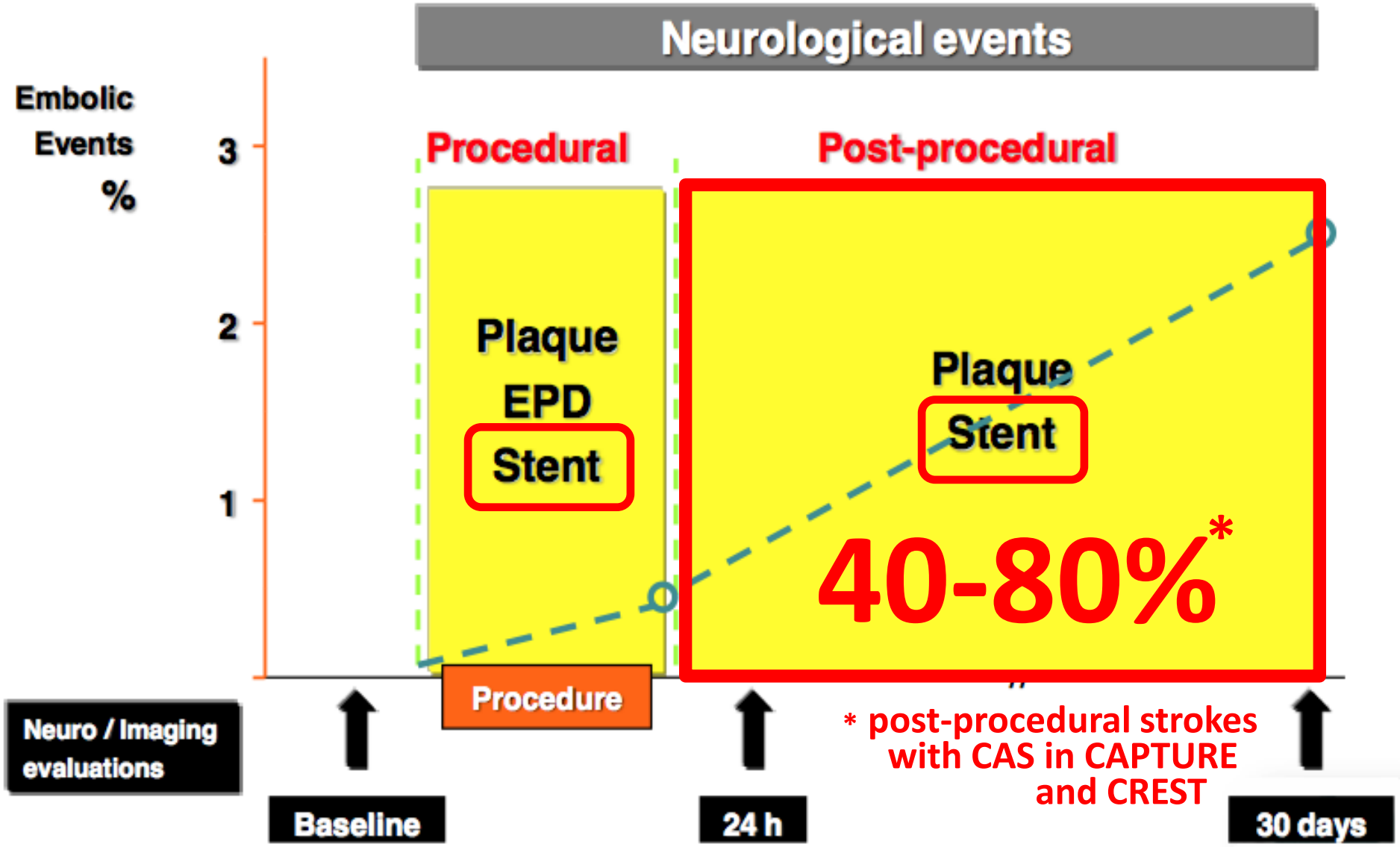
Post-procedural Embolization with conventional carotid stents

DW-MRI post CAS



Schofer J et al, JACC Cardiovasc interv 2008

Timing of neuro-embolic events after CAS

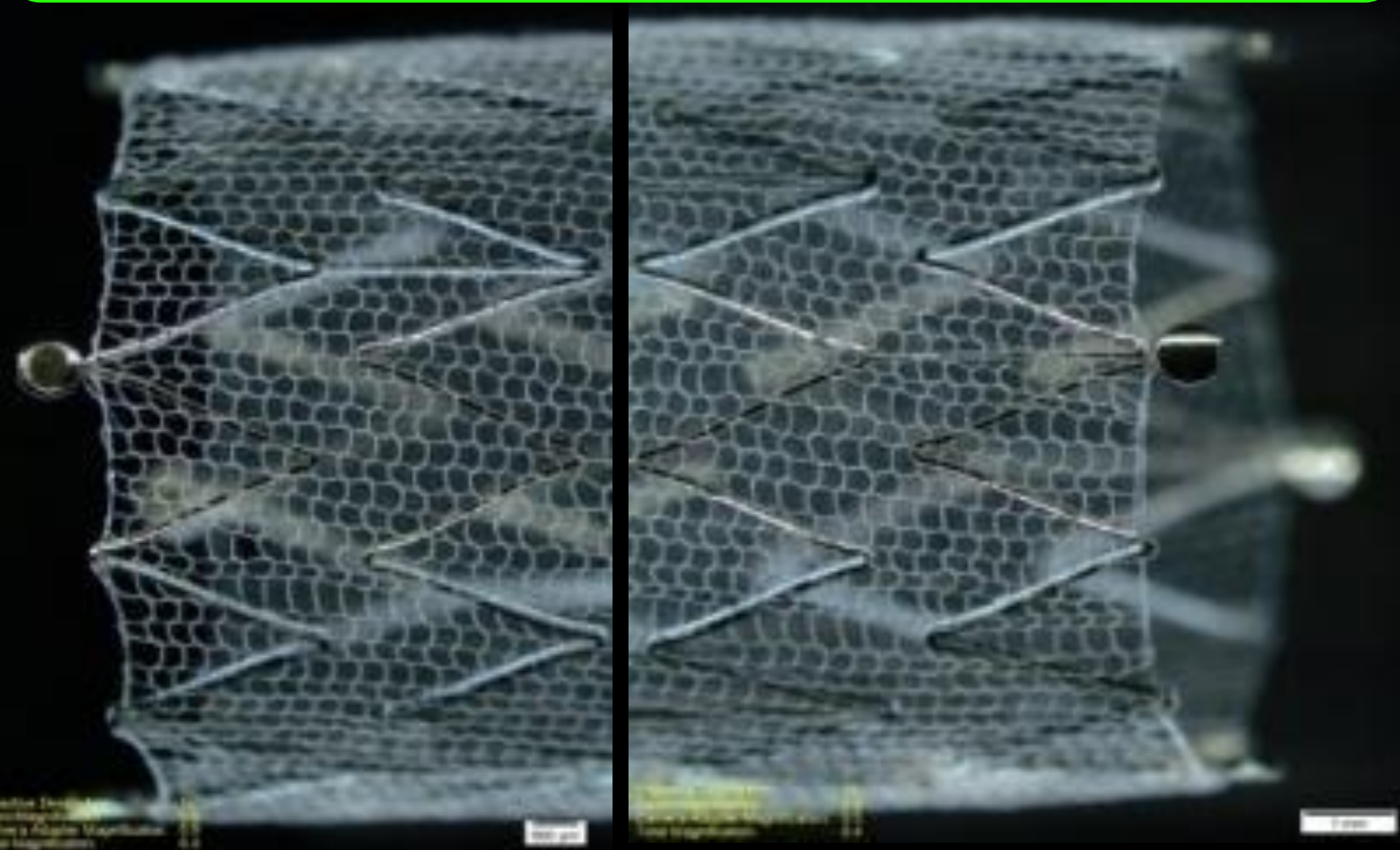


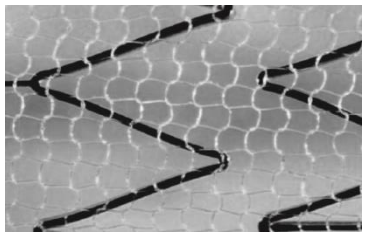
D. McCormick TCT 2012, modified

Role of CAS in 2018

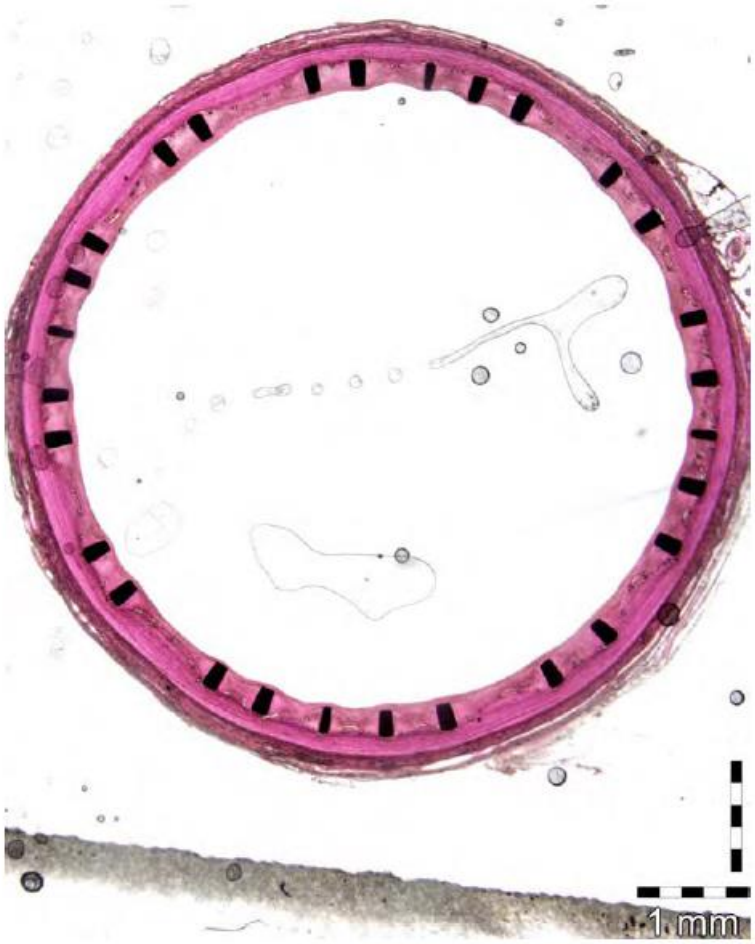
- CEA excludes the plaque
- In CAS, the stent should exclude the plaque too

CGuard™ embolic prevention system

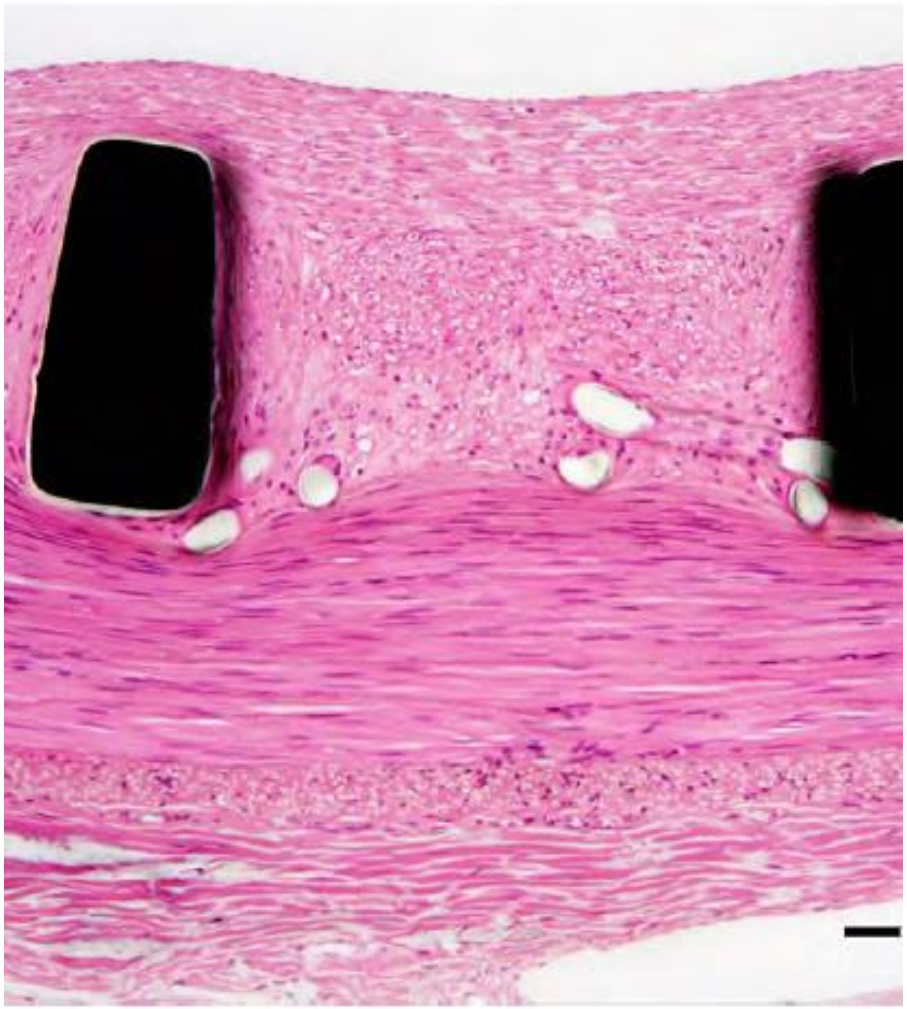




CGuard EPS 90 days/pig



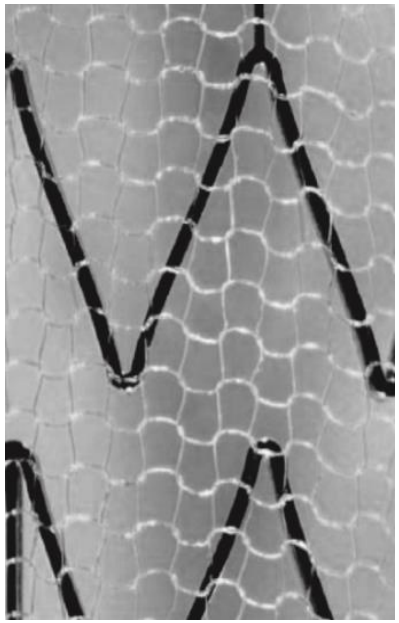
12-105 LCCA-S 3 13-1689-3 1.25x H&E.tif

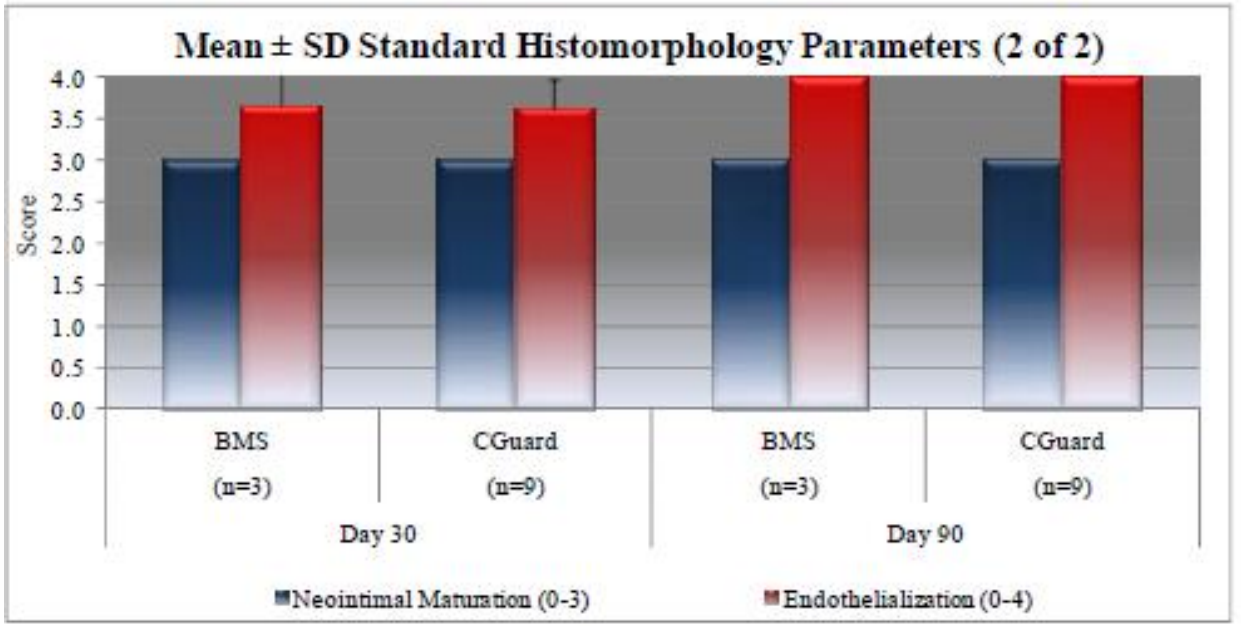


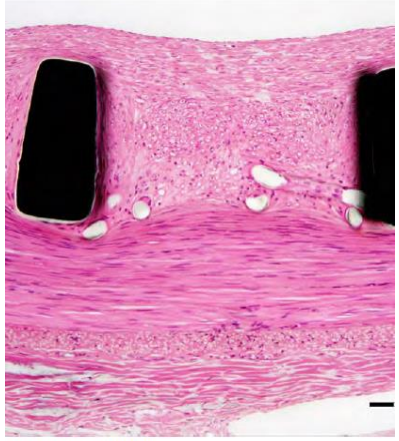
CA-S 3 13-1689-3 10x H&E.tif

InspireMD data / by permission

CGuard EPS 30 & 90 days / pig







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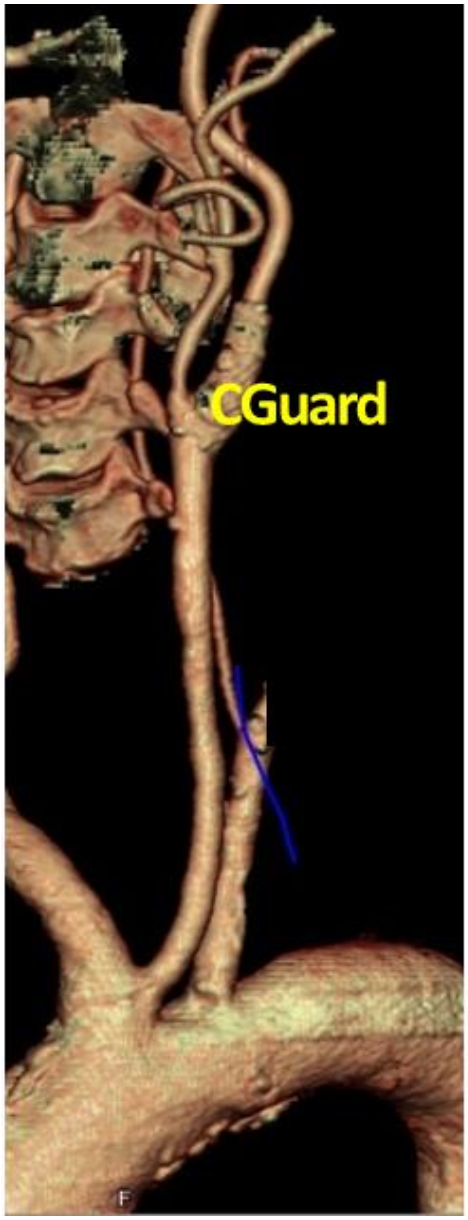
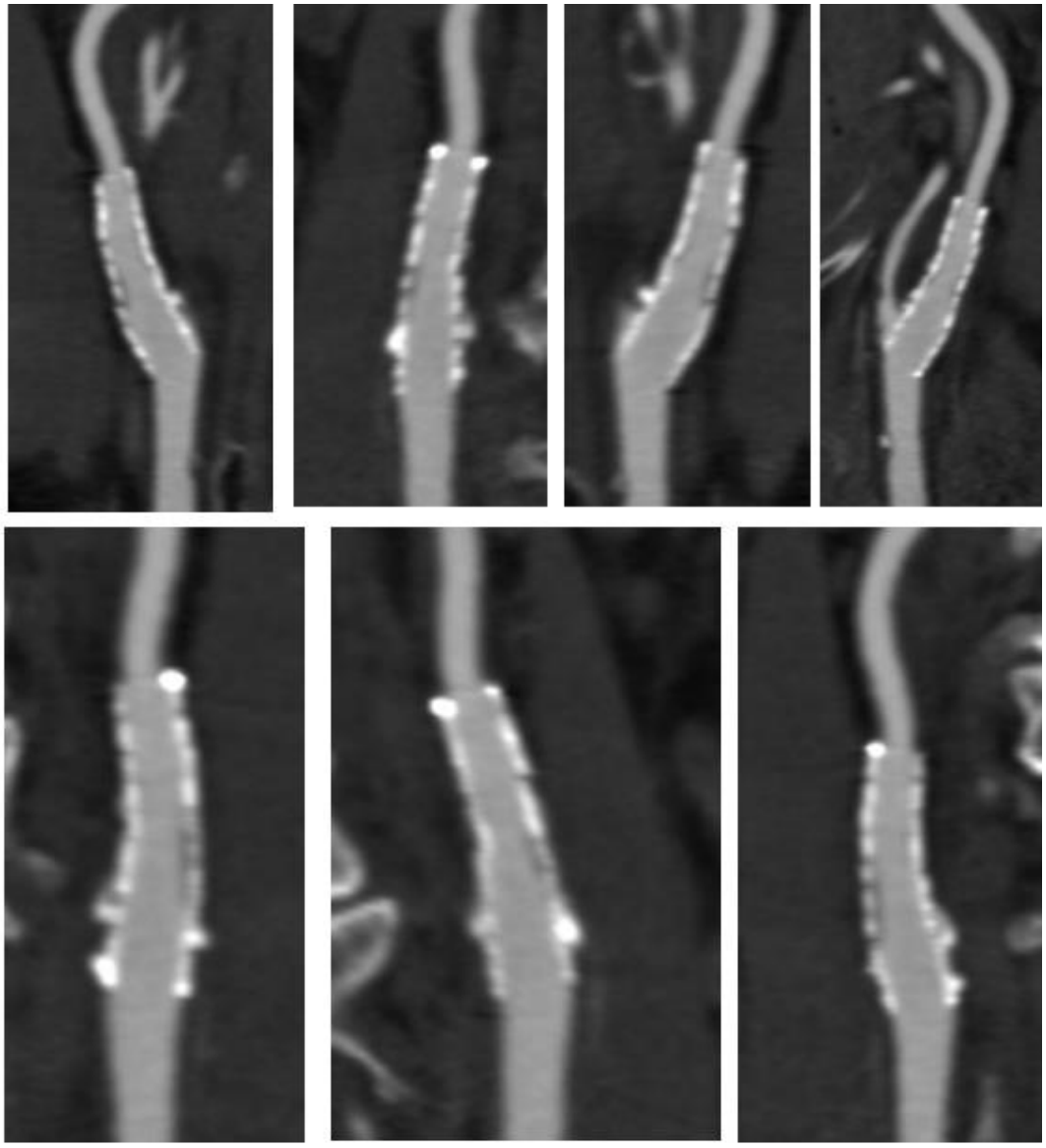
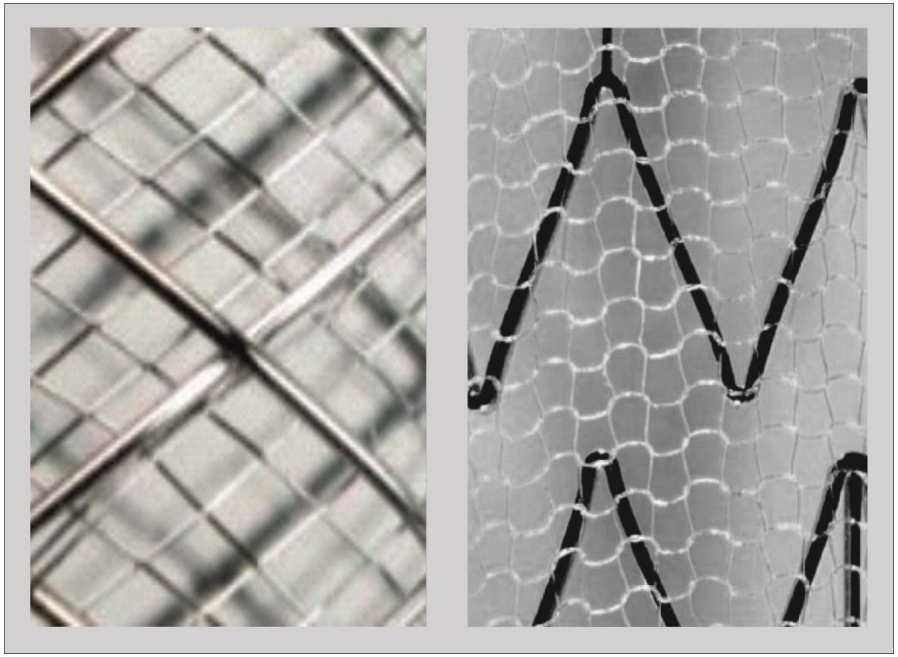
Mean ± SD and Median Standard Histomorphology Parameters								
Parameter	Day 30				Day 90			
	BMS (n=3)		CGuard (n=9)		BMS (n=3)		CGuard (n=9)	
Injury (0-3)	0.00 ± 0.01	0.00	0.00 ± 0.01	0.00	0.01 ± 0.02	0.00	0.00 ± 0.01	0.00
Inflammation (0-3)	0.43 ± 0.23	0.51	0.41 ± 0.22	0.36	0.17 ± 0.16	0.11	0.09 ± 0.08	0.07
Neointimal Fibrin (0-3)	1.13 ± 0.23	1.00	0.82 ± 0.37	1.00	0.00 ± 0.00	0.00	0.00 ± 0.00	0.00
Adventitial Fibrosis (0-3)	0.00 ± 0.00	0.00	0.02 ± 0.07	0.00	0.00 ± 0.00	0.00	0.00 ± 0.00	0.00
Neointimal Maturation (0-3)	3.00 ± 0.00	3.00	3.00 ± 0.00	3.00	3.00 ± 0.00	3.00	3.00 ± 0.00	3.00
Endothelialization (0-4)	3.67 ± 0.42	3.80	3.62 ± 0.35	3.80	4.00 ± 0.00	4.00	4.00 ± 0.00	4.00

BMS = non mesh-covered CGuard nitynol frame; InspireMD data / used with permission

Normal Long-Term Healing





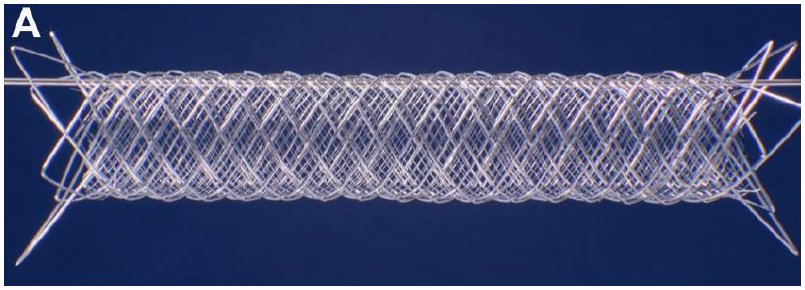


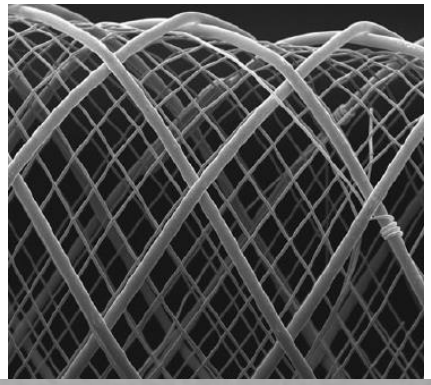
Musialek & Stabile
EuroIntervention 2017

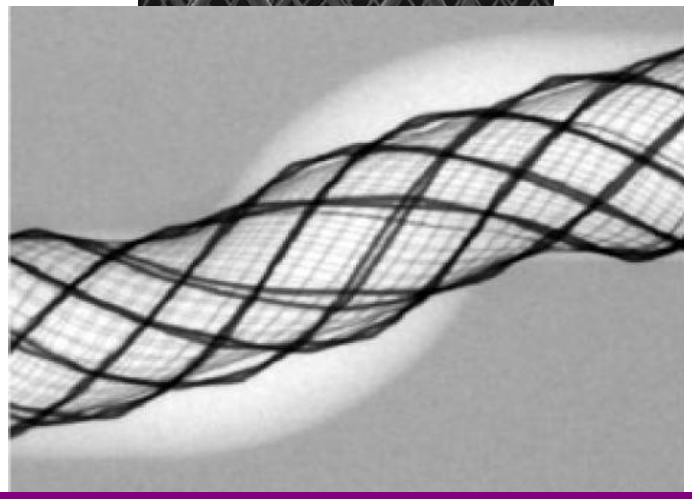
mechanical

Properties

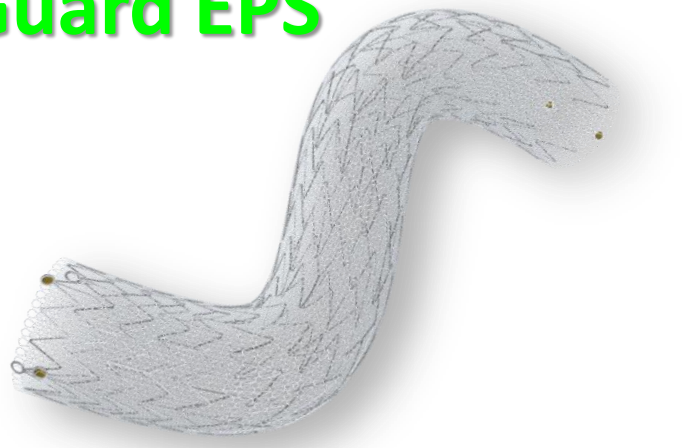
RoadSaver / Casper

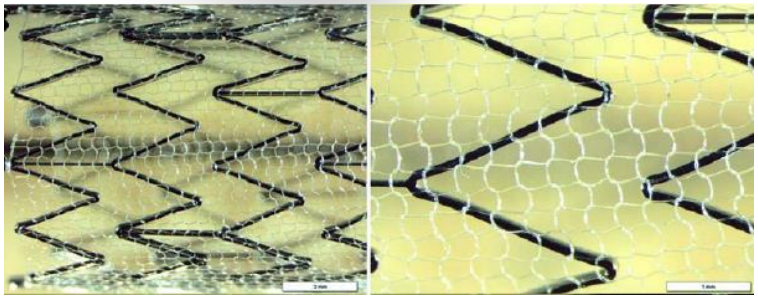


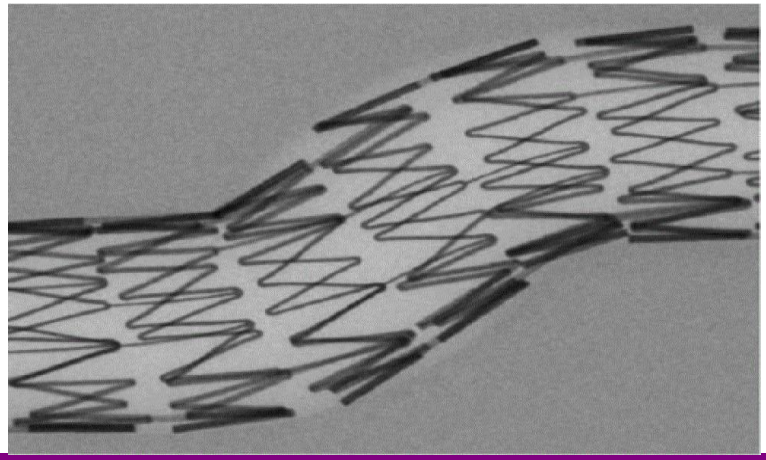




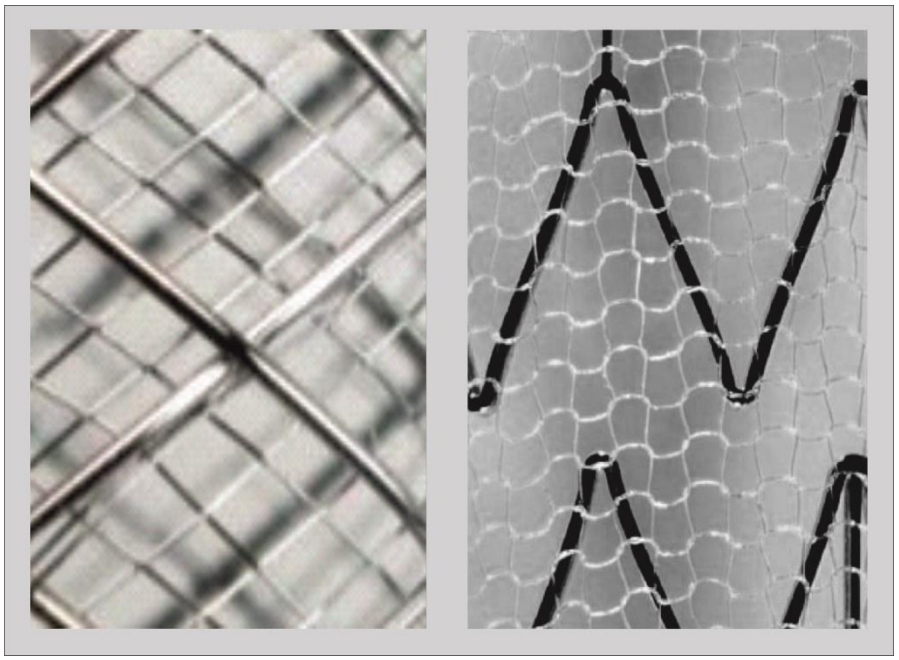
CGuard EPS

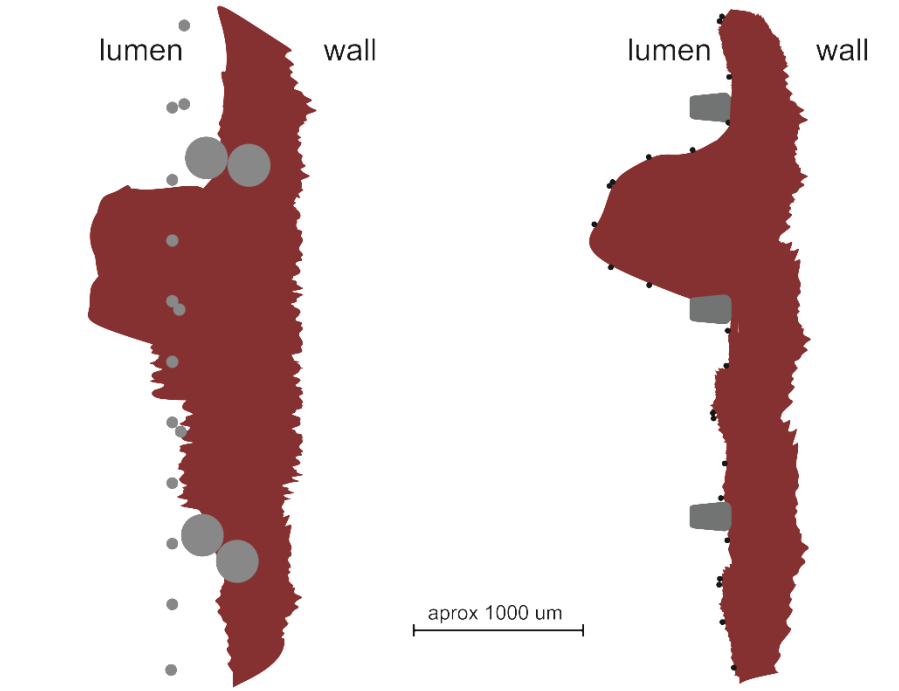




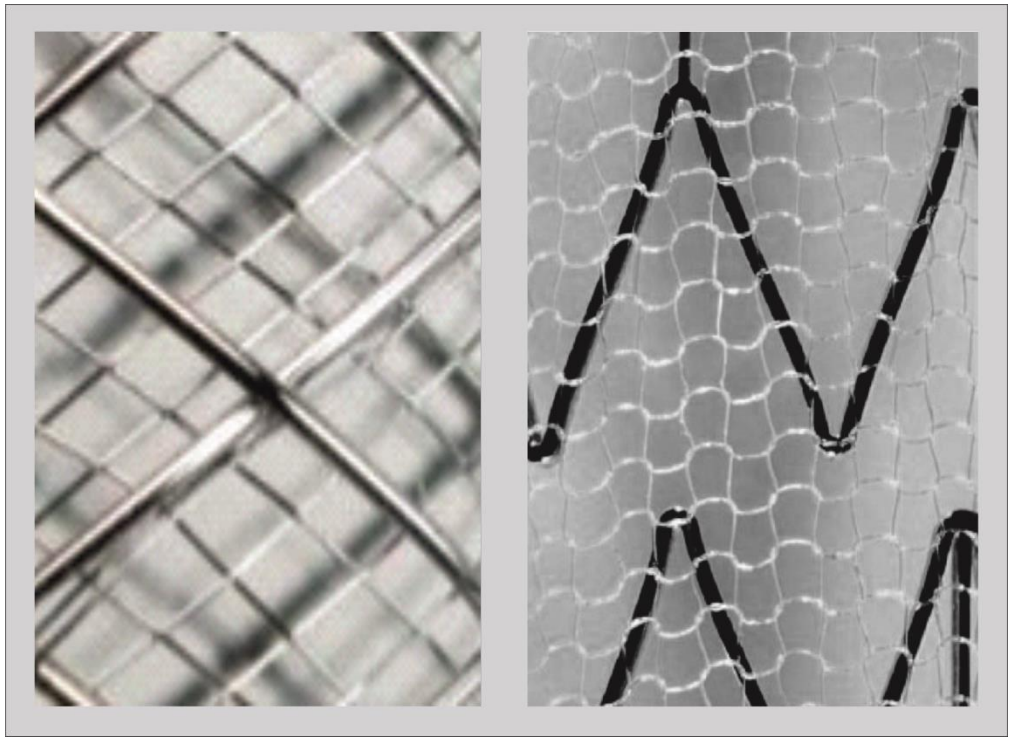


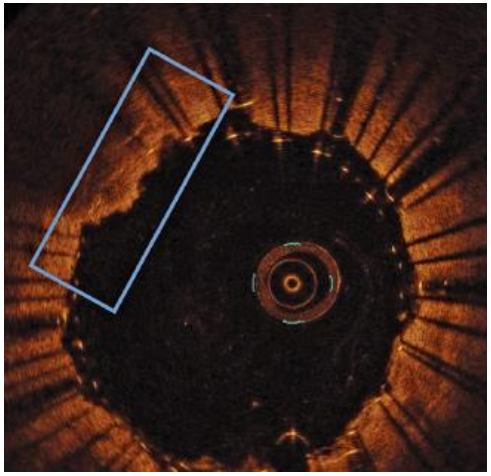
C. Wissgott and colleagues. *J Endovasc Ther.* 2015;22:634-39
C. Wissgott and colleagues. *J Endovasc Ther.* 2017;24:130-7

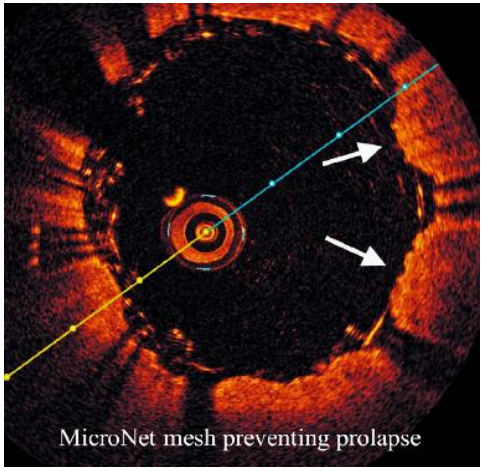


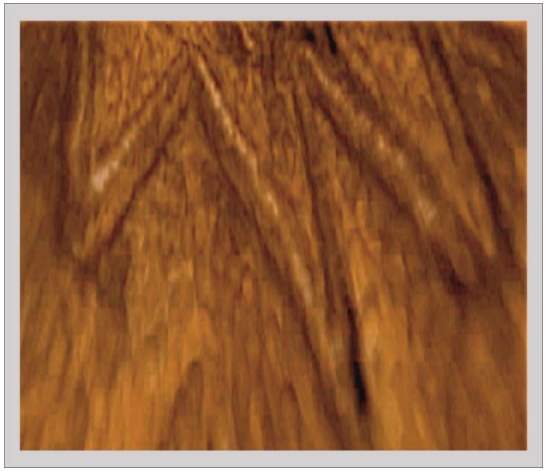


Musialek & Stabile
EuroIntervention 2017









Nerla et al. *EuroIntervention* 2017
Musialek & Stabile *EuroIntervention* 2017
Umemoto et al. *EuroIntervention* 2017

CAS (and CEA) are –and will remain– emboli-generating procedures

Effect of the Distal-Balloon Protection System on Microembolization During Carotid Stenting

Nadim Al-Mubarak, MD; Gary S. Roubin, MD, PhD; Jiri J. Vitek, MD, PhD; Sriram S. Iyer, MD; Gishel New, MD; Martin B. Leon, MD

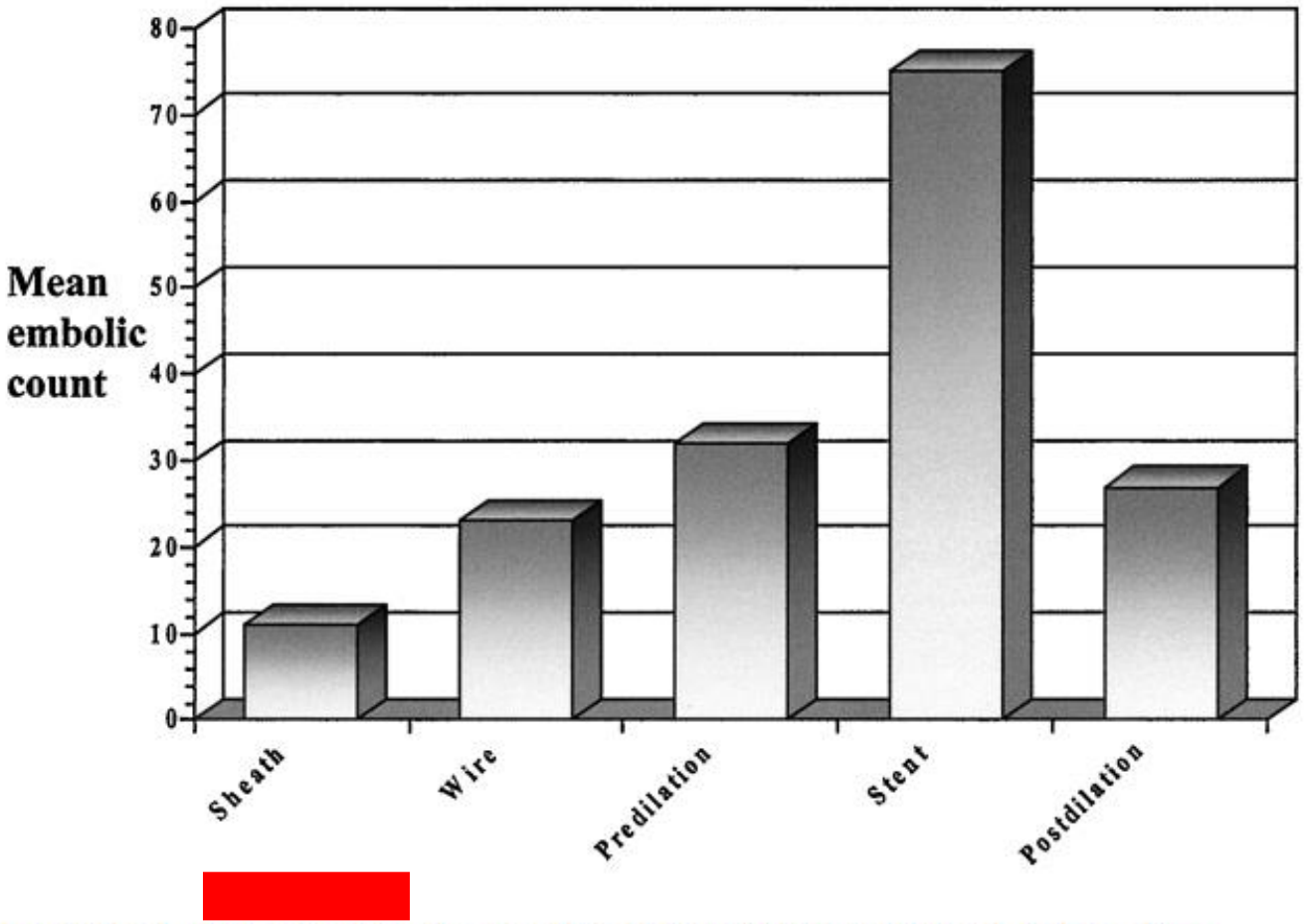


Figure 1. Microembolic profile during unprotected CAS. The mean MES counts during various phases of the procedure are displayed.

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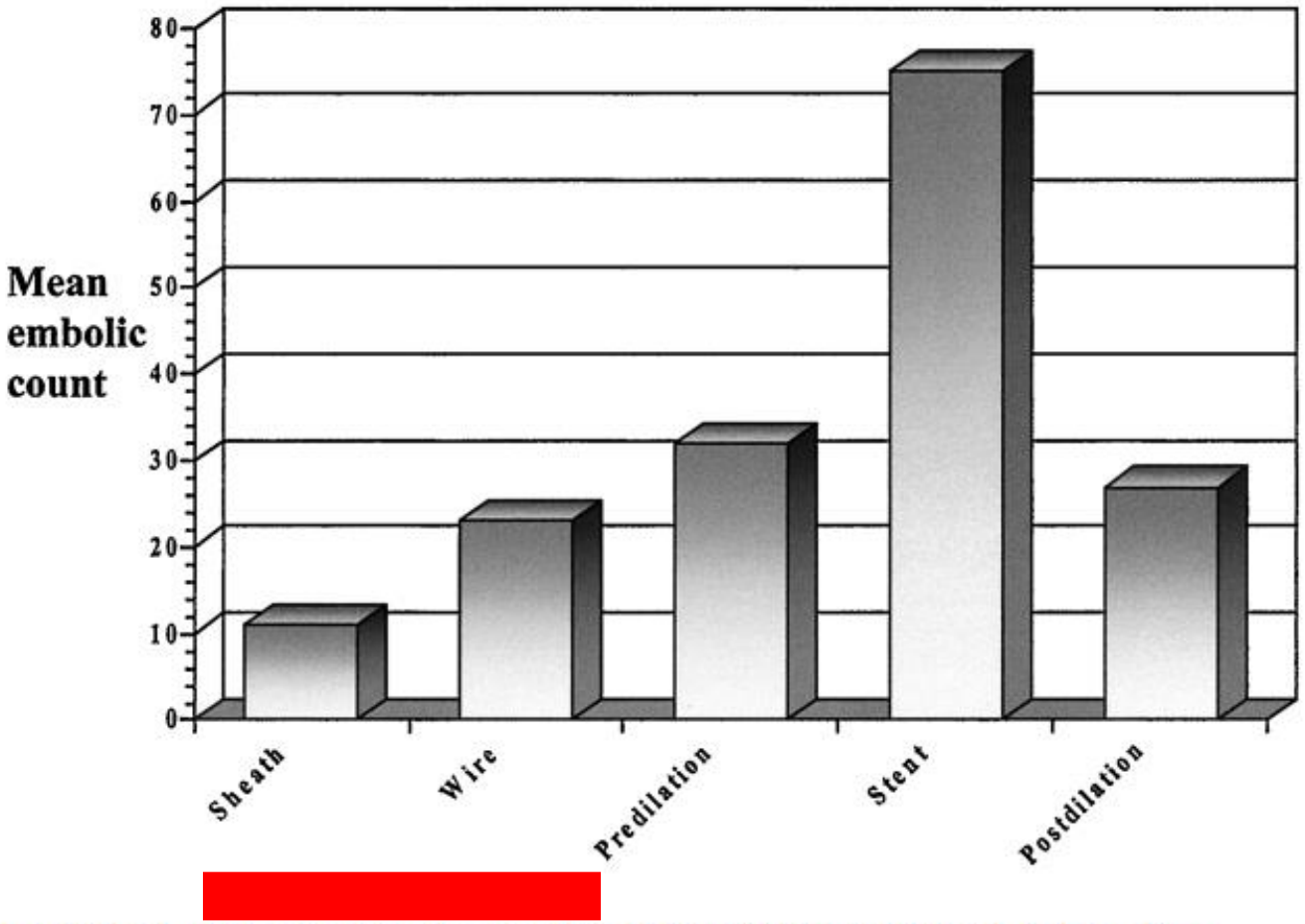

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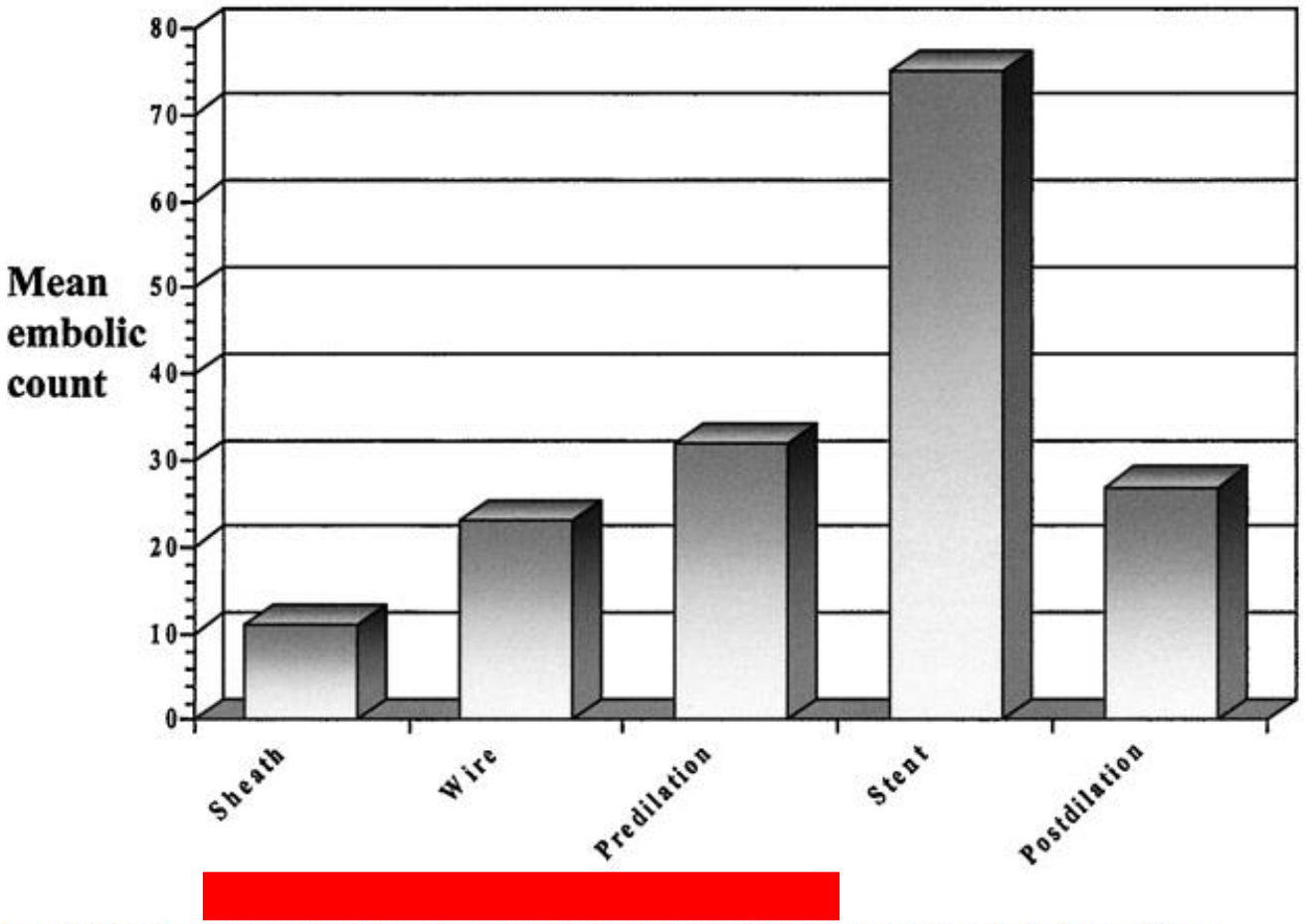

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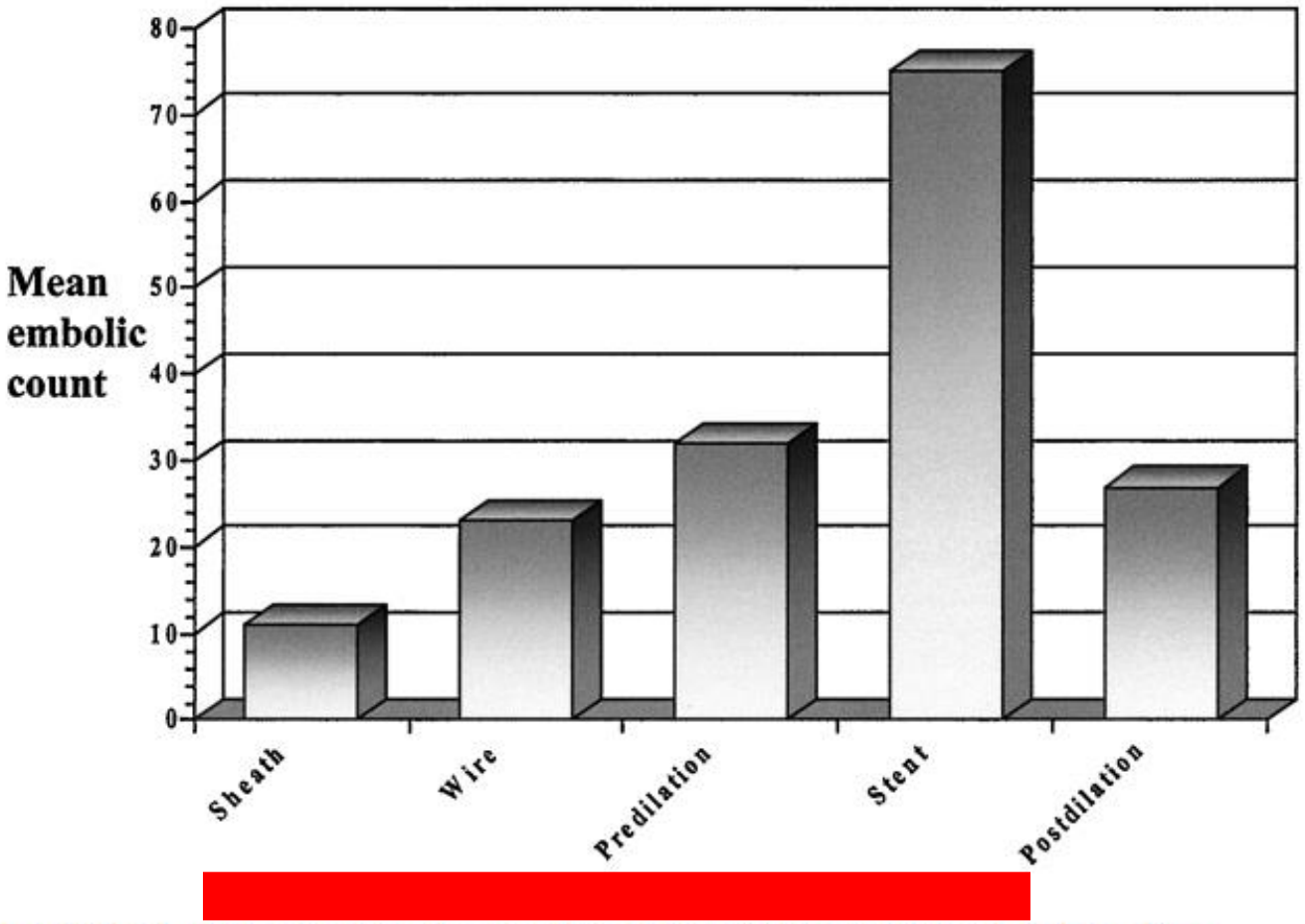

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CAS (and CEA) are –and will remain– emboli-generating procedures

Effect of the Distal-Balloon Protection System on Microembolization During Carotid Stenting

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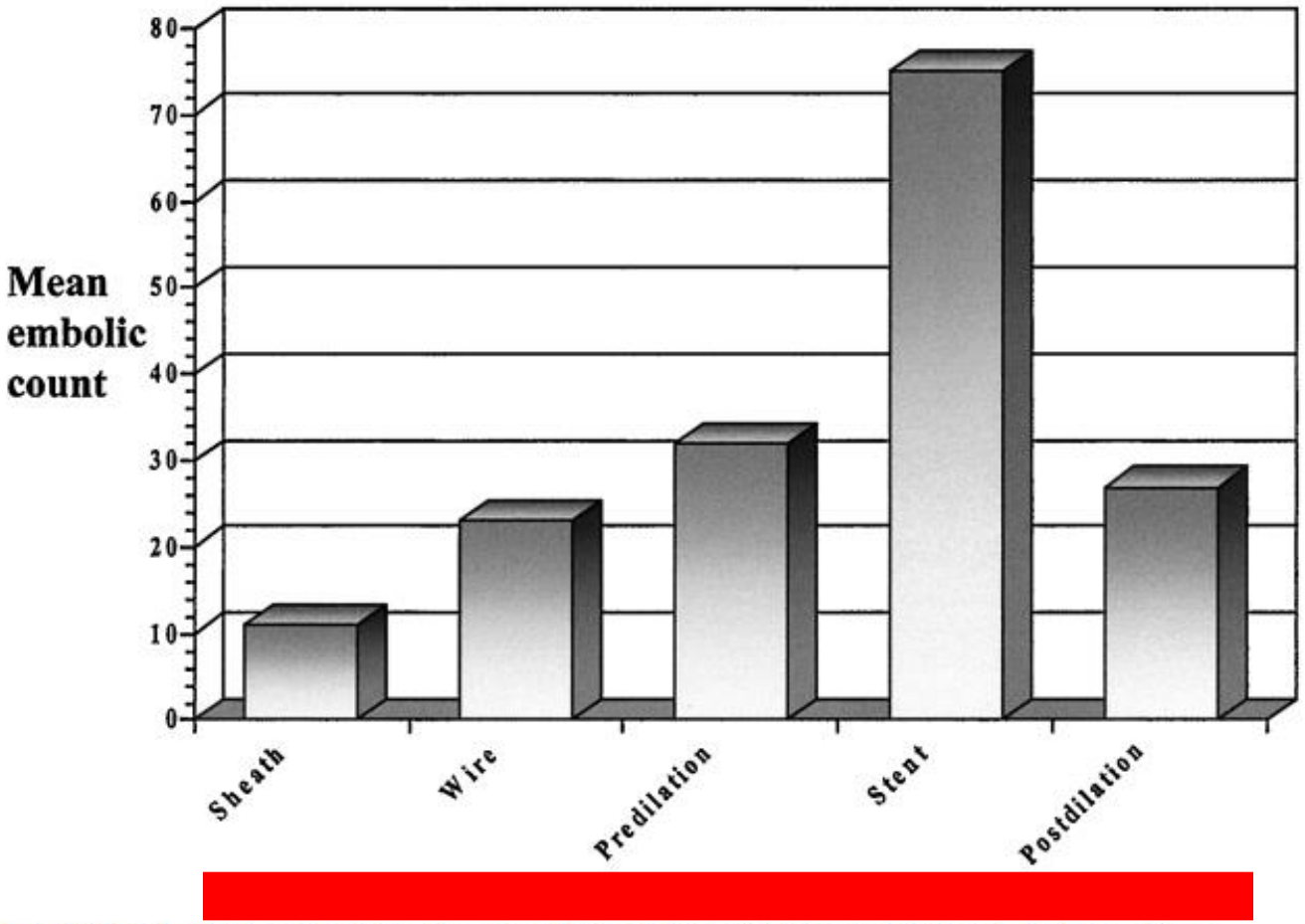
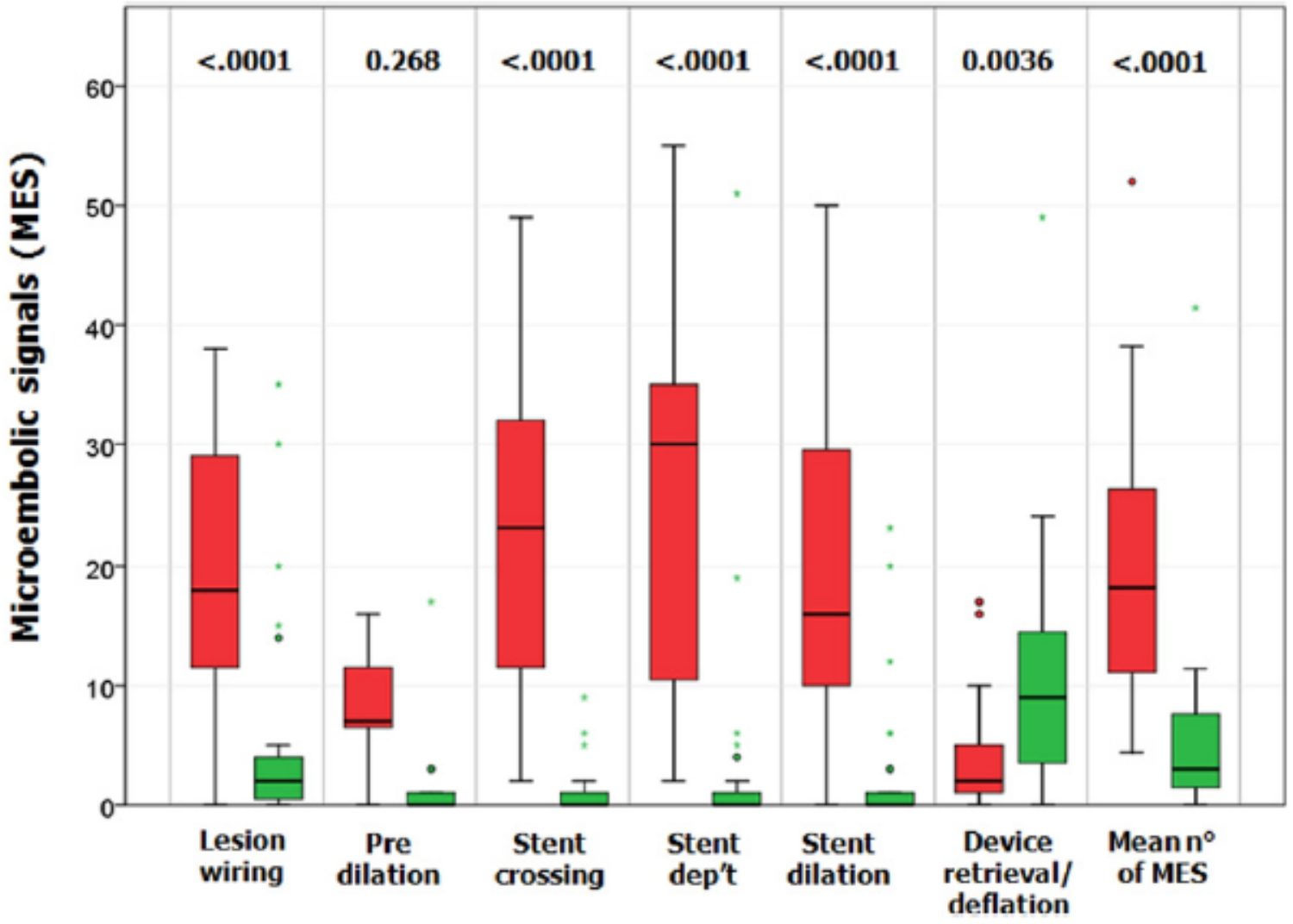


Figure 1. Microembolic profile during unprotected CAS. The mean MES counts during various phases of the procedure are displayed.

Microembolization During Carotid Artery Stenting

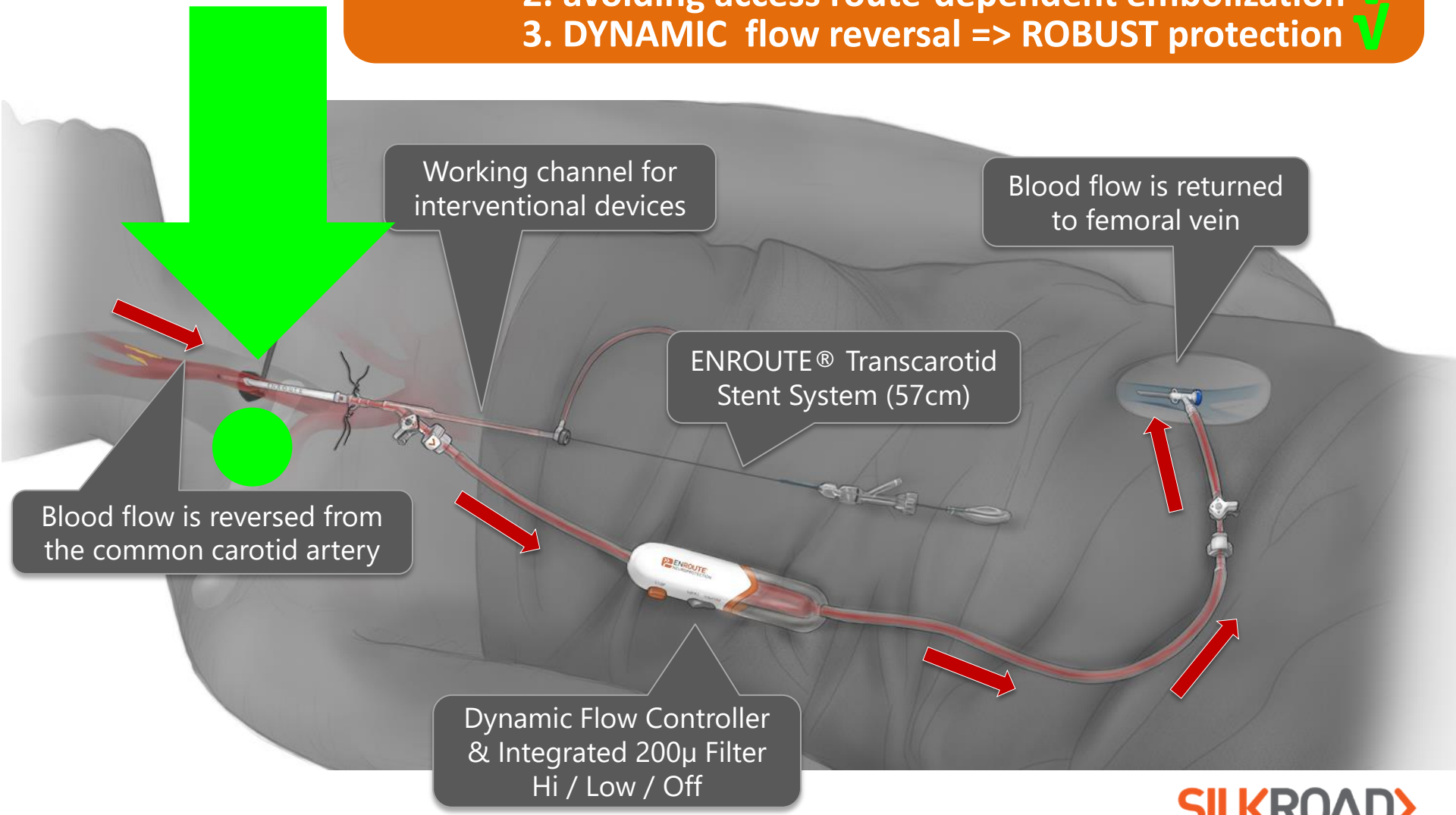
A Randomized Trial of Proximal Versus Distal Cerebral Protection



Montorsi P et al. JACC 2011

TransCarotid Artery Revascularization (TCAR)

TCAR = CLEAR ADVANTAGES
1. avoiding arch √
2. avoiding access route-dependent embolization √
3. DYNAMIC flow reversal => ROBUST protection √

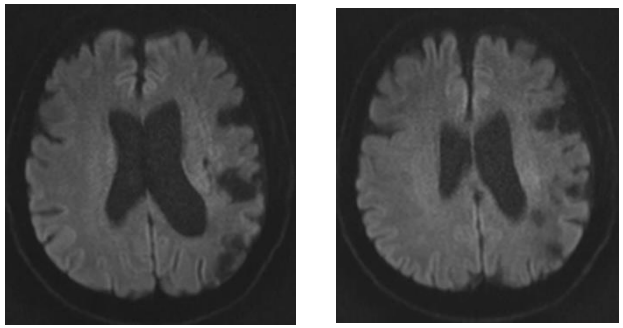


SILKROAD

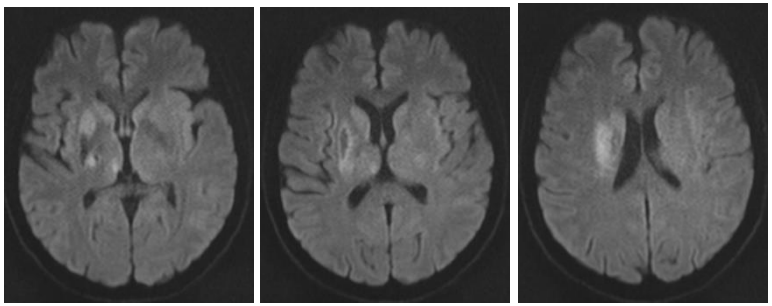
T.W., man 69 yo

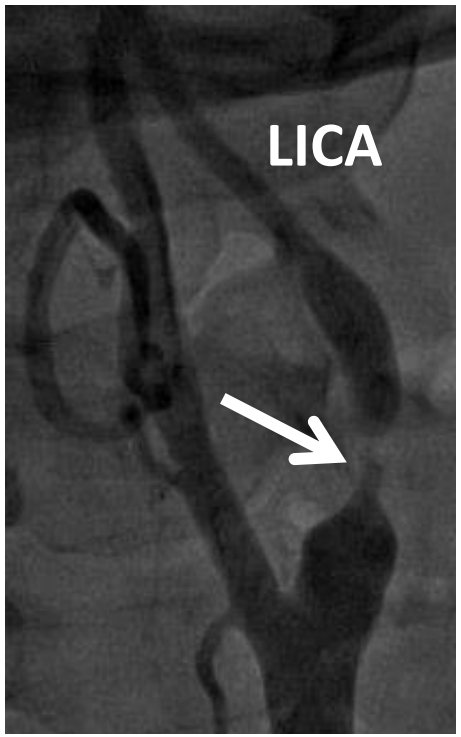
critical LICA stenosis

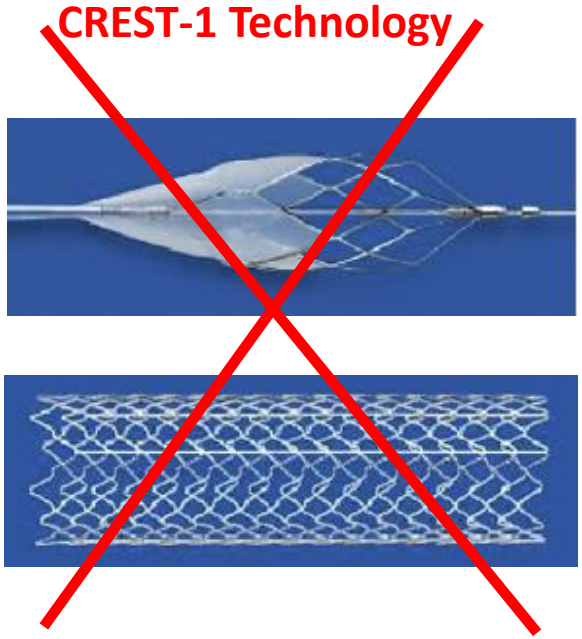
L haemisph stroke 5mo

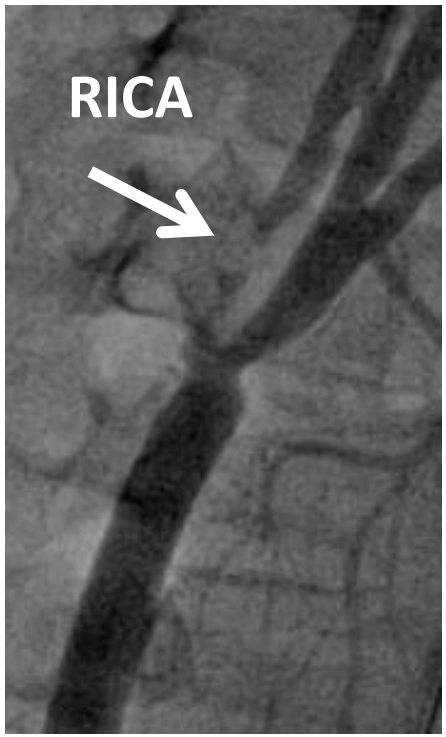


E.W., woman, 58 y,
TWO recent (20d and 5d)
R haemispheric
minor strokes despite OMT !

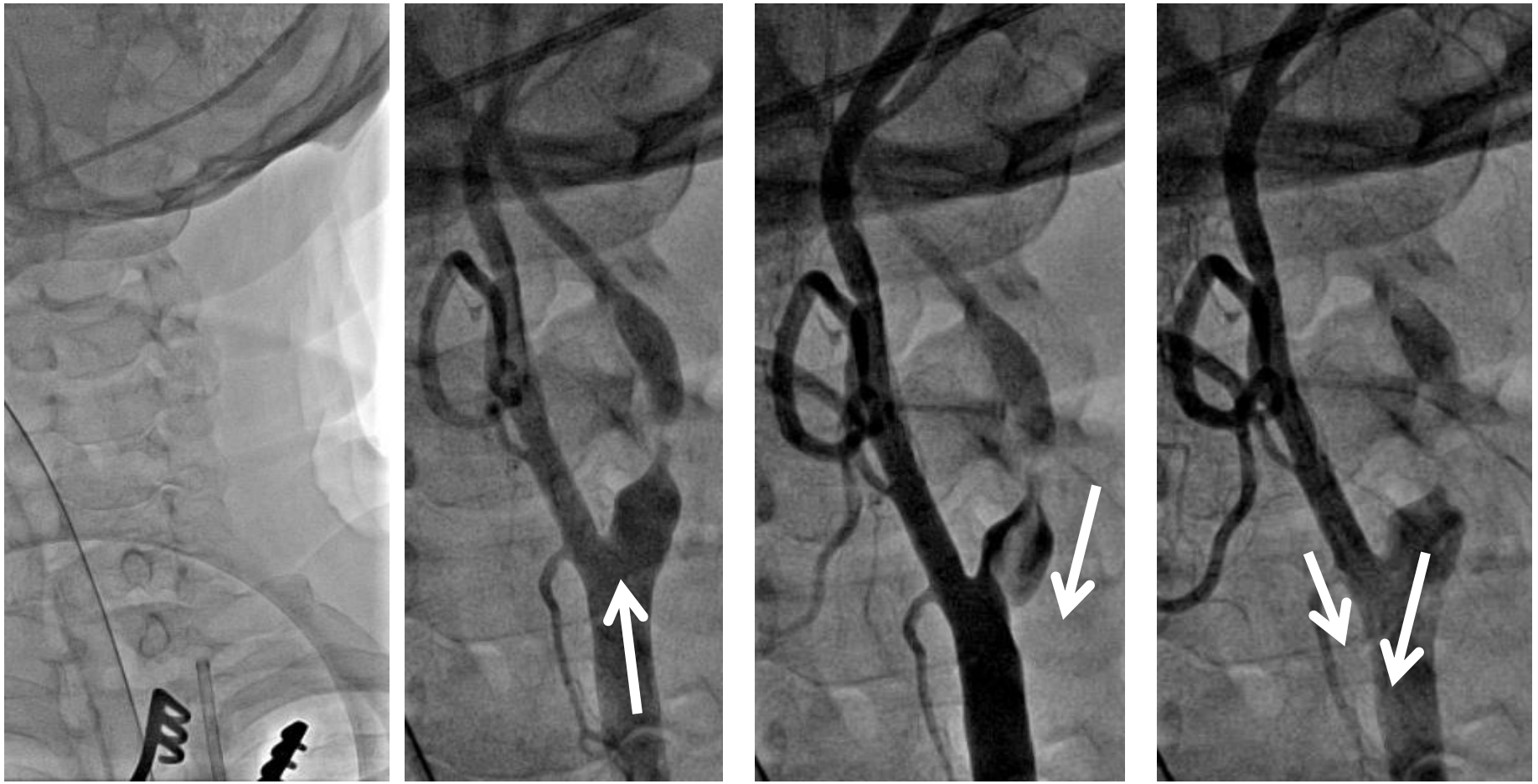








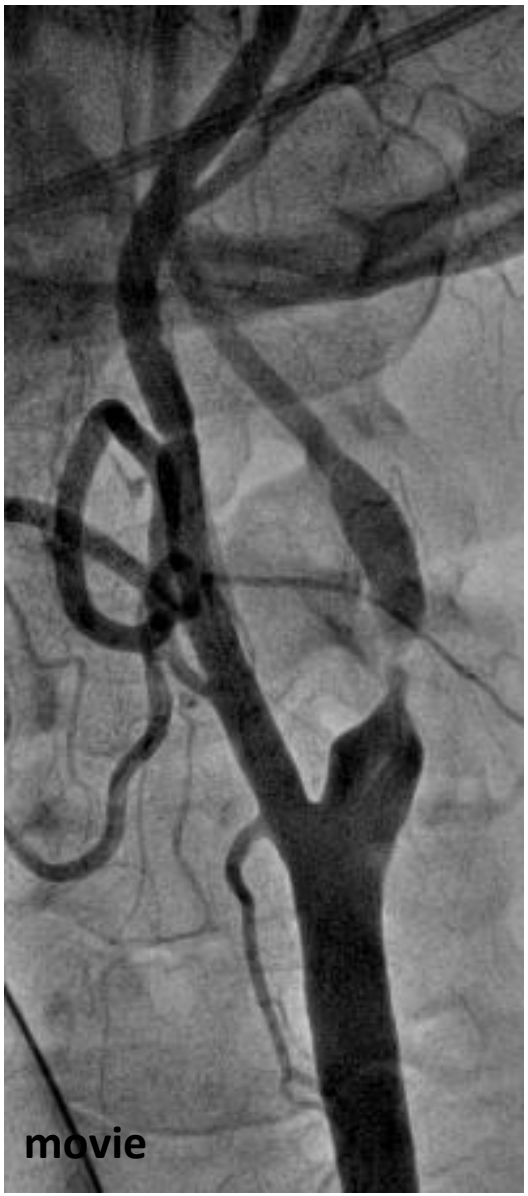
TW, man 69 yo
critical LICA stenosis, post-stroke

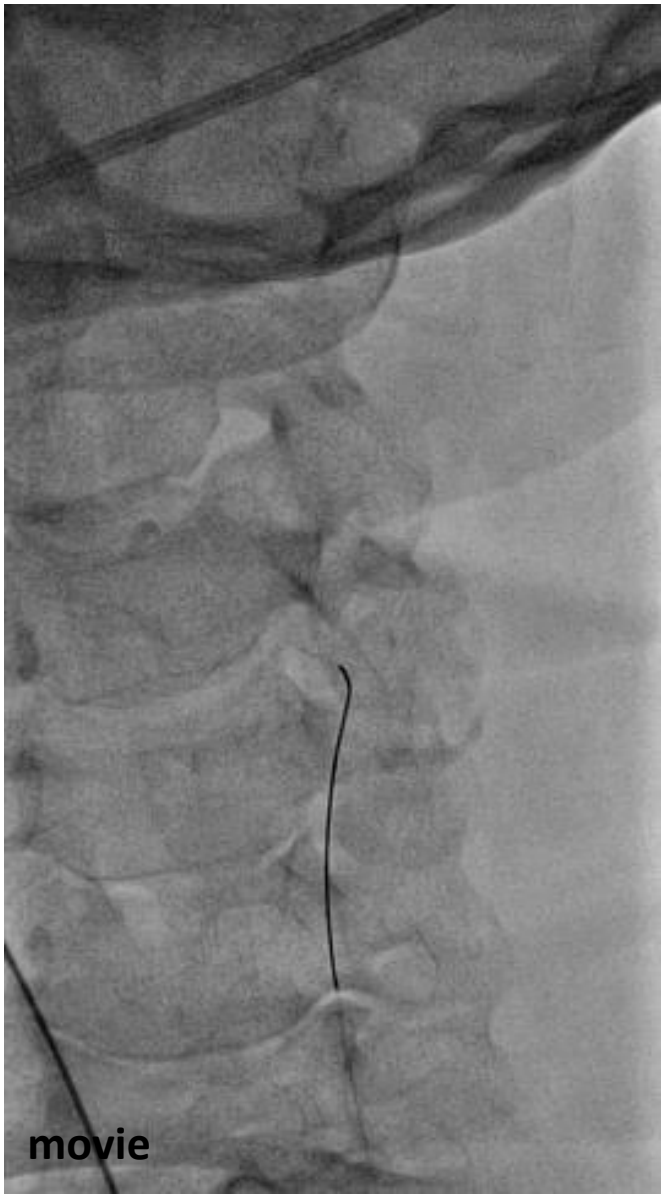


Surgical Team: M. Trystula, M. Kazubudzki, J. Krzywoń, A. Brzychczy; L. Pinter
Endo: P. Musialek & A. Mazurek

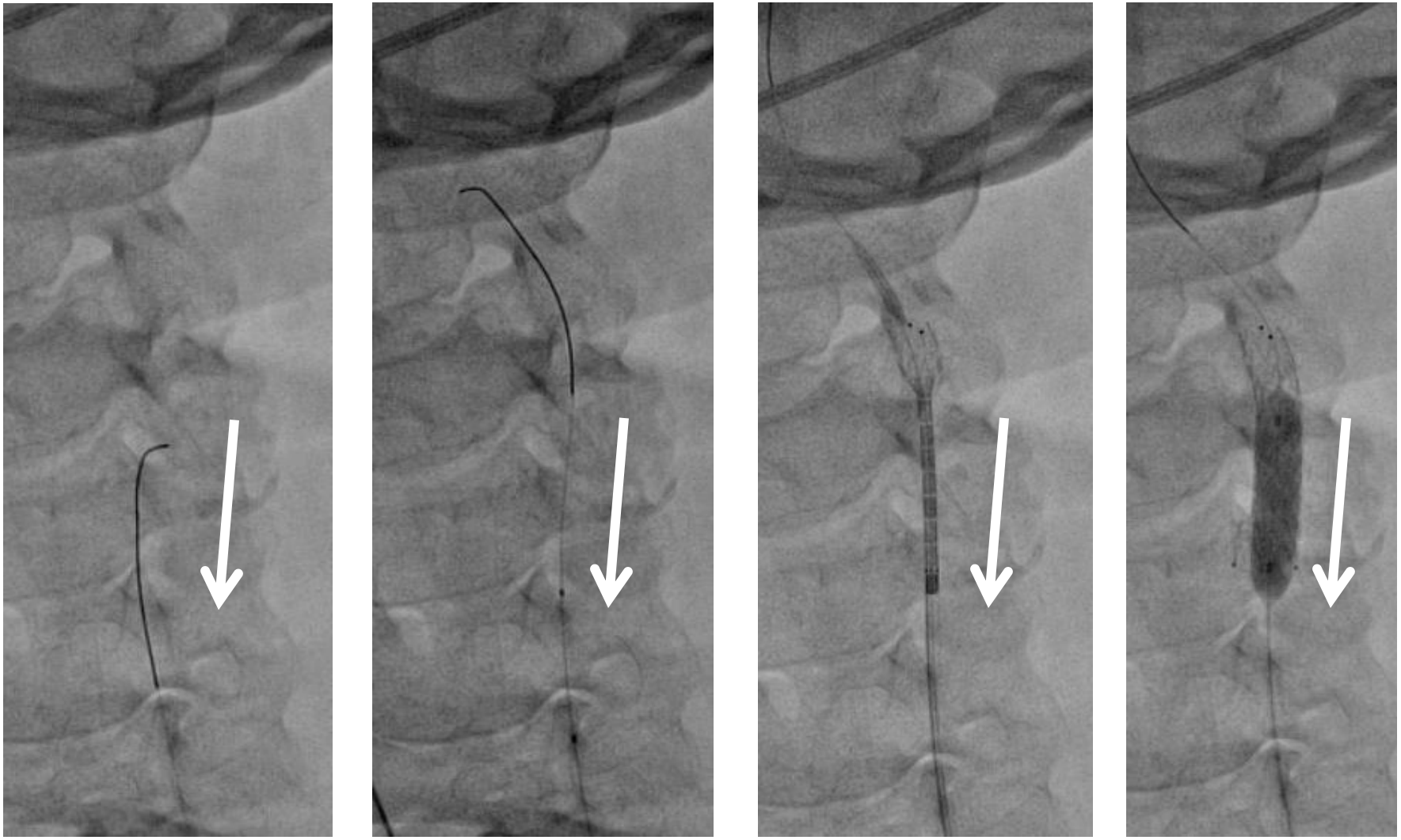
Direct carotid access CAS (TCAR)
Under En Route (SilkRoad Medical) Flow Reversal

TW, man 69 yo
critical LICA stenosis, post-stroke



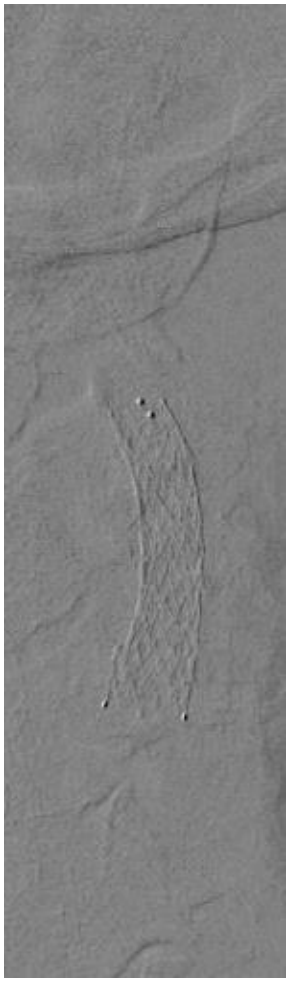


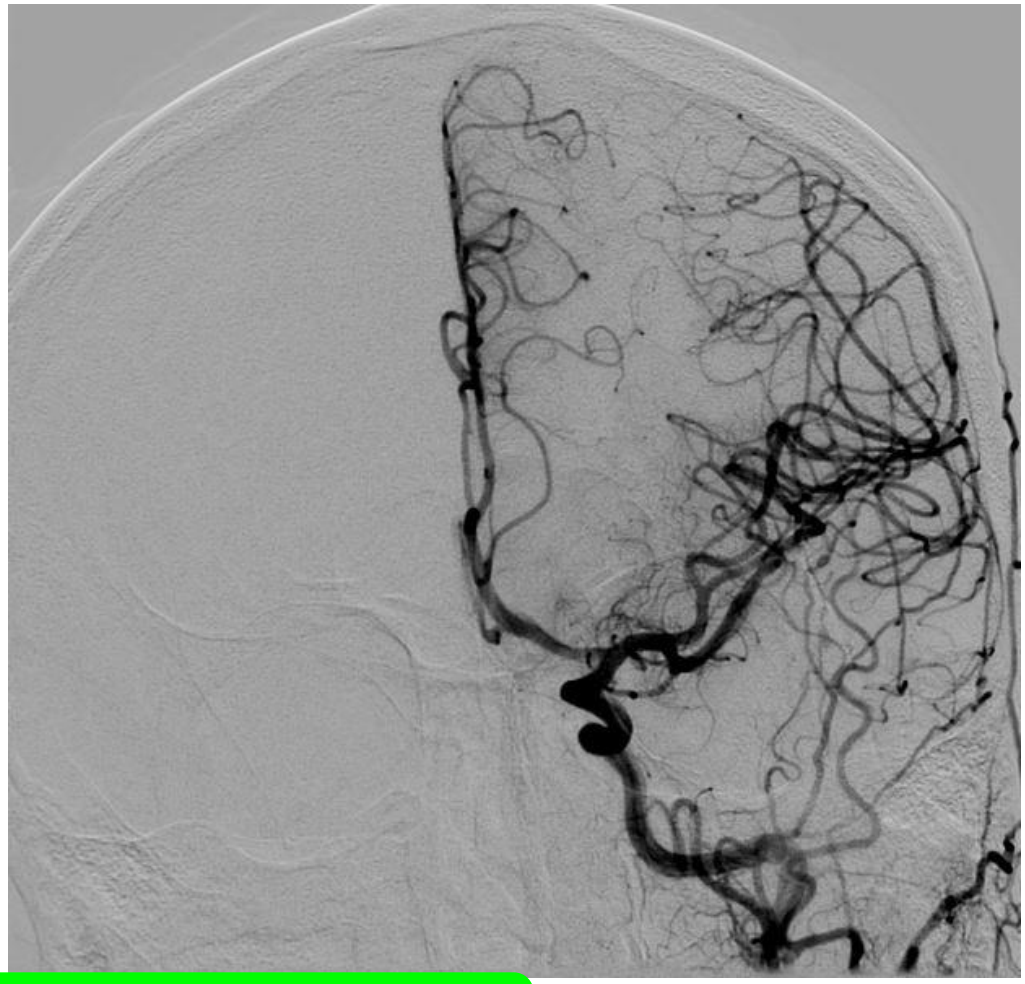
TW, man 69 yo
critical LICA stenosis, post-stroke



lesion crossing, predil, CGuard stent implantation and postdil under En Route (SilkRoad Medical) Flow Reversal

TW, man 69 yo
critical LICA stenosis, post-stroke



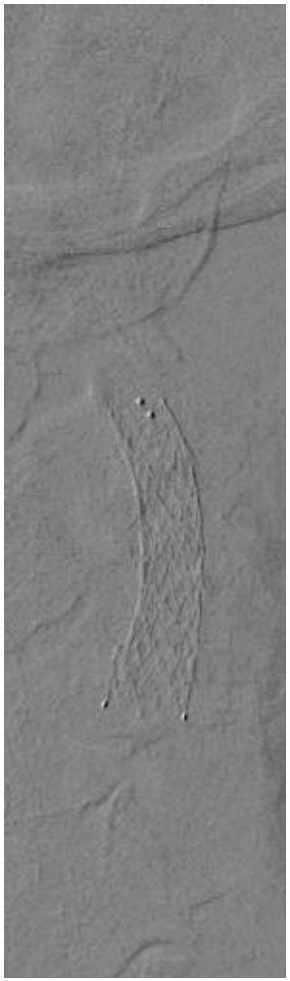


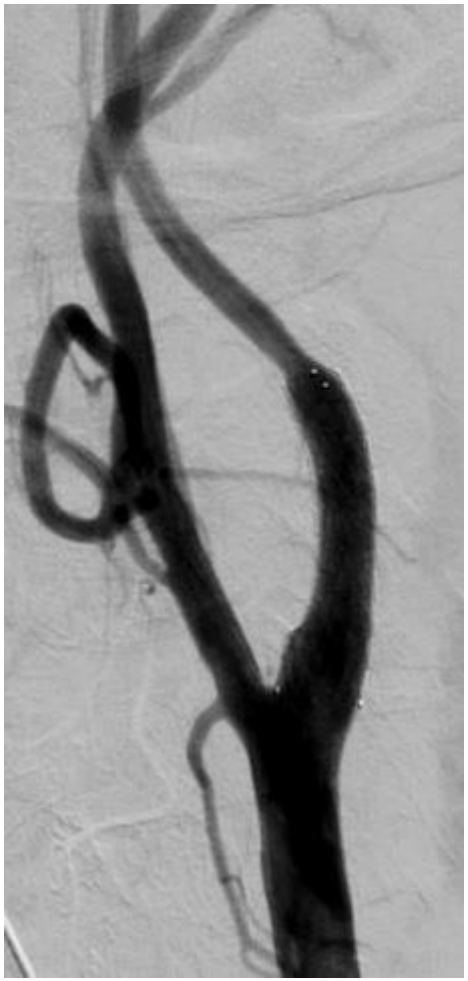
CGuard 7.0 x 30mm

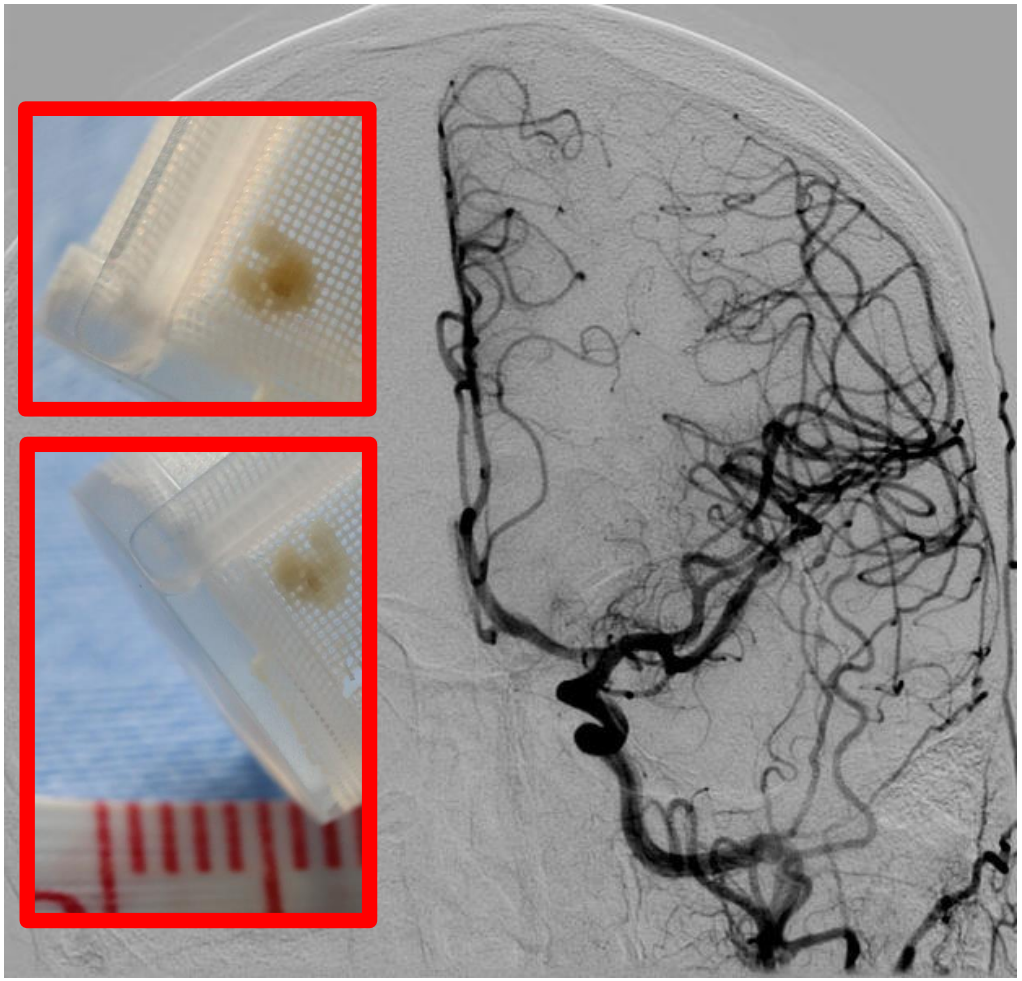
full endovascular reconstruction

Direct carotid access CAS under
En Route (SilkRoad Medical) Flow Reversal

TW, man 69 yo
critical LICA stenosis, post-stroke







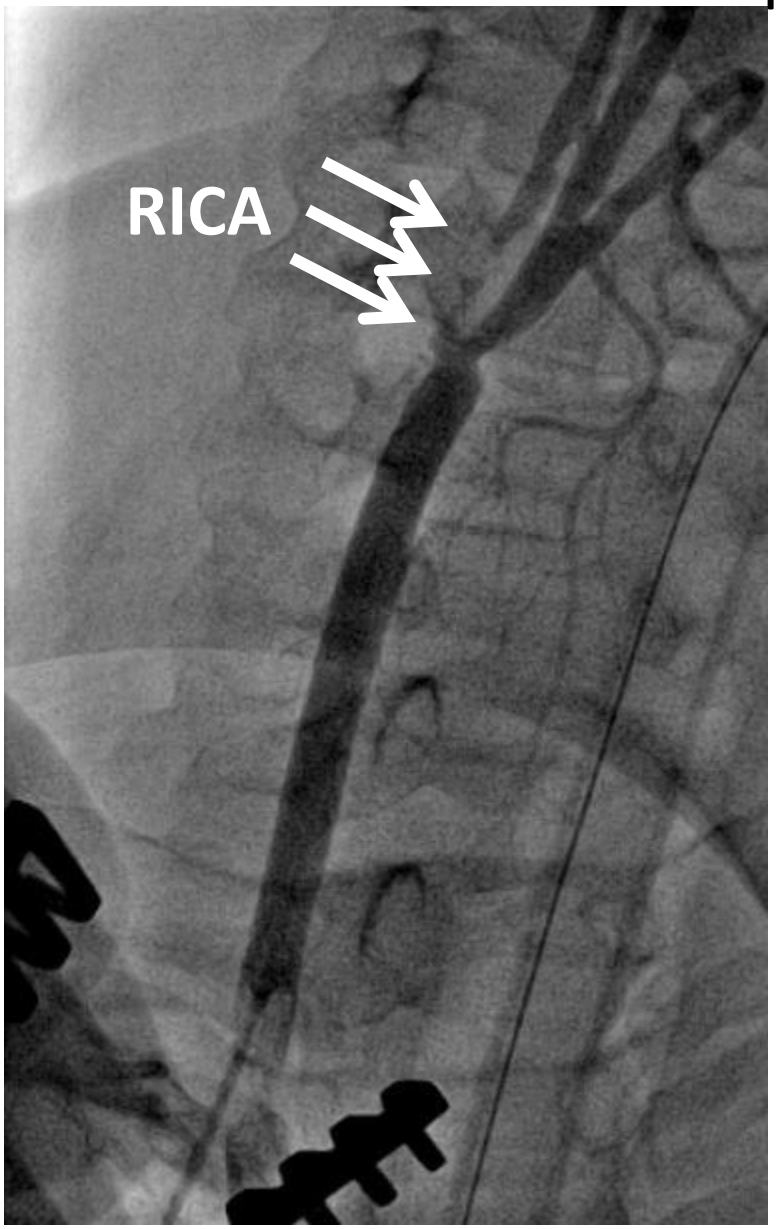
CGuard **7.0x30mm** **full endovascular reconstruction**

direct carotid access CAS under
En Route (SilkRoad Medical) Flow Reversal

P Musialek @ ePCR 2018

WE, woman, 58 y, **R** haemispheric minor stroke x 2

TCAR plus **CGuard**



WE, woman, 58 y, **R** haemispheric minor stroke x 2

TCAR plus **CGuard**

En Route (SilkRoad Medical) Dynamic Flow Reversal

WE, woman, 58 y, **R** haemispheric minor stroke x 2

TCAR plus **CGuard**

lesion crossing, predil, CGuard stent implantation and postdil under En Route (SilkRoad Medical) Flow Reversal

WE, woman, 58 y, **R** haemispheric minor stroke x 2

TCAR plus **CGuard**

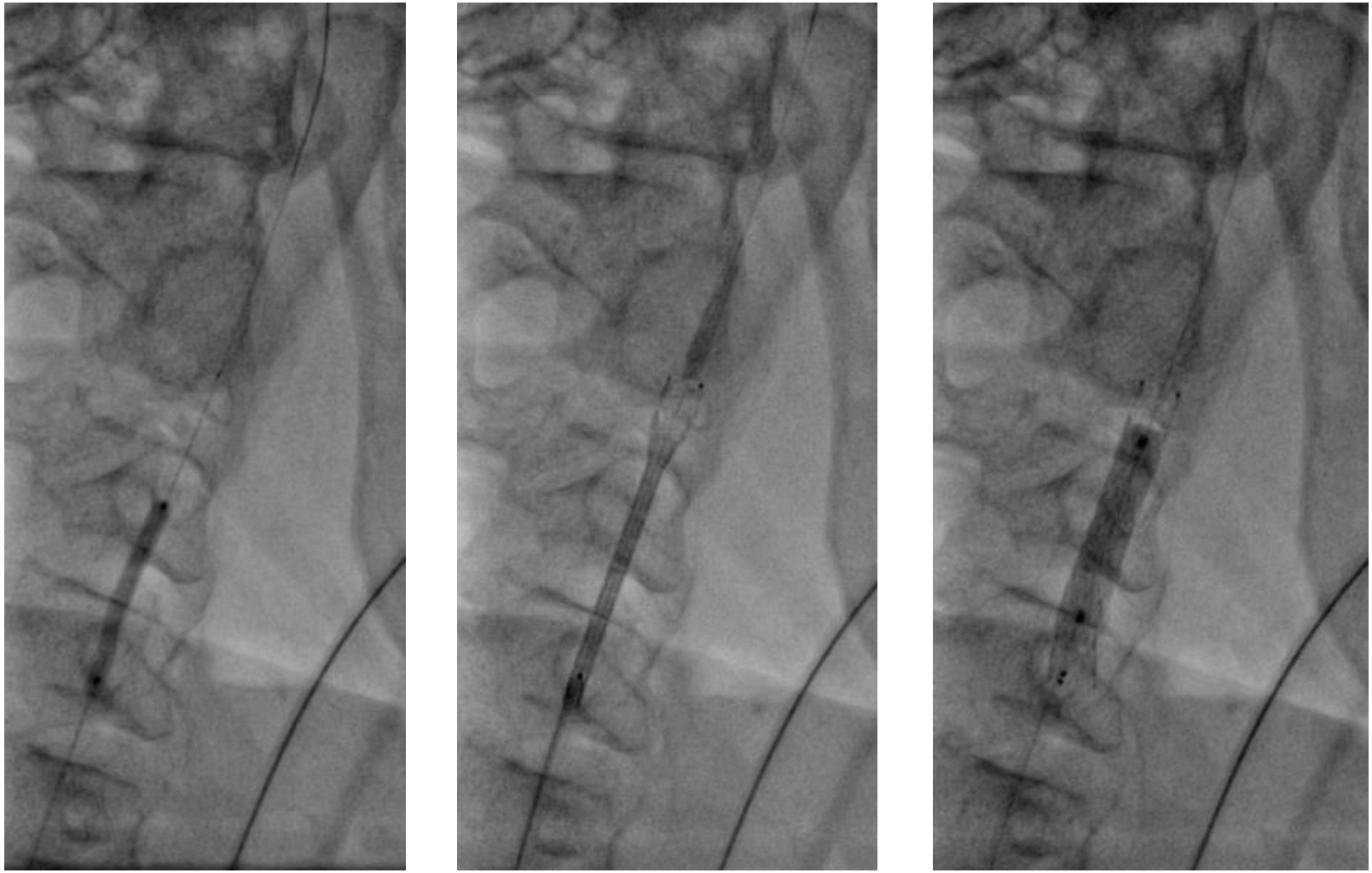
Debris captured in the A-V shunt filter

in this procedure

lesion crossing, predil, CGuard stent implantation and postdil under En Route (SilkRoad Medical) Flow Reversal

WE, woman, 58 y, **R** haemispheric minor stroke x 2

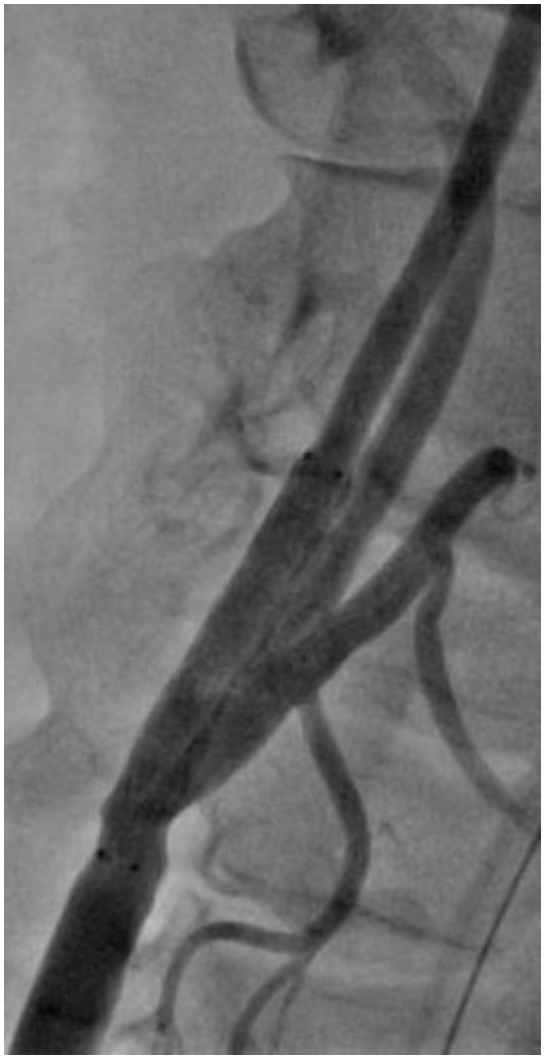
TCAR plus **CGuard**



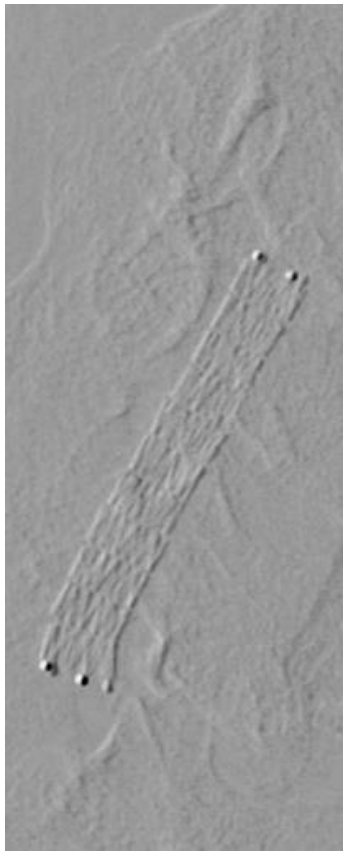
lesion crossing, predil, CGuard stent implantation and postdil under En Route (SilkRoad Medical) Flow Reversal

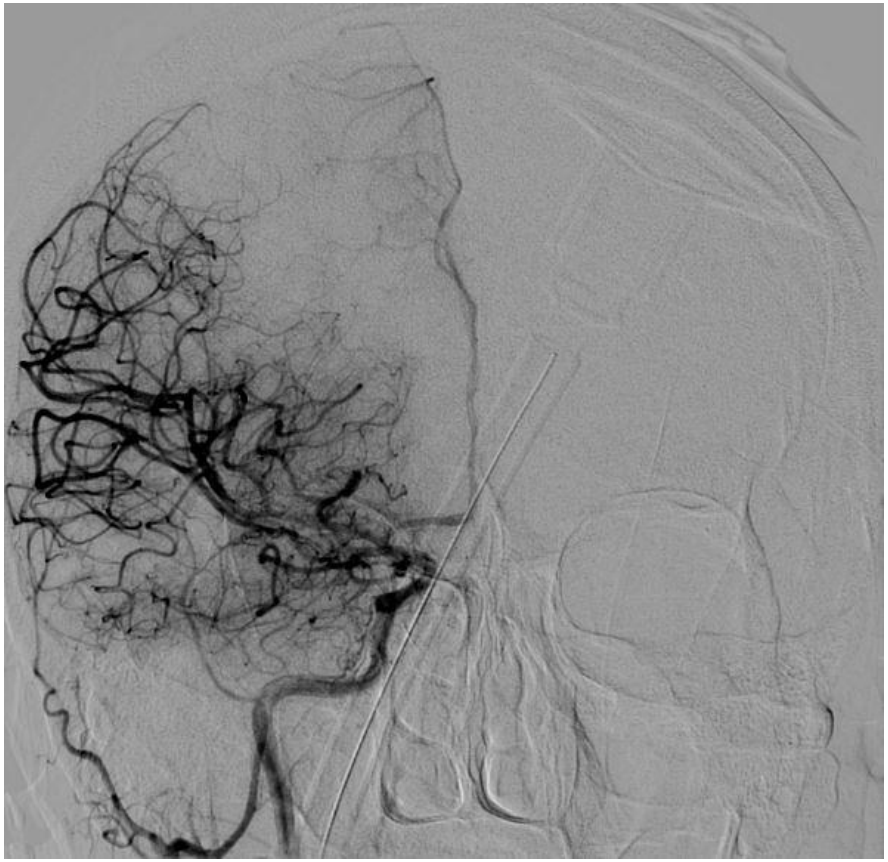
WE, woman, 58 y, **R** haemispheric minor stroke x 2

TCAR plus **CGuard**



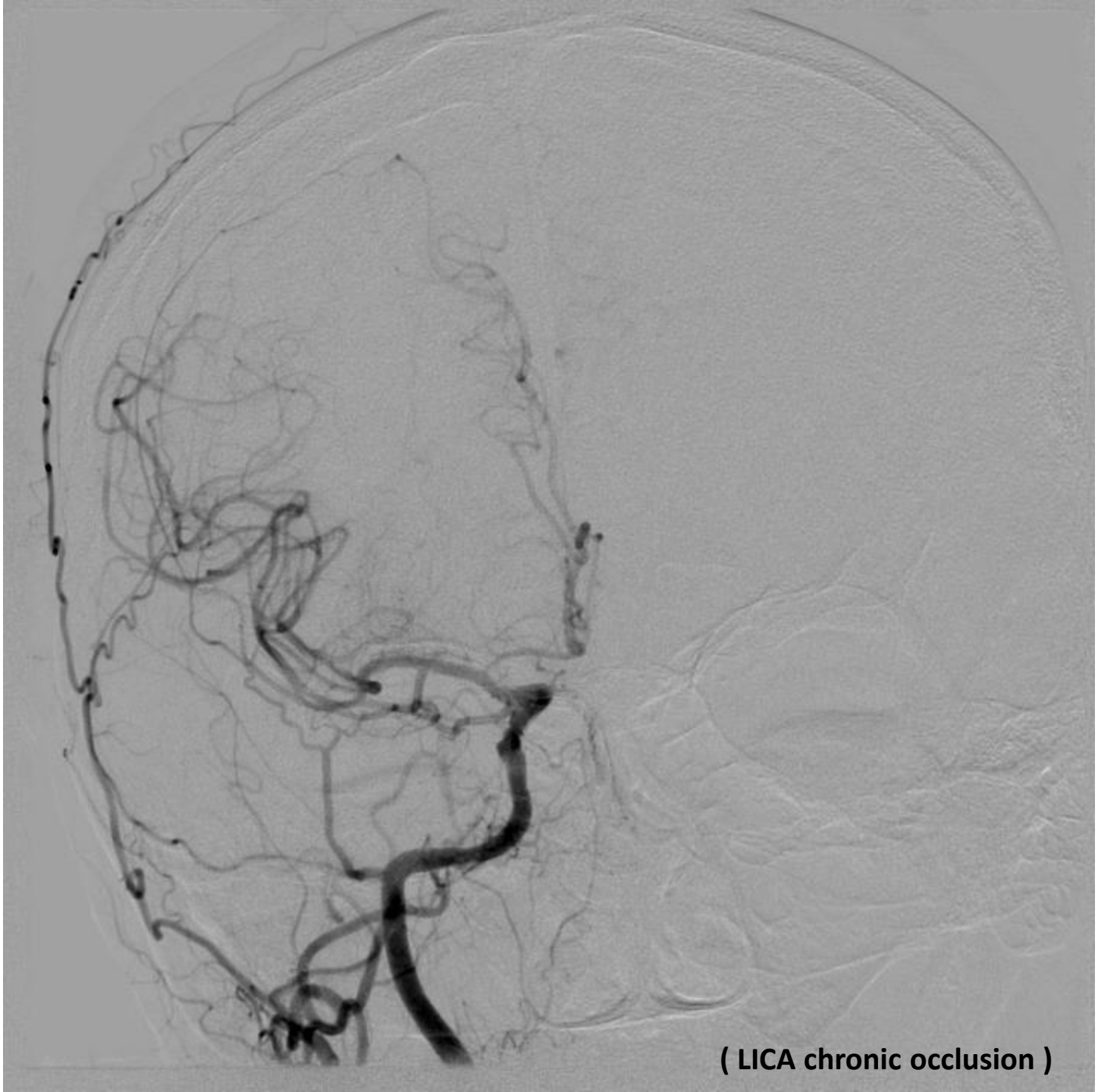
Final Result



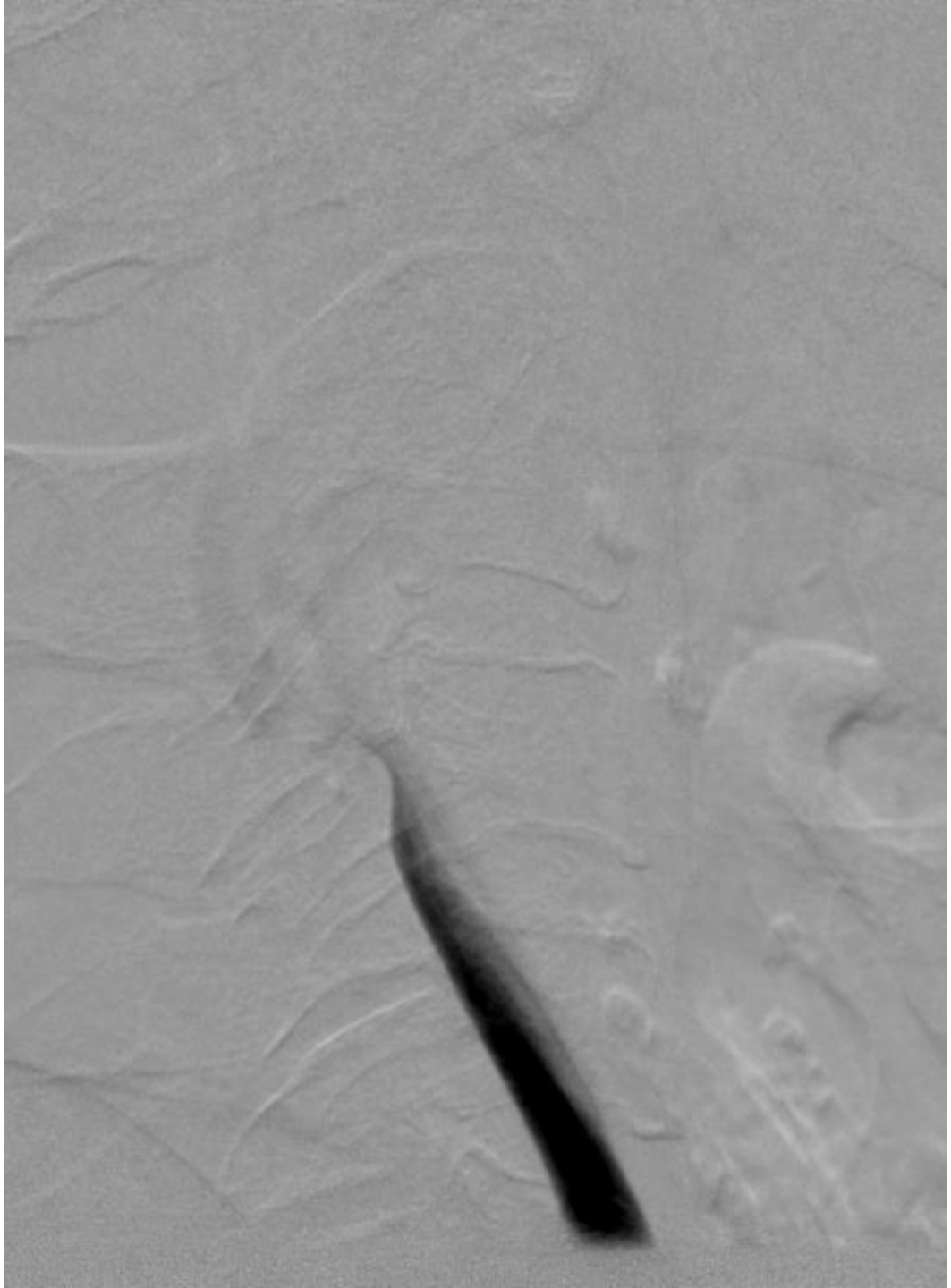


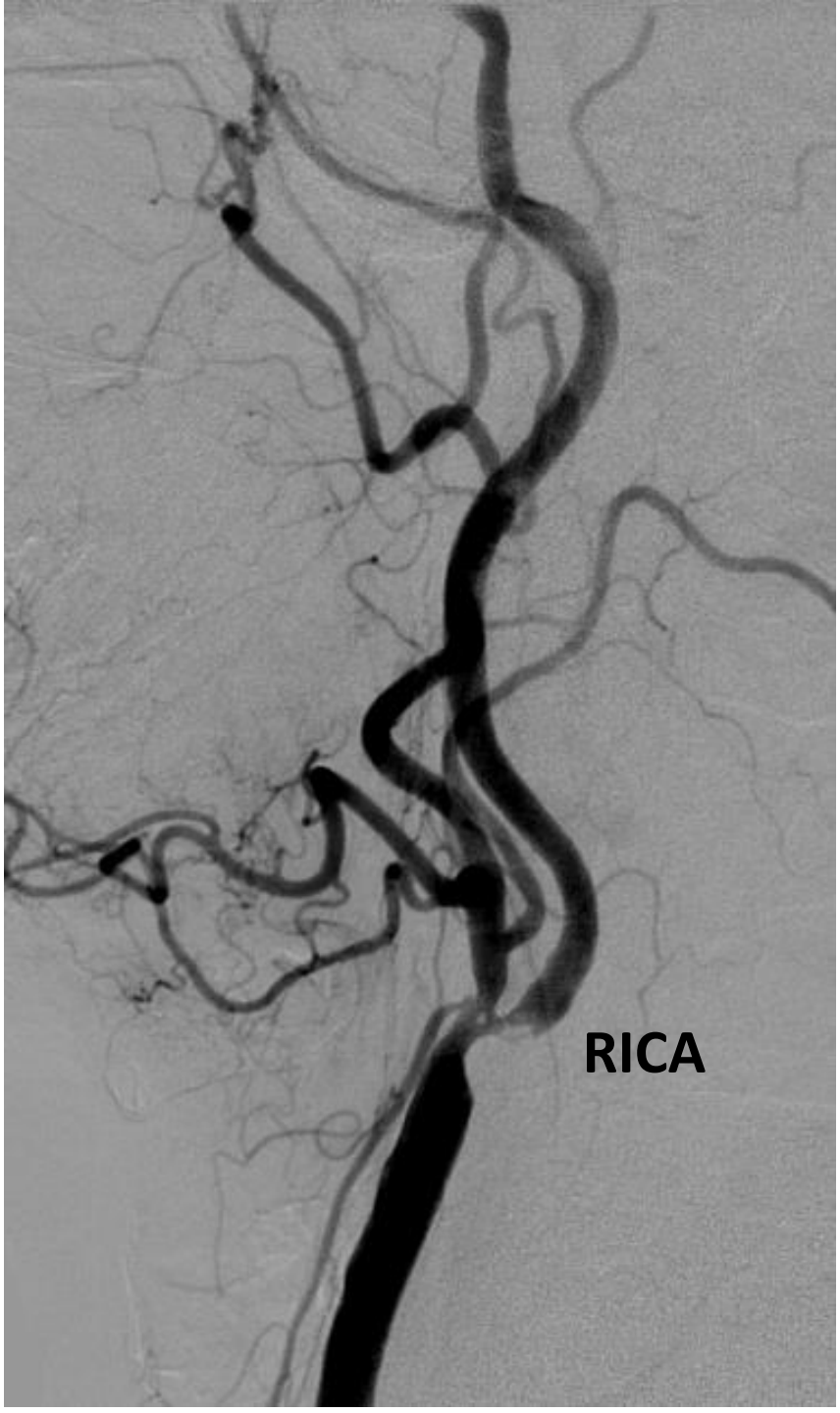
CGuard 7.0x30 mm **full endovascular reconstruction**

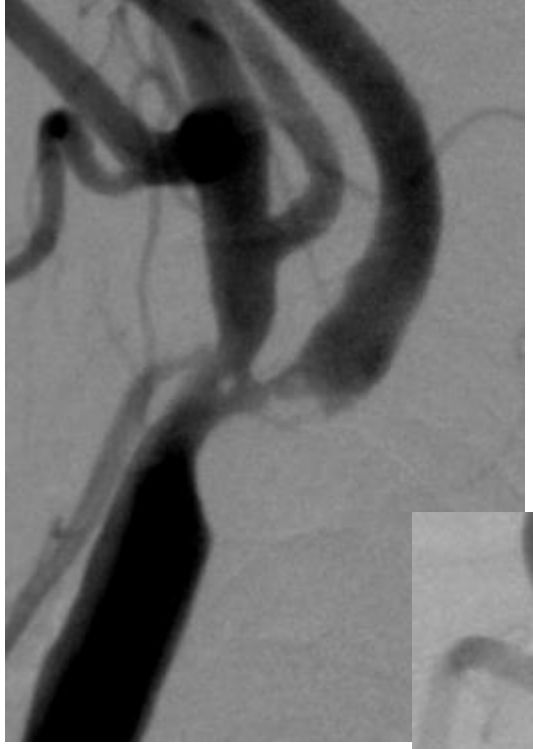
plus NO new lesions on DW-MRI !

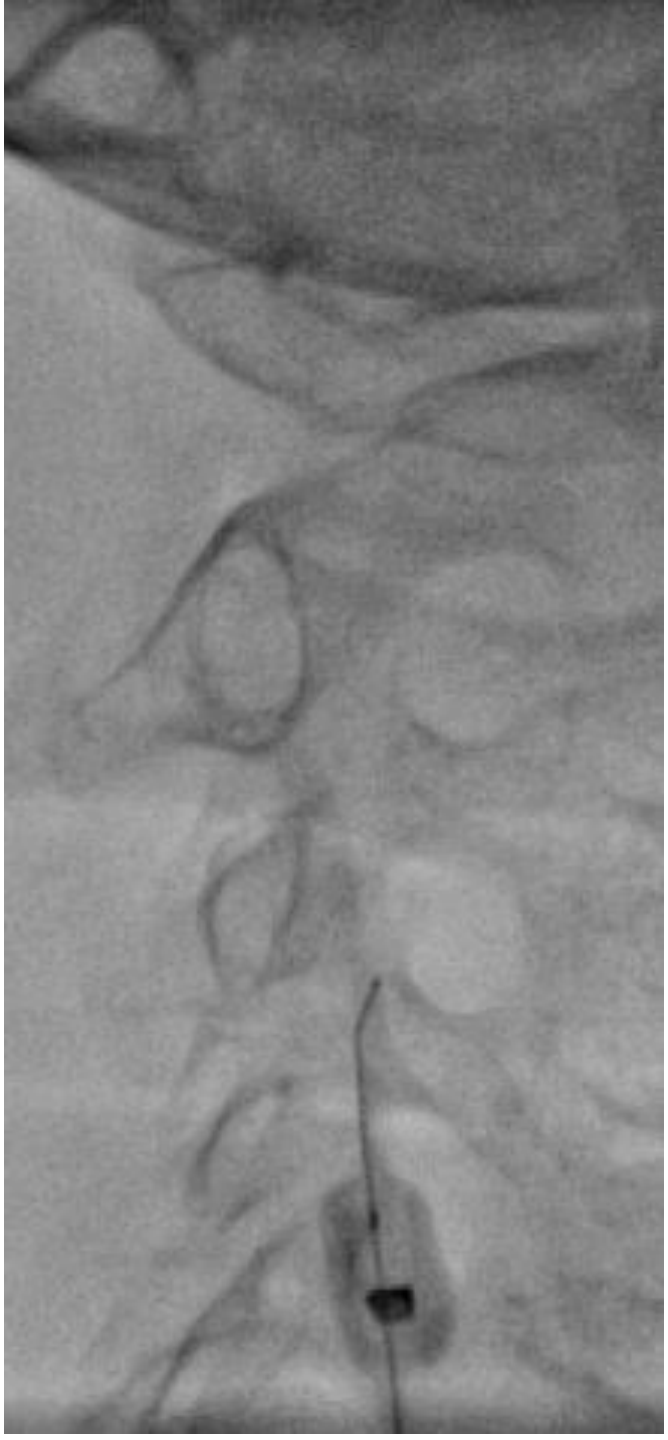


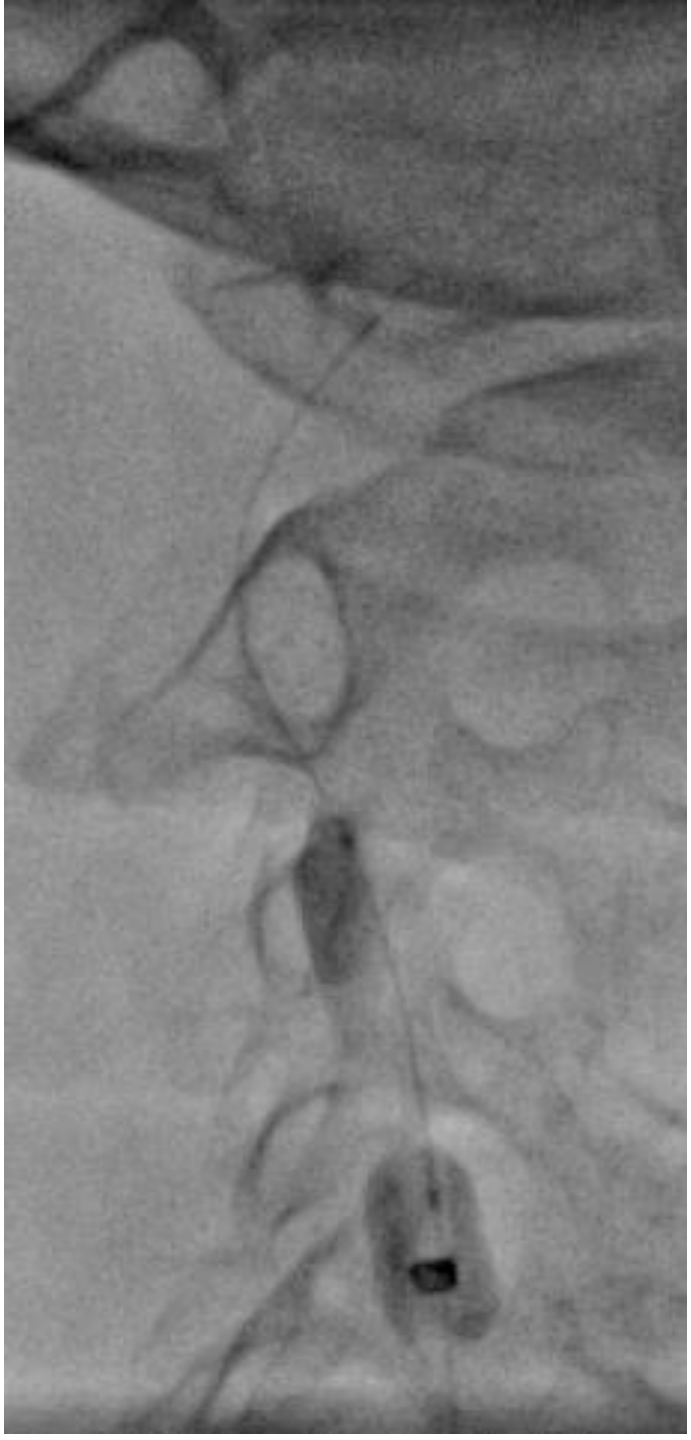
(LICA chronic occlusion)

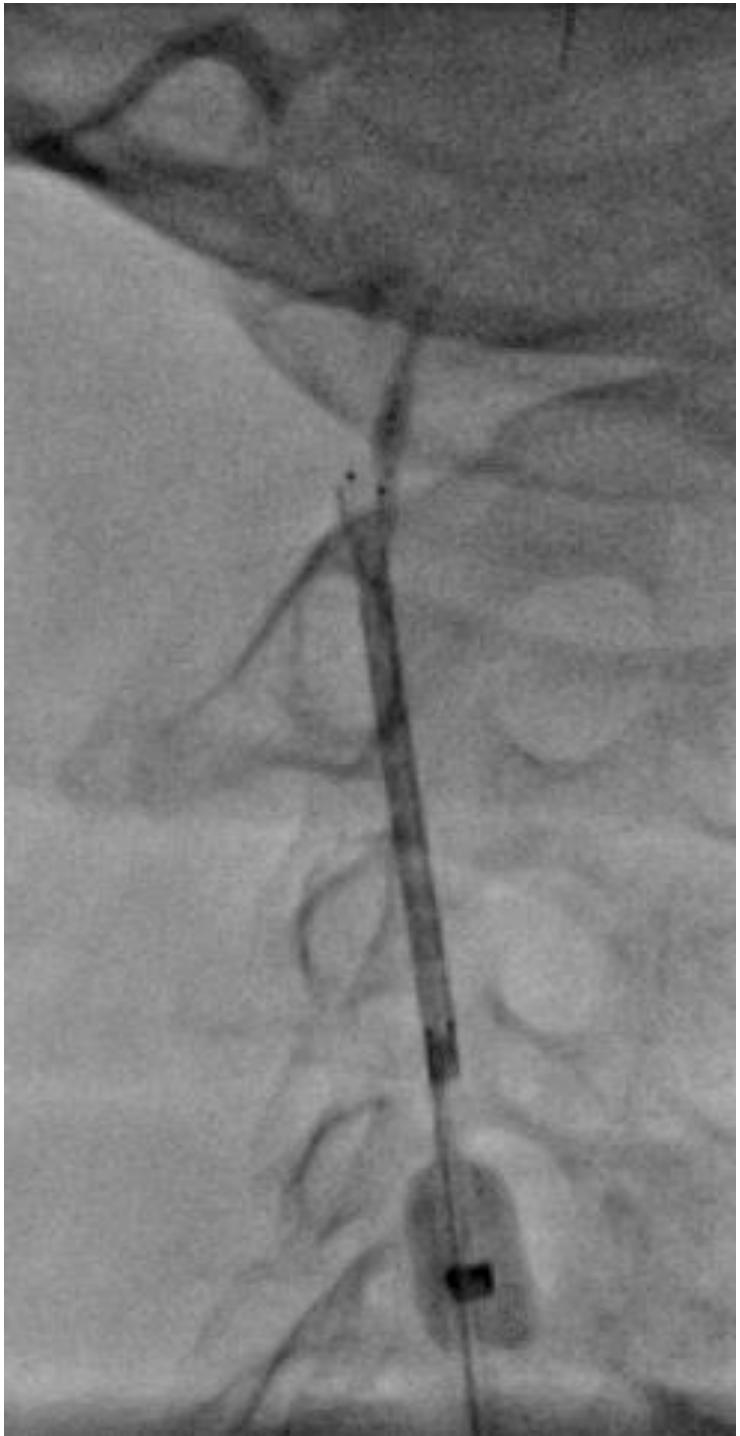



RICA



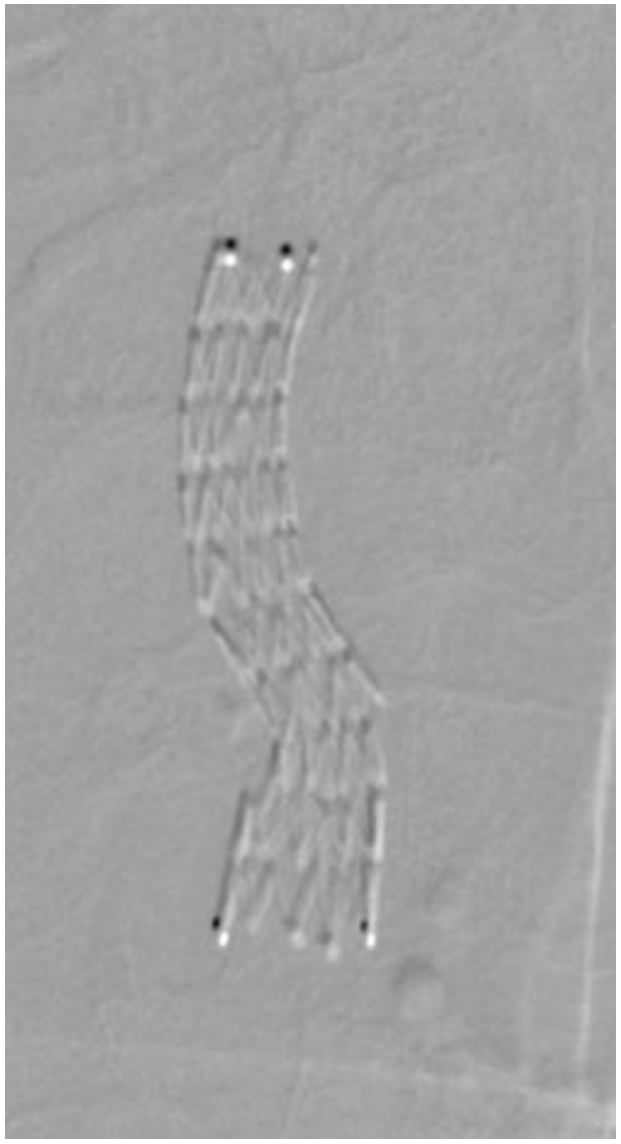


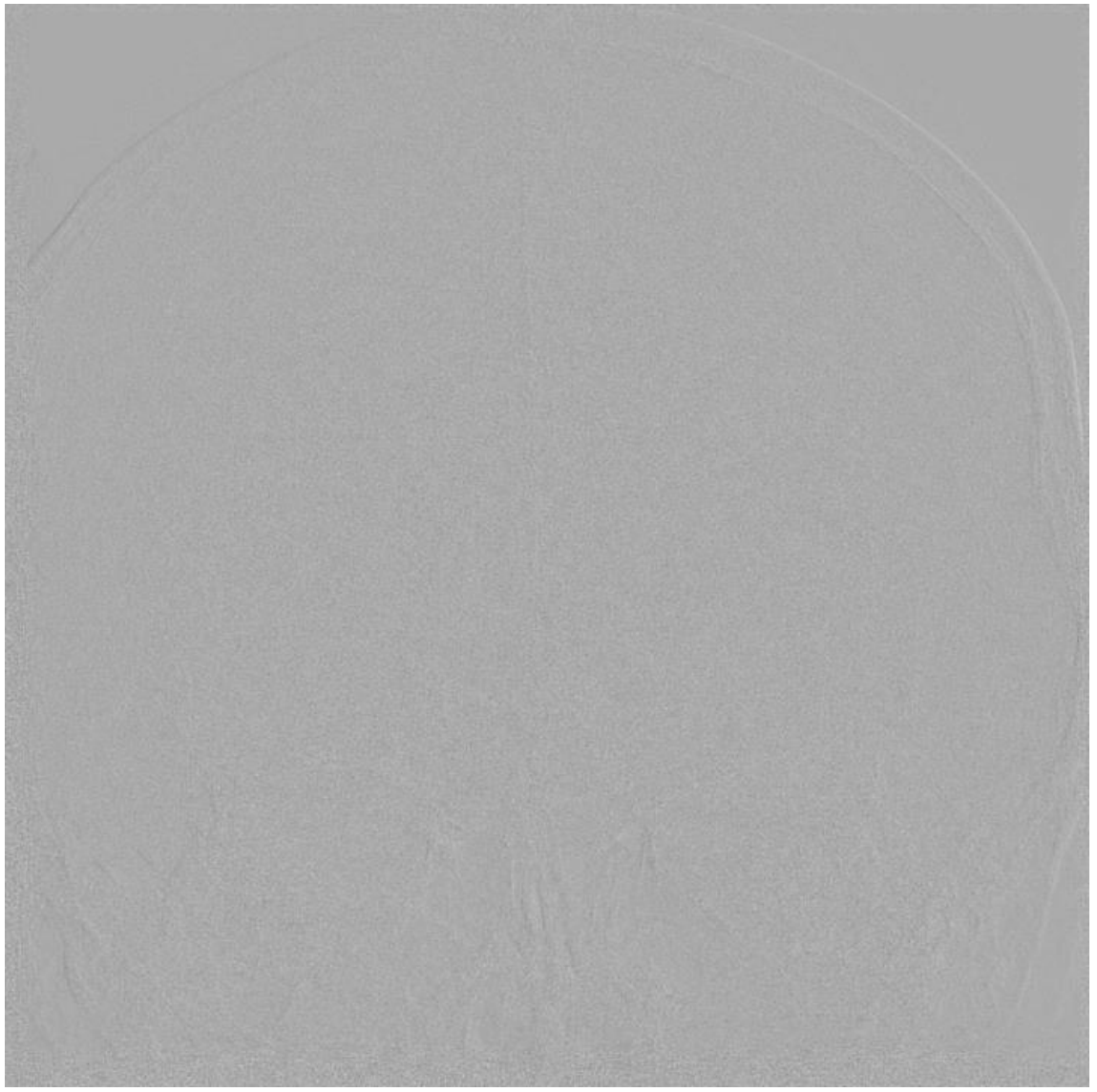




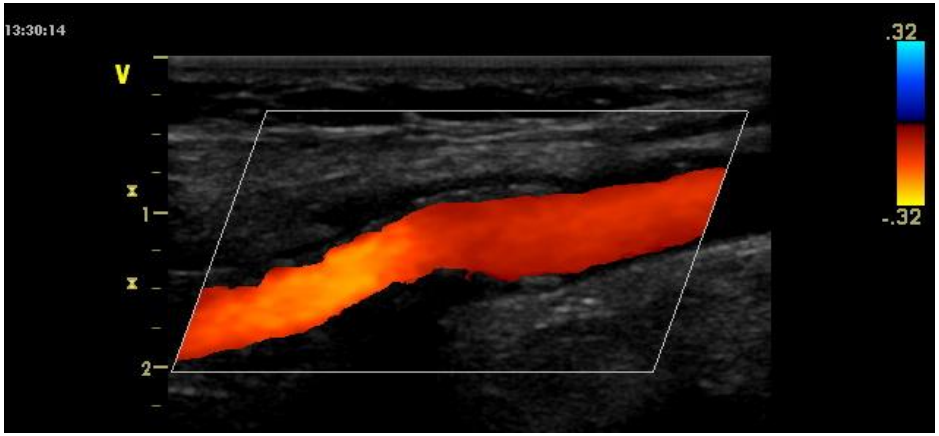
Flow reversal time 7min 10sec
Intolerance in the last 80sec
(active aspiration still !! performed)

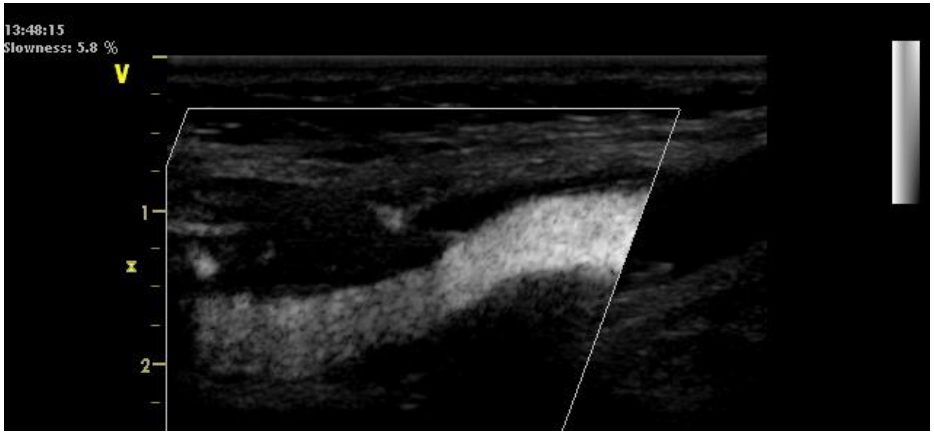
Final Result



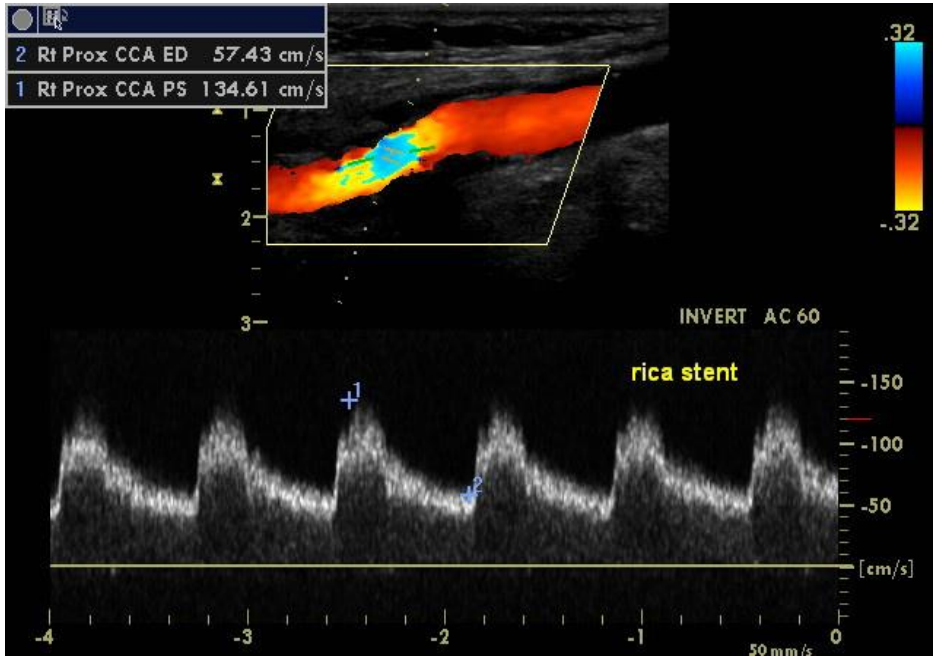


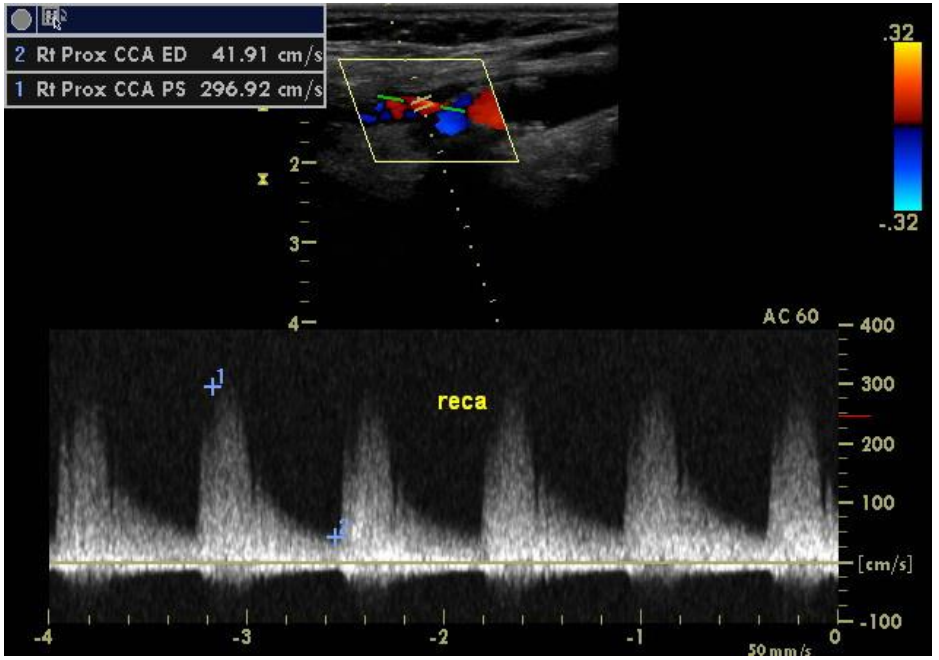
November 13, 2017 – patient A/S, discharged home





Normal stent image





Normal velocities

ECA patent

WILEY

Double layered stents for carotid angioplasty: A meta-analysis of available clinical data

Anna Sannino, MD[1,2*] | Giuseppe Giugliano, MD, PhD[1,2*] | Evelina Toscano, MD[1,2] | Gabriele G. Schiattarella, MD[1,2] | Anna Franzone, MD, PhD[1,2] | Tullio Tesorio, MD[3] | Bruno Trimarco, MD[1,2] | Giovanni Esposito, MD, PhD[1,2] | Eugenio Stabile, MD, PhD[1,2]

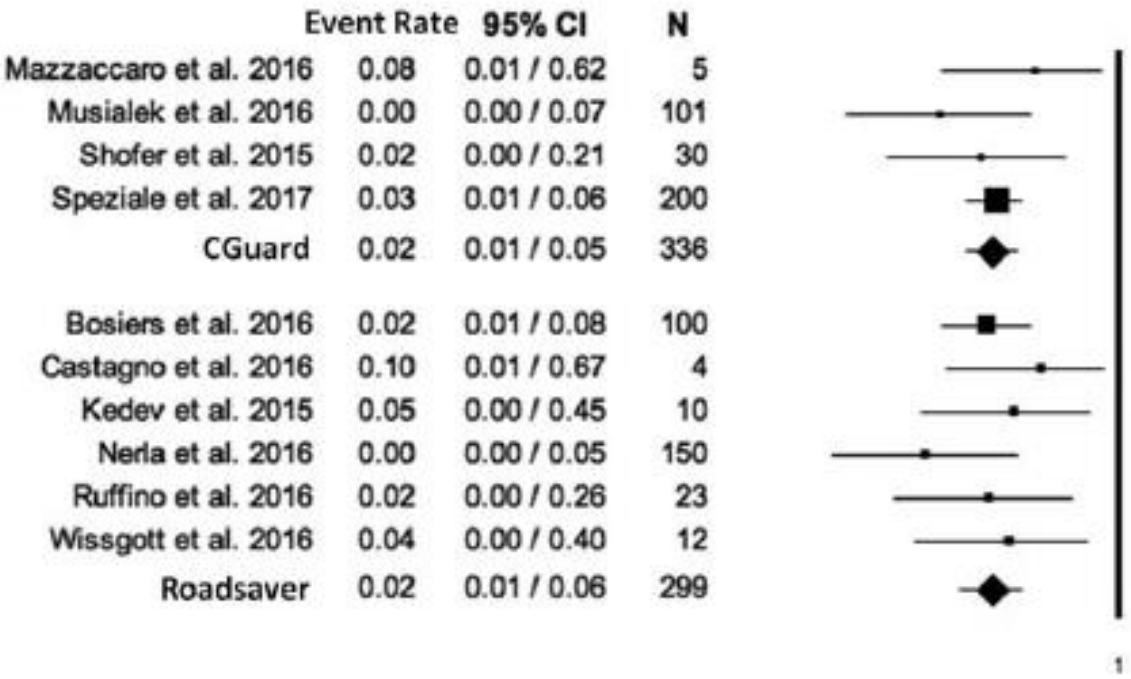


FIGURE 2 30-day mortality and stroke rate. Random effects event rate and 95% confidence interval for 30-day mortality and stroke (A) and relative subgroup analysis (B)

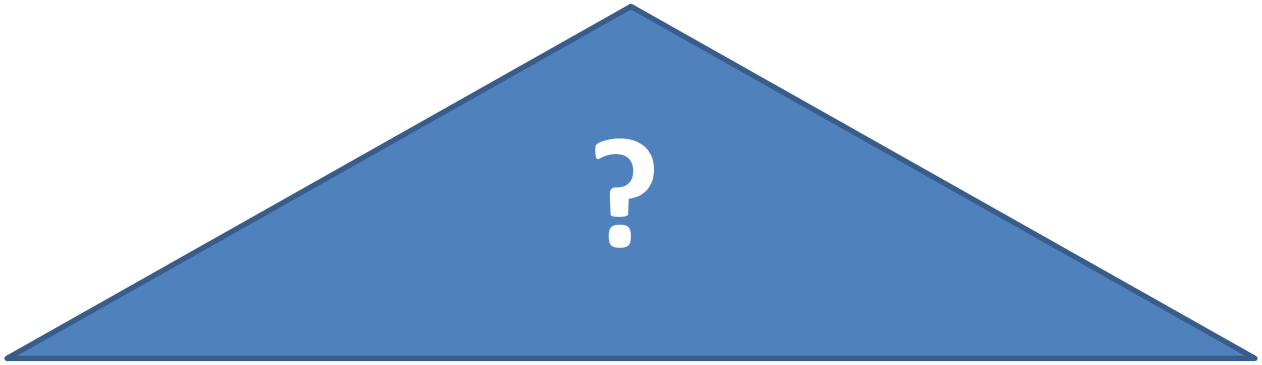
CAS Trends – 2018

”Asymptomatic” carotid artery stenosis

(evaluate stroke risk & SIGNS of ischaemia)

PHARMACOTHERAPY
+ INERVENTIION

ISOLATED
PHARMACOTHERAPY



CAS Trends – 2018

”Asymptomatic” carotid artery stenosis

PHARMACOTHERAPY
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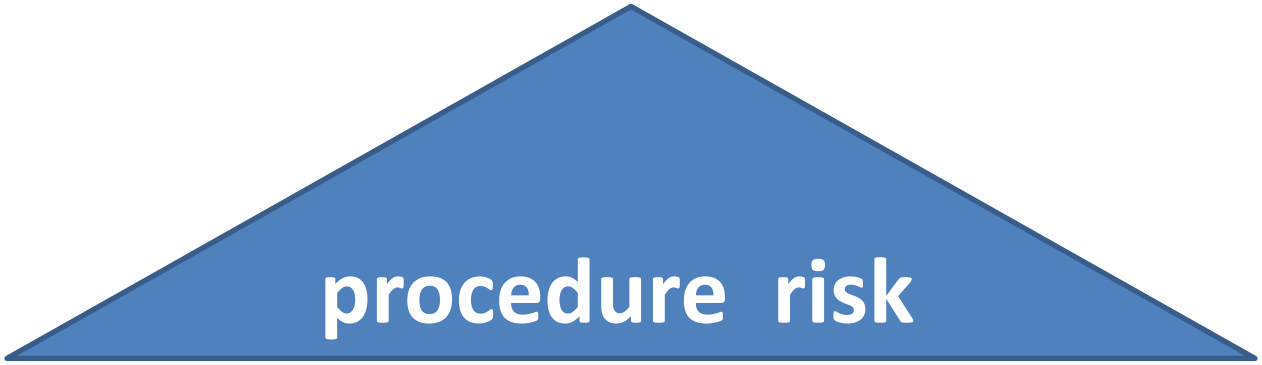
ISOLATED
PHARMACOTHERAPY

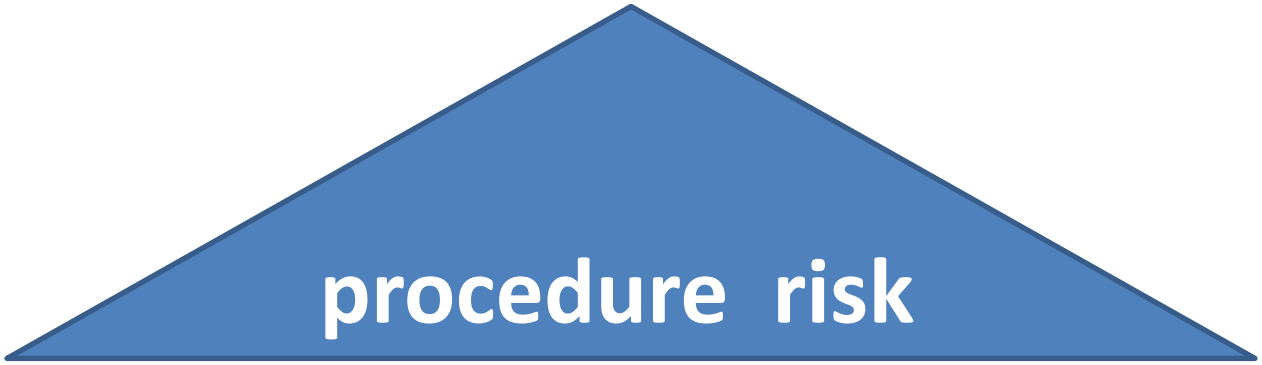


CAS Trends – 2018

”Asymptomatic” carotid artery stenosis

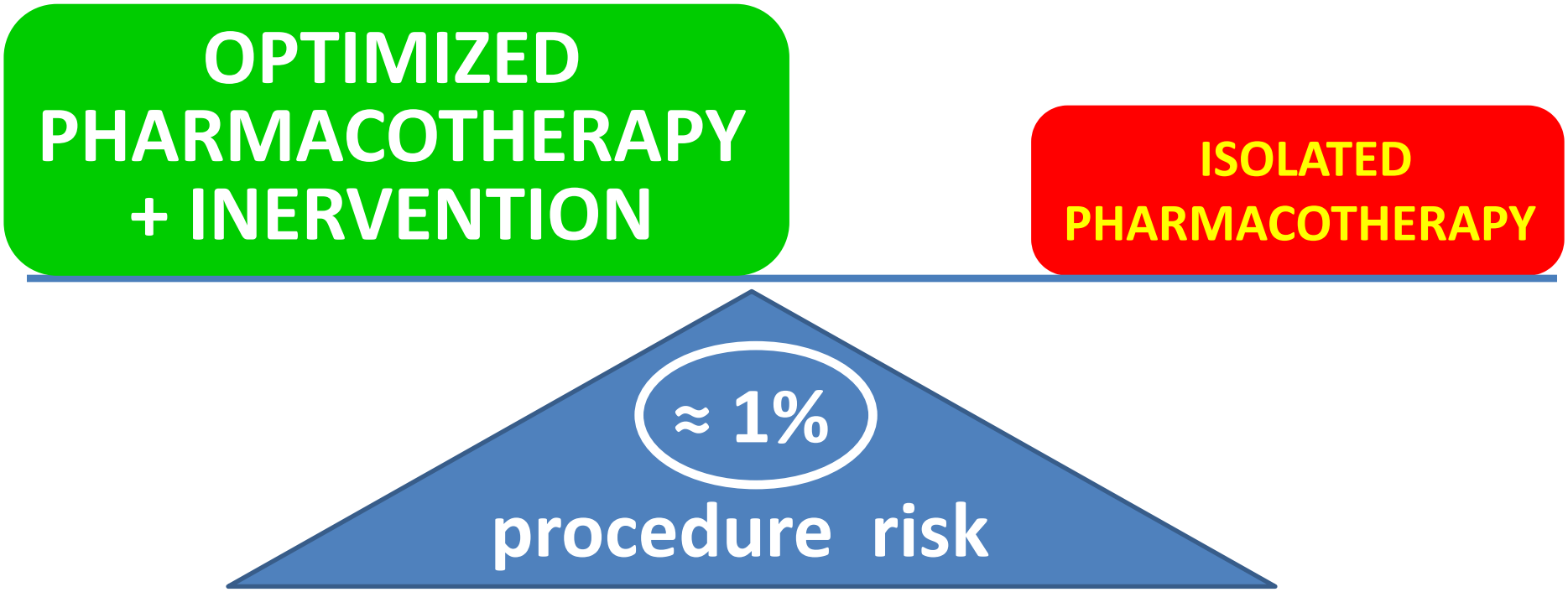
PHARMACOTHERAPY
+ INERVENTIION

ISOLATED
PHARMACOTHERAPY



CAS Trends – 2018

”Asymptomatic” carotid artery stenosis



CAS Trends – 2018

- Double-layered stents ⇈
- Stenting replaces CEAs
- Minimal invasiveness incl. TransRadial ↗

CAS Trends – 2018

- **Double-layered stents** ⇑⇑

  eg. CGuard growth by > **130%** (Q1 2017/Q1 2018)

- **Stenting replaces CEAs!**

  eg. TCAR growth (coming predominantly from CEA) by > **350%** (2016/2017)
  CMS (US) reimbursememt, both in symptomatics and HR asymptomatics
  already > 500 patients in ROADSTER-2 + Vascular Quality Initiative

- **Minimal invasiveness incl. TransRadial** ↗

One swallow does not a summer make but many swallows do: accumulating clinical evidence for nearly-eliminated peri-procedural and 30-day complications with mesh-covered stents transforms the carotid revascularisation field

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Abstract

Atherosclerotic carotid artery stenosis (CS) continues to be a common cause of acute ischaemic stroke. Optimised medical therapy (OMT), the first-line treatment modality in CS, may reduce or delay – but it does not abolish – CS-related strokes. As per current AHA/ASA and ESC/ESVS/ESO guidelines, carotid artery stenting (CAS) is a less-invasive alternative to carotid endarterectomy (CEA) for CS revascularisation in primary and secondary stroke prevention.

Ten-year follow-up from the CREST trial in patients with symptomatic and asymptomatic CS confirmed equipoise of CAS and CEA in the primary endpoint. Nevertheless CAS – using a widely open-cell, first-generation stent and first-generation (distal/filter) neuroprotection – has been criticised for its relative excess of (mostly minor) strokes by 30 days, a significant proportion of which were post-procedural.

Atherosclerotic plaque protrusion through conventional carotid stent struts, confirmed on intravascular imaging, has been implicated as a leading mechanism of the relative excess of strokes with CAS vs. CEA, including delayed strokes with CAS. Different designs of mesh-covered carotid stents have been developed to prevent plaque prolapse. Several multi-centre/multi-specialty clinical studies with CGurad MicroNet-Covered Embolic Prevention Stent System (EPS) and RoadSaver/Casper were recently published and included routine DW-MRI cerebral imaging peri-procedurally and at 30 days (CGuard EPS).

Data from more than 550 patients in mesh-covered carotid stent clinical studies to-date show an overall 30-day complication rate of ~1% with near-elimination of post-procedural events. While more (and long-term) evidence is still anticipated, these results – taken together with optimised intra-procedural neuroprotection in CAS (increased use of proximal systems including trans-carotid dynamic flow reversal) and the positive 12-month mesh-covered stent data reports in 2017 – are transforming the carotid revascularisation field today.

Establishing effective algorithms to identify the asymptomatic subjects at stroke risk despite OMT, and large-scale studies with mesh-covered stents including long-term clinical and duplex ultrasound outcomes, are the next major goals.

Key words: carotid artery stenting, mesh, stroke, endarterectomy, neuroprotection.

10:30 - 12:00 ■ Carotid angioplasty evolution for 2018

ROOM 343 Level 3

Chairperson: L.N. Hopkins

10:30 › Accumulating two-year clinical and duplex ultrasound evidence from the CGuard PARADIGM-Extend prospective academic trial: durability of stroke prevention
P. Musialek

10:38 › Discussion and audience interaction

10:43 › Predictors of the long-term antihypertensive effect of carotid artery stenting
F. Shukurov

10:51 › Discussion and audience interaction

10:56 › Total wrist access for carotid artery stenting
B. Zafirovska

11:04 › Discussion and audience interaction

11:09 › Synchronous vs. staged carotid artery stenting and open heart surgery ? a propensity score matched comparison
J. Martins

11:22 › What we learned after first 122 CAS procedures using dual-layer micromesh Roadsaver stents
P. Odrowaz-Pieniazek

11:30 › Discussion and audience interaction

11:35 › Novel angiographic algorithm to grade calcification severity of carotid stenosis: development and performance in the CGuard PARADIGM trial involving highly-calcific lesions management
A. Mazurek

11:43 › Discussion and audience interaction

11:48 › Results of hybrid repair multilevel lesions of the brachiocephalic arteries
M. Chernyavskiy

11:56 › Discussion and audience interaction

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