SIVEC 2019: New data in carotid disease

CGuard MicroNET-Covered Embolic Prevention Stent:

State of the Art

P. Musialek
on behalf of PARADIGM/PARADIGM-Extend Study Team

Jagiellonian University Dept. of Cardiac & Vascular Diseases
John Paul II Hospital, Kraków, Poland
& Collaborating Vascular Centres

Supported K/ZDS/007819 (Jagiellonian University Medical College)


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SIVEC /SIENA
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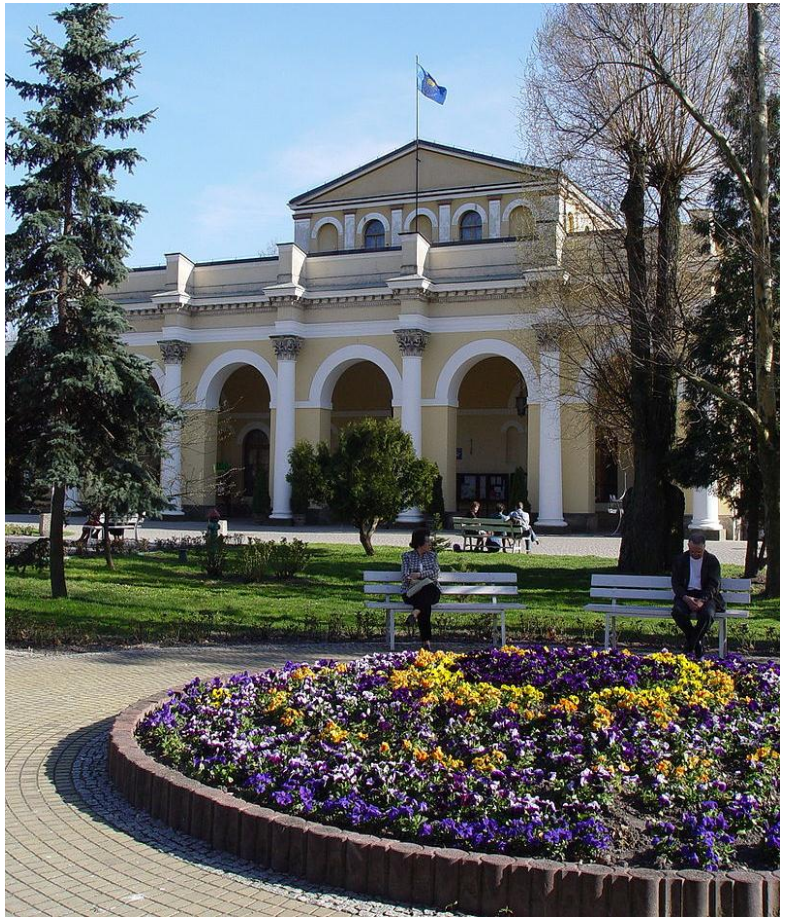
SEPTEMBER 2019

THE JOHN PAUL II HOSPITAL IN KRAKOW

Busko-Spa

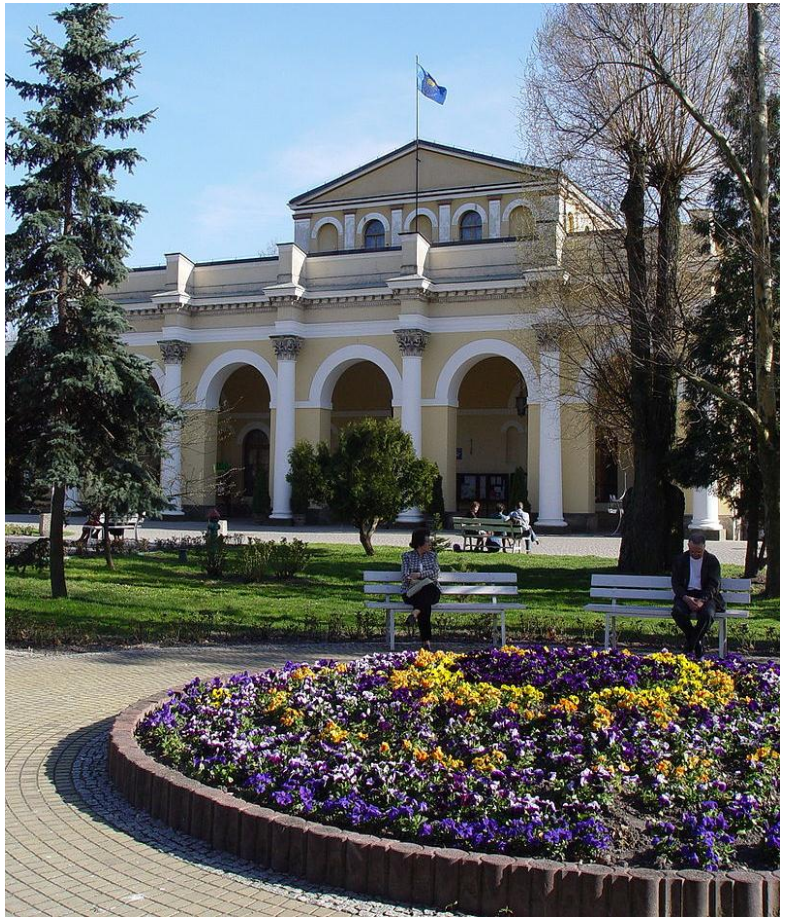
Enrico Marconi (1792 Roma

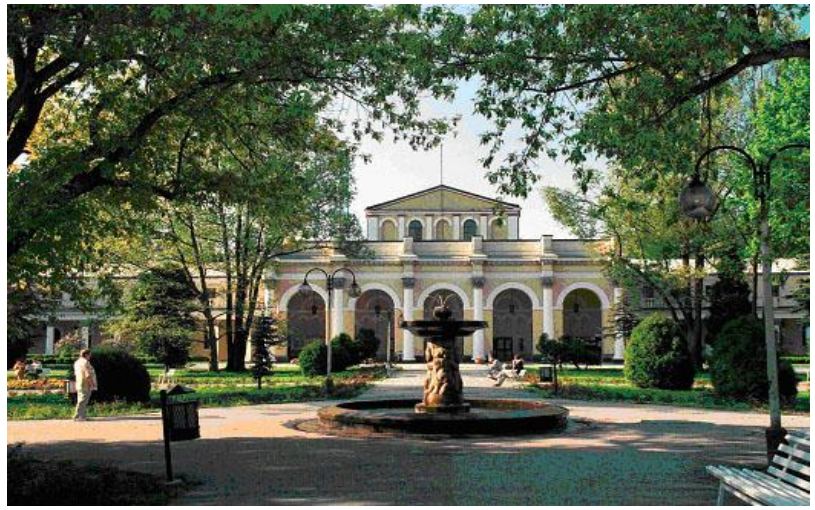
Busko-Spa

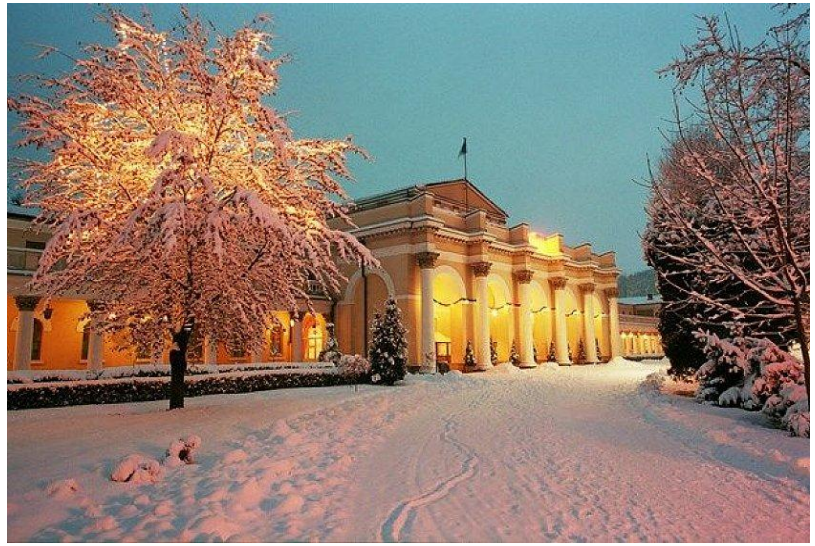


Enrico Marconi (1792 Roma –

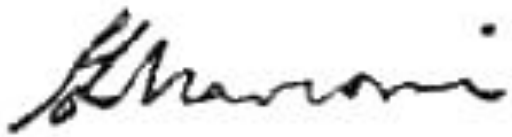
Busko-Spa







Enrico Marconi (1792 Roma – 1863 Varsovia)



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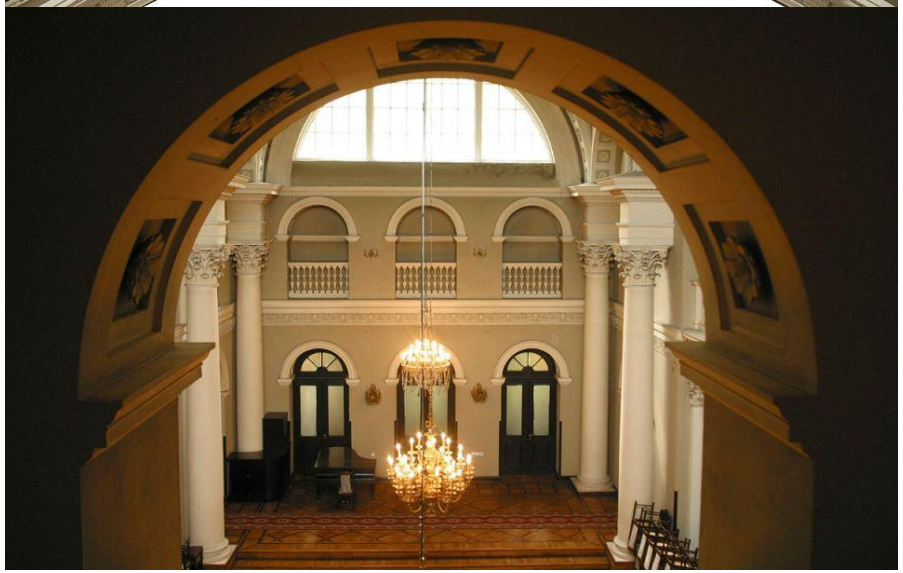

Palazo Pac, Varsovia

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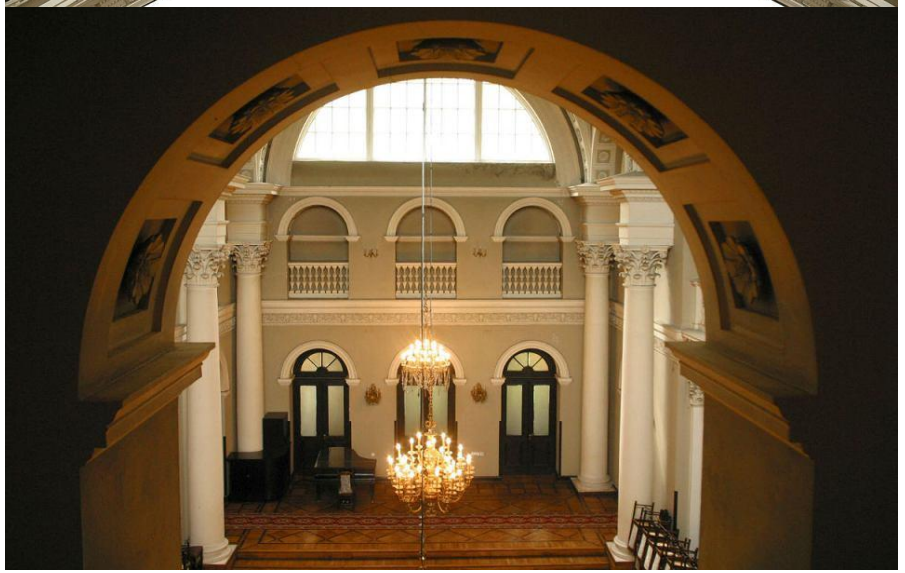
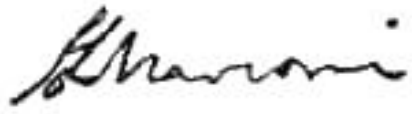
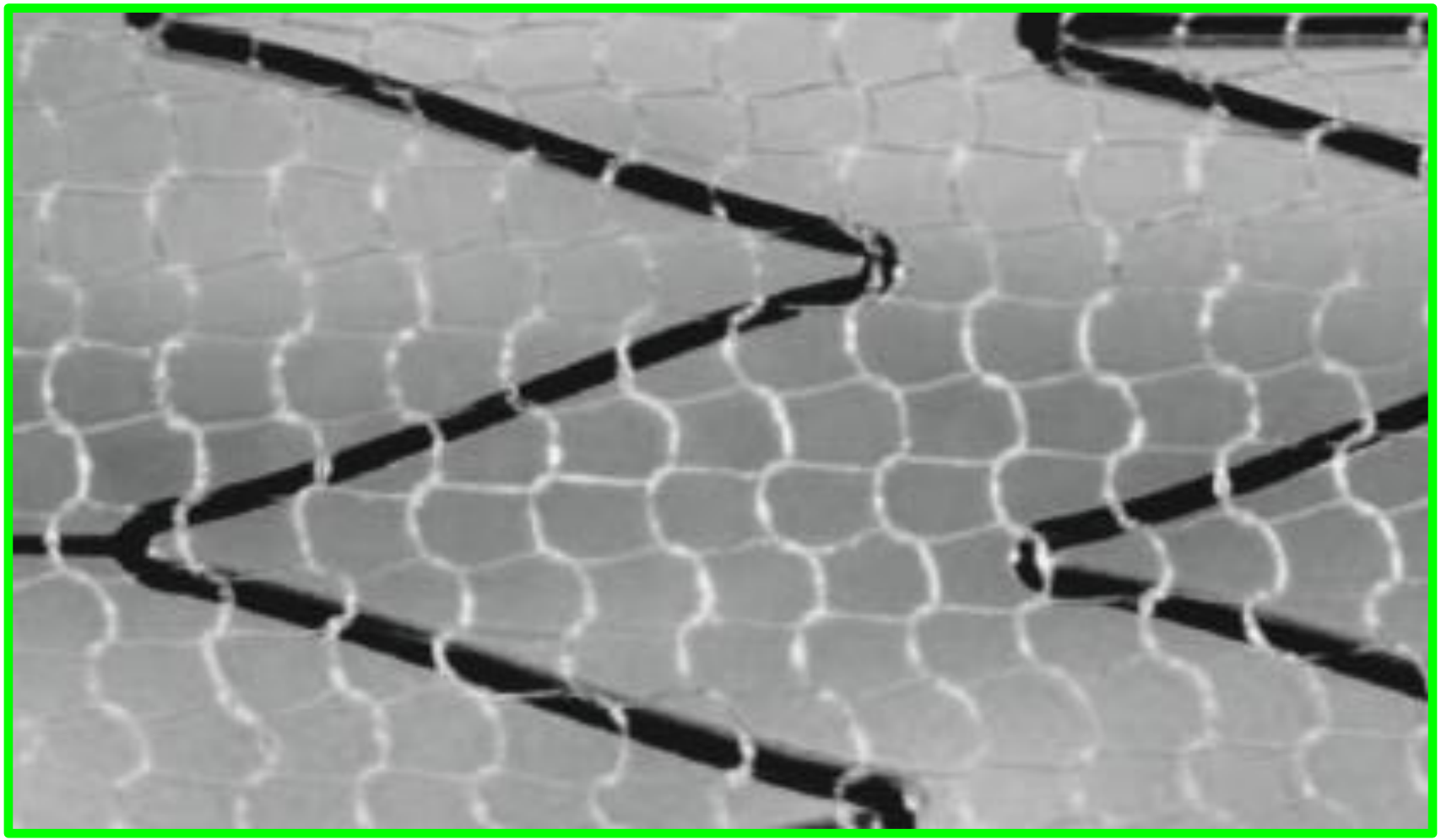


Palazo Pac, Varsovia – Ministry of Health

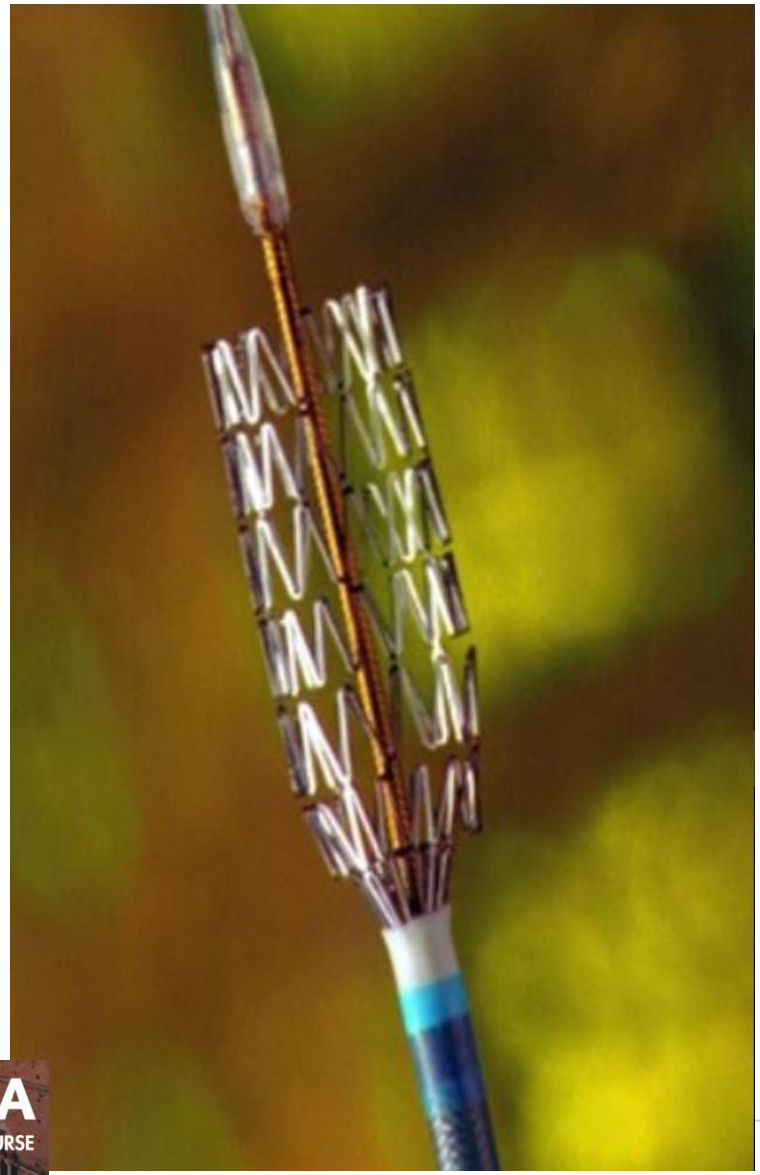


CGuard



Conventional Carotid Stents

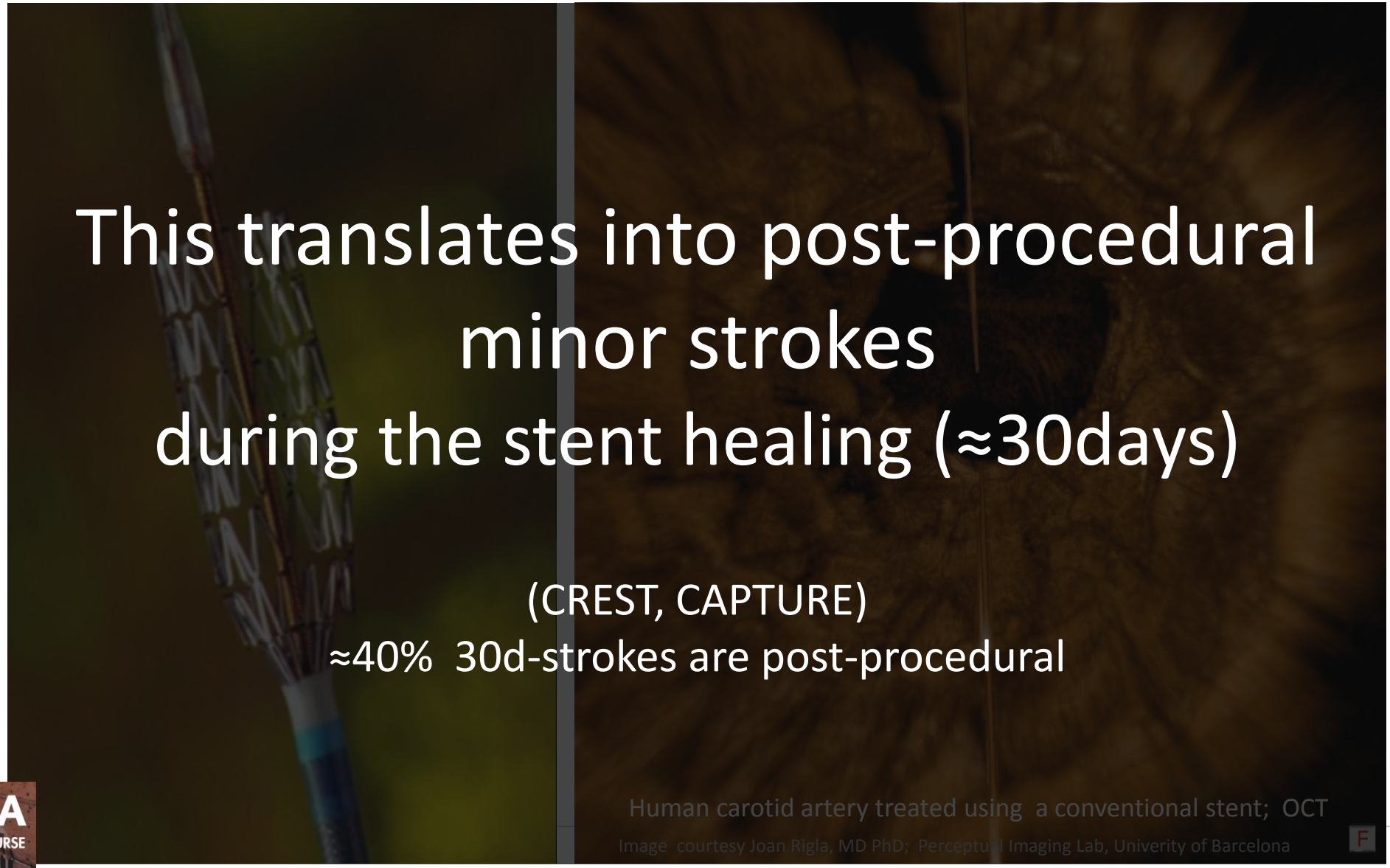
Do Have A Problem



Human carotid artery treated using a conventional stent; OCT

Image courtesy Joan Rigla, MD PhD; Perceptual Imaging Lab, Univerity of Barcelona

Conventional Carotid Stents
Do Have A Problem



This translates into post-procedural minor strokes during the stent healing (≈30days)

(CREST, CAPTURE)
≈40% 30d-strokes are post-procedural

Human carotid artery treated using a conventional stent; OCT

Image courtesy Joan Rigla, MD PhD; Perceptual Imaging Lab, Univerity of Barcelona

FUNDAMENTAL

- CEA, by excluding the plaque, excludes the post-procedural problem of the plaque

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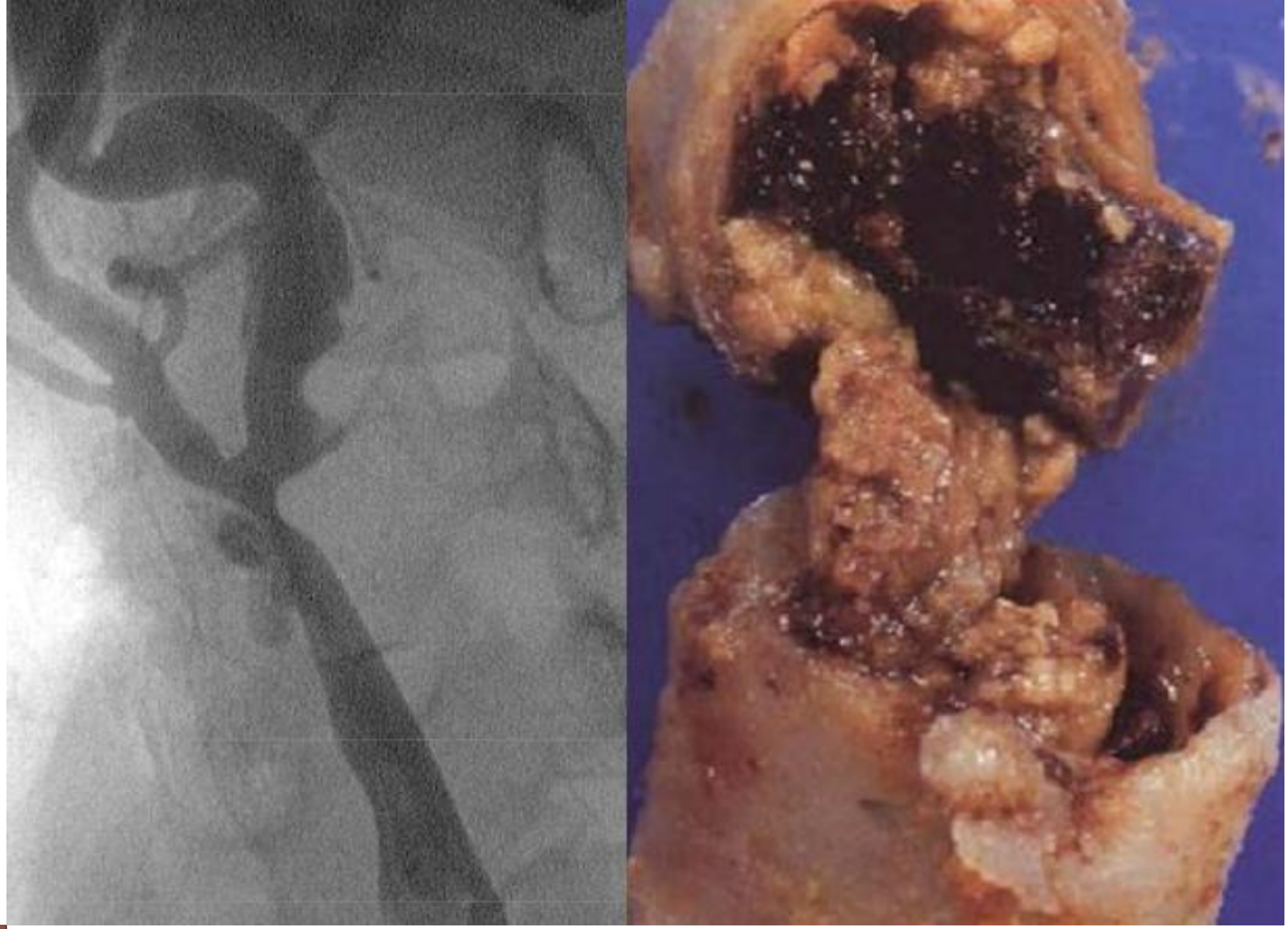
- In CAS, the stent needs to exclude the plaque too

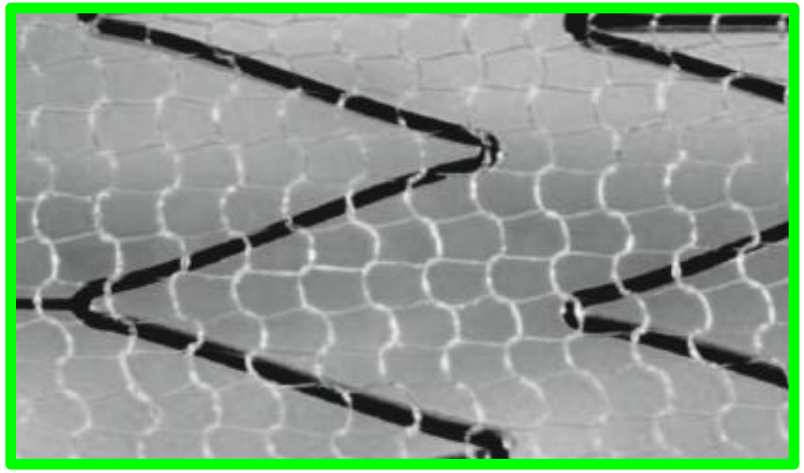


FUNDAMENTAL

- CEA, by excluding the plaque, excludes the post-procedural problem of the plaque

CAROTID PLAQUE SEQUESTRATION

- In CAS, the <u>stent needs to exclude the plaque too</u>

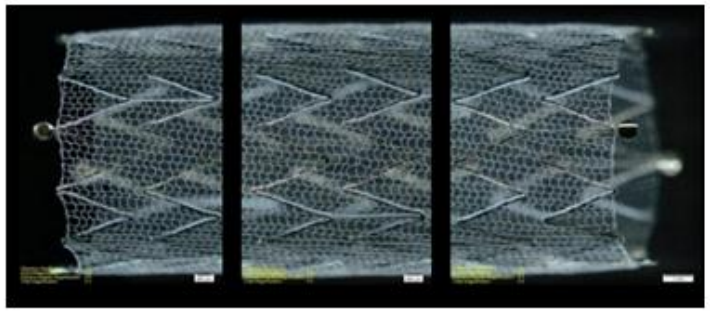


CGuard™– Carotid Embolic Prevention System

System specifications	
Stent type	Nitinol – self expanding
Micronet aperture size	150-180 µm
Guidewire	0.014”
Sizes - Diameter - Length	 6-10mm 20-60mm

CE Mark – March 2014

carotid-dedicated design

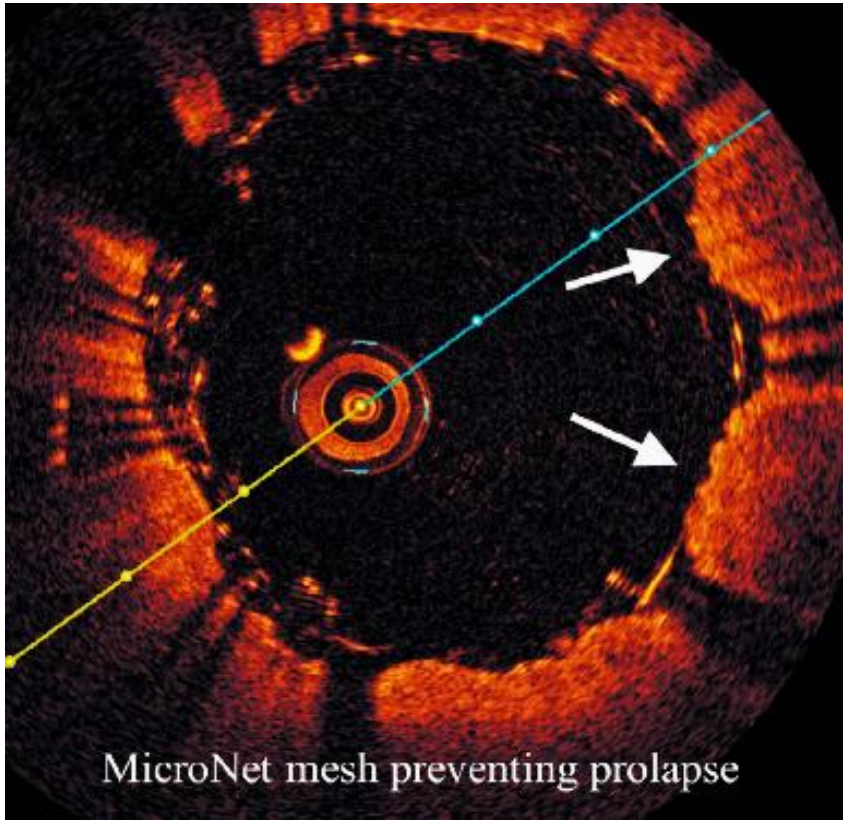


Nitinol frame open-cell area ≈ 21 mm^2

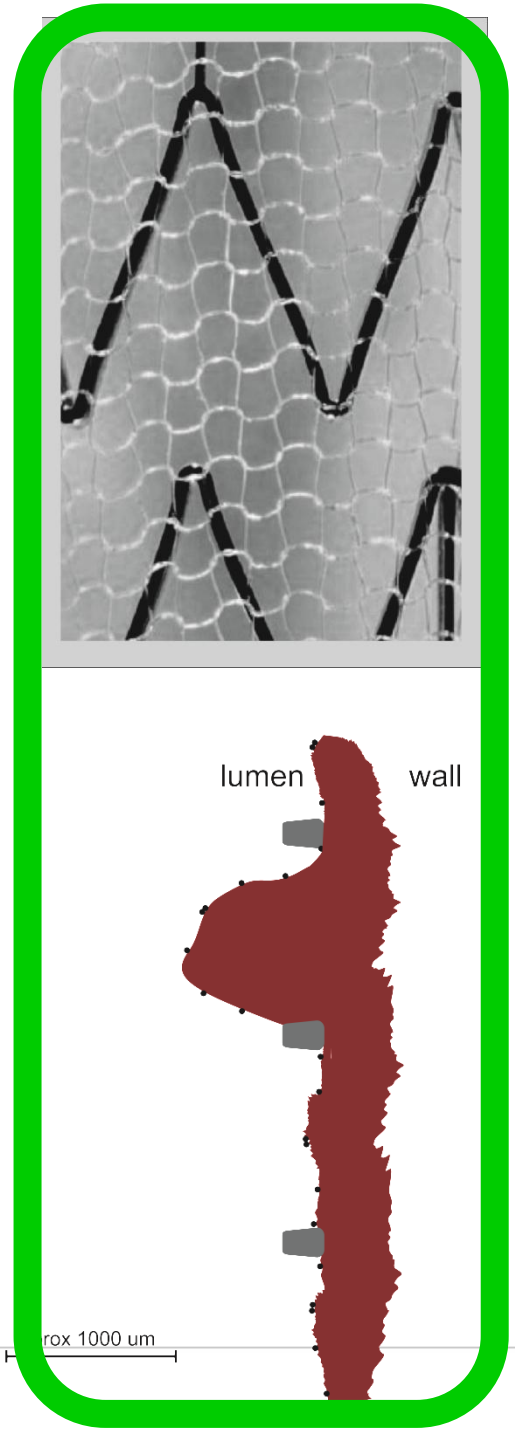
MicroNet closed-cell area ≈ 0.3mm^2

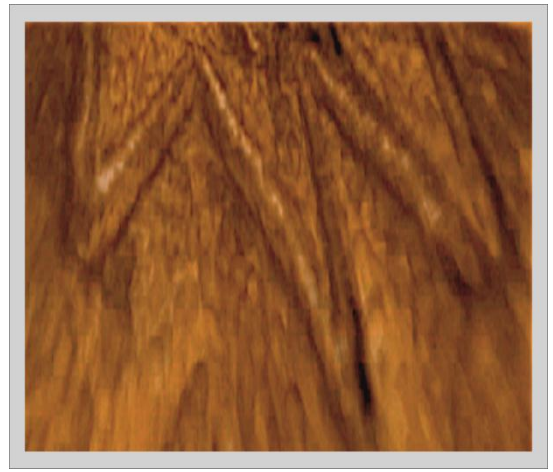
LARGEST √

SMALEST √

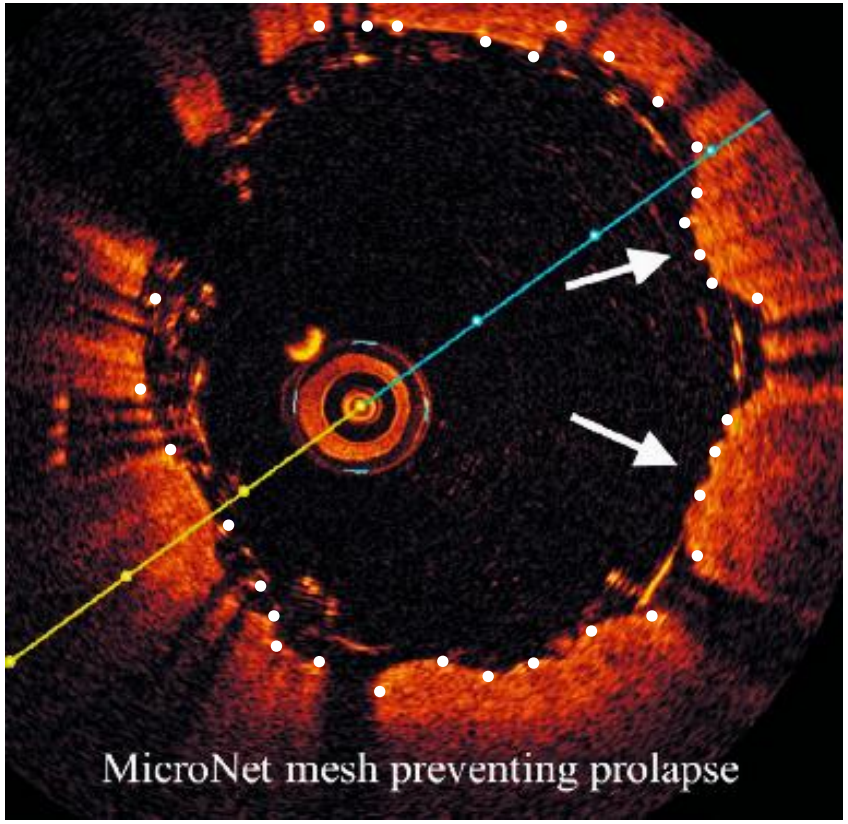


Tomyuki Umemoto et al.
EuroIntervention 2017





Musialek & Stabile
EuroIntervention 2017



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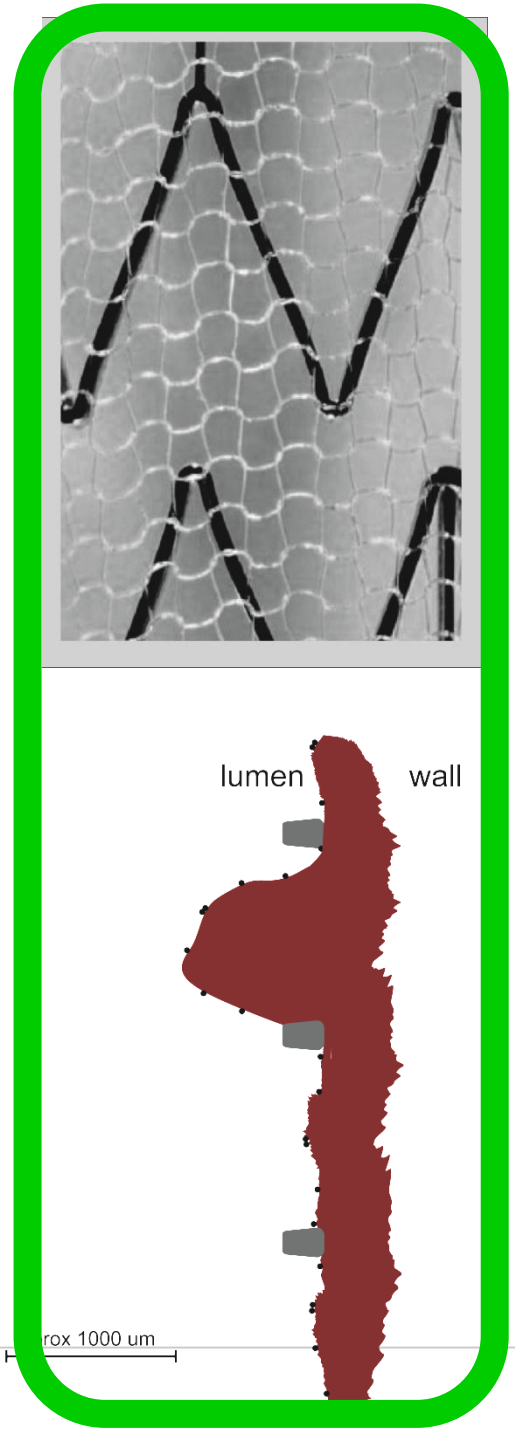

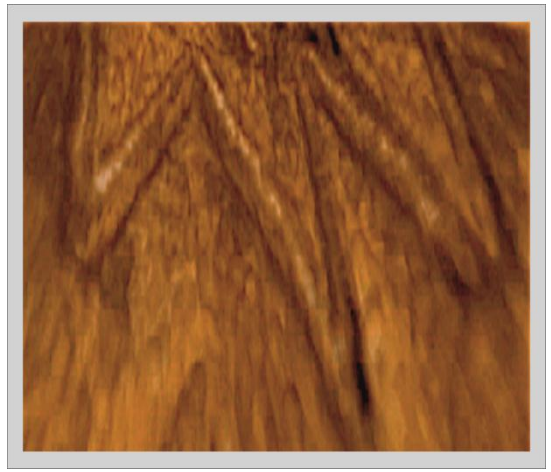

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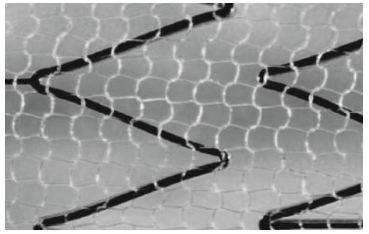
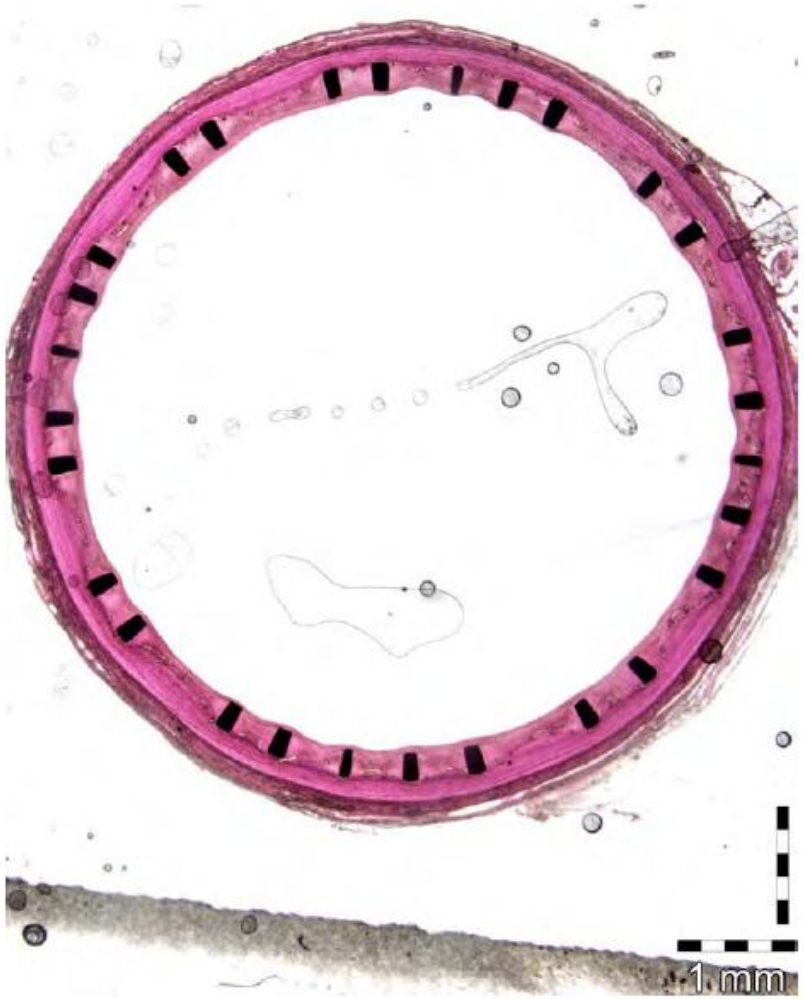
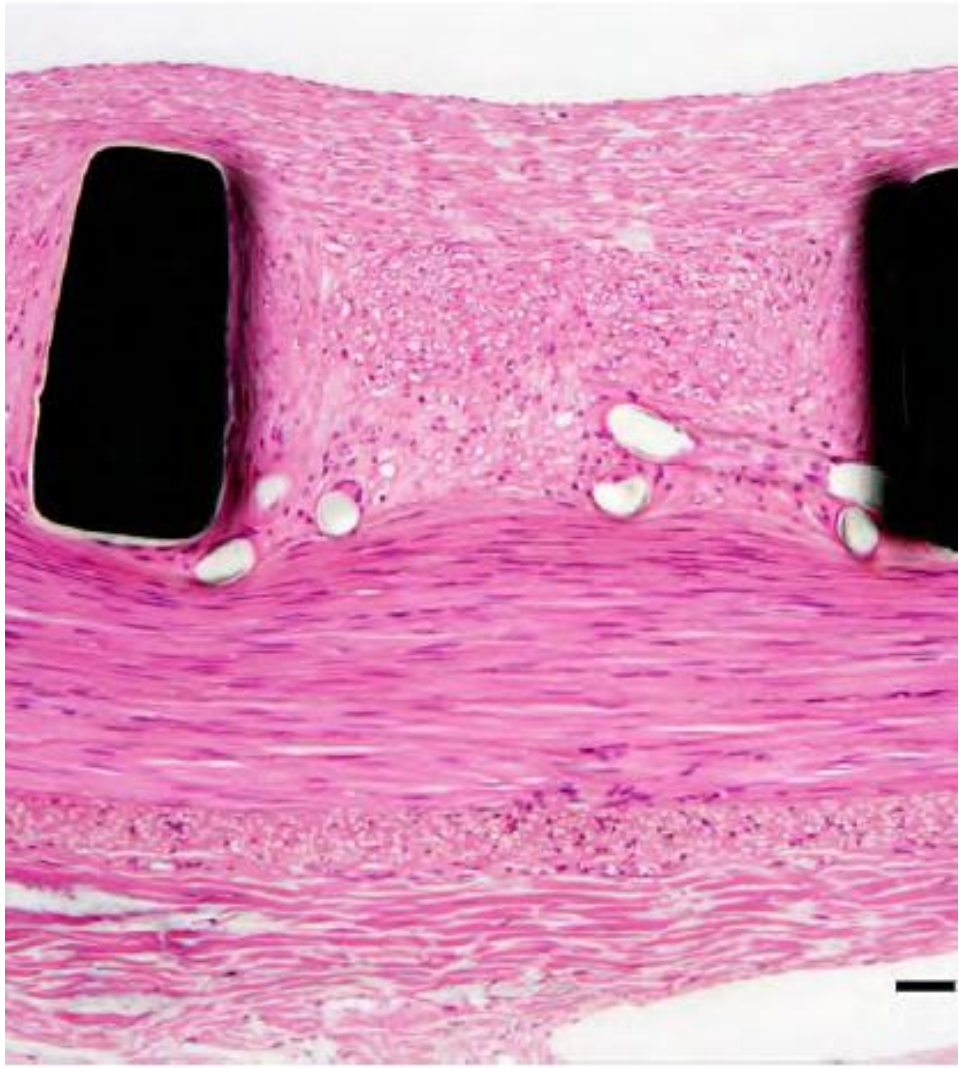


CGuard EPS 90 days/pig



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



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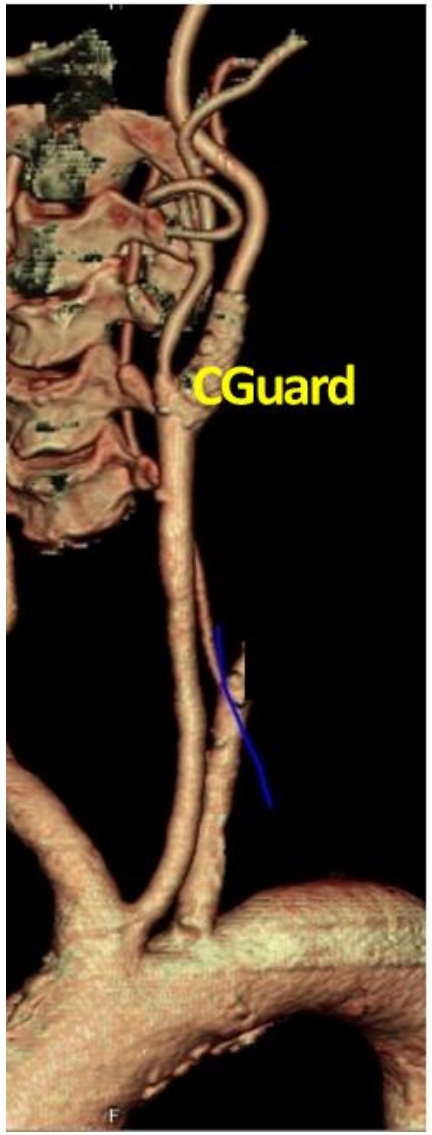
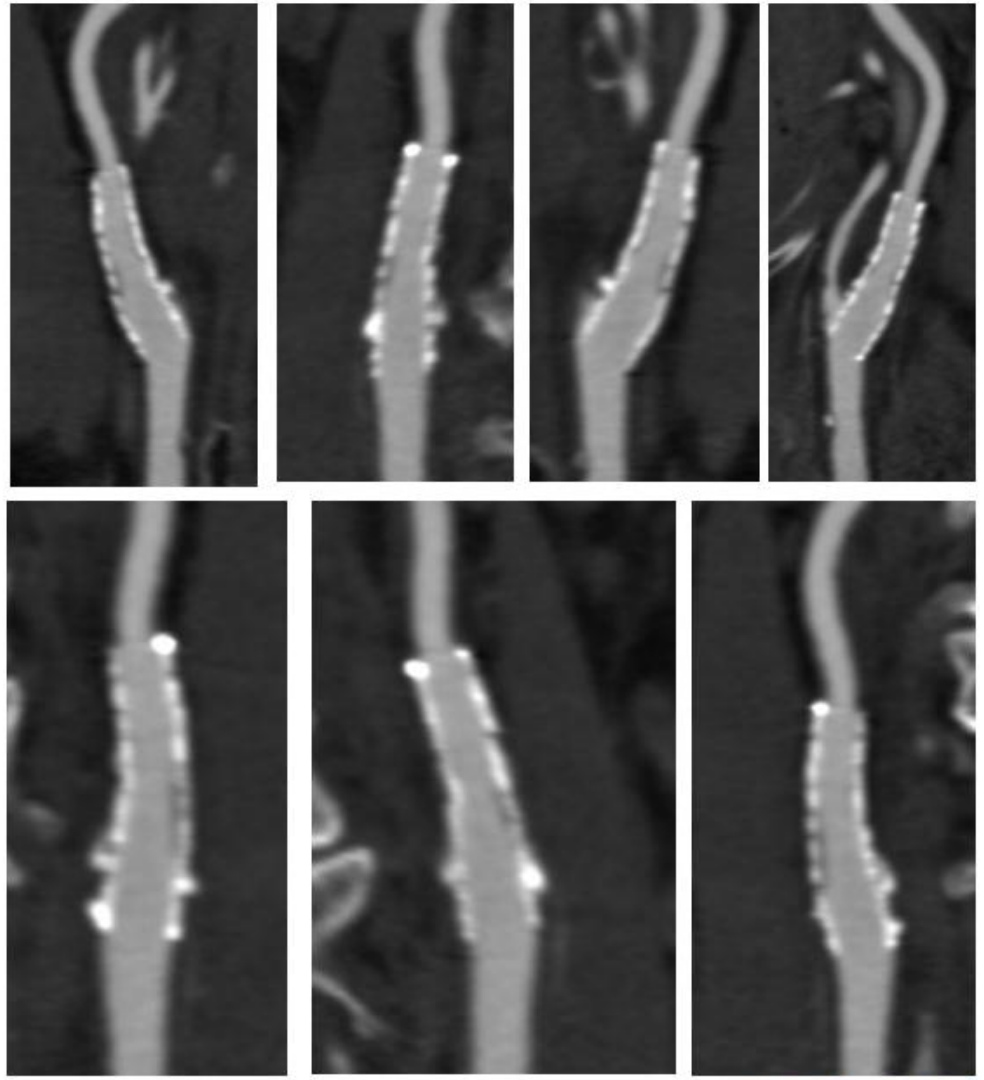
InspireMD data / by permission

CGuard: Normal Healing Profile





CGuard

clinical

Evidence

10^{+} studies

JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 8, NO. 9, 2015

ISSN 1936-8798/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jcin.2015.04.016

A Prospective, Multicenter Study of a Novel Mesh-Covered Carotid Stent

The CGuard CARENET Trial (Carotid Embolic Protection Using MicroNet)

CGuard

30d data

Joachim Schofer, MD,* Piotr Musiałek, MD, DPHIL,† Klaudija Bijuklic, MD,* Ralf Kolvenbach, MD,‡ Mariusz Trystula, MD,† Zbigniew Siudak, MD,†§ Horst Sievert, MD‖

Per-Protocol DW-MRI cerebral imaging at B/L, 24-48h after CAS, and at 30 days

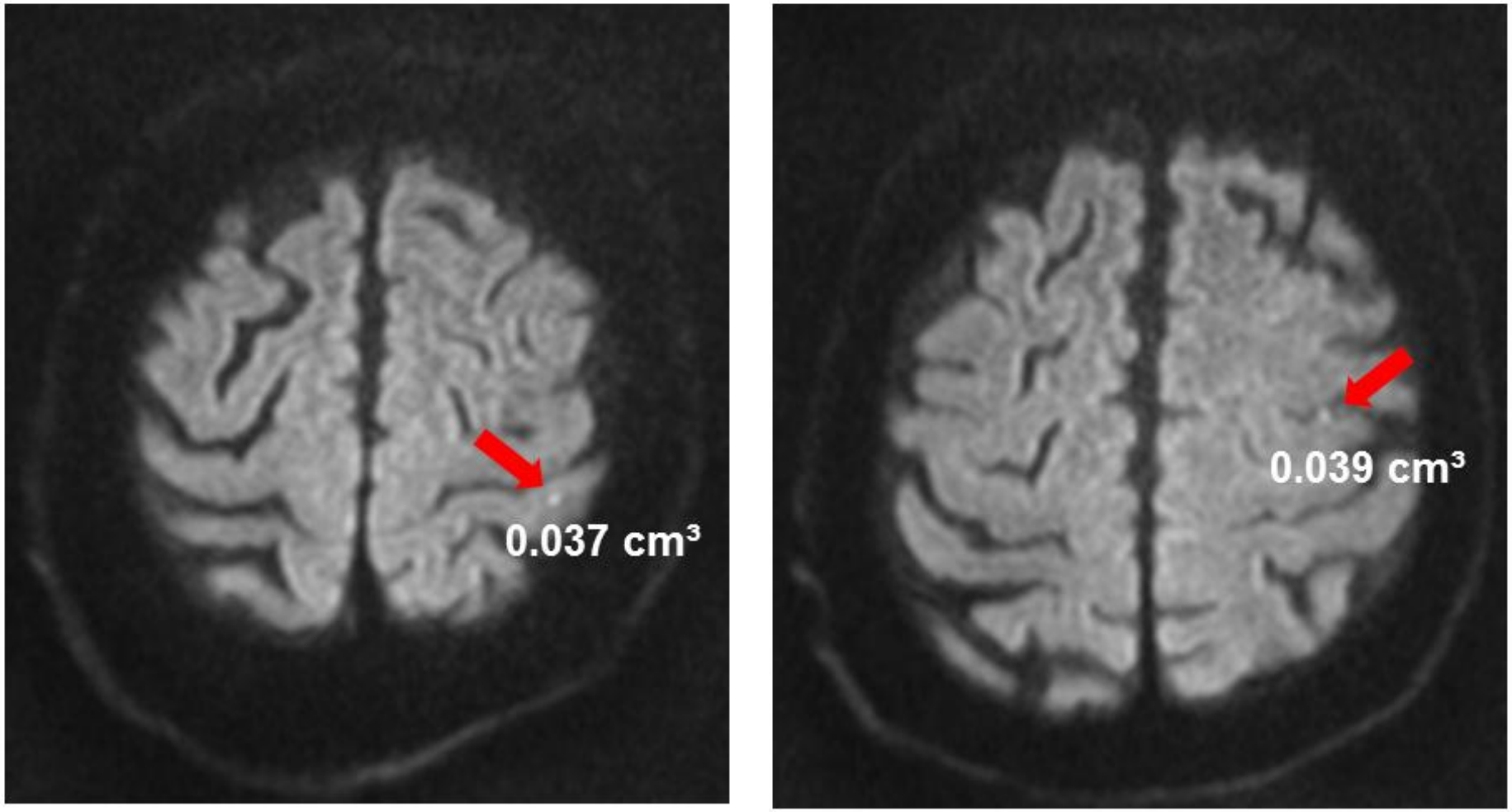
ABSTRACT

OBJECTIVES This study sought to evaluate the feasibility of the CGuard Carotid Embolic Protective Stent system—a novel thin strut nitinol stent combined with a polyethylene terephthalate mesh covering designed to prevent embolic events from the target lesion in the treatment of carotid artery lesions in consecutive patients suitable for carotid artery stenting.

BACKGROUND The risk of cerebral embolization persists throughout the carotid artery stenting procedure and remains during the stent healing period.

METHODS A total of 30 consecutive patients (age 71.6 ± 7.6 years, 63% male) meeting the conventional carotid artery stenting inclusion criteria were enrolled in 4 centers in Germany and Poland.

The Power of DW-MRI...



48h after LICA-CAS

M. Urbanczyk, P. Banys, Dept. Radiology, JP2 Hospital, Krakow, Poland

- Intra-procedural cerebral embolization is **minimized**
- Post-procedural procedural cerebral embolization is **eliminated**

J. Schofer, P. Musialek, et al. JACC Interv 20152015;8:1229-1234

CARENET 1y

A Prospective, Multicenter Study of a Novel Mesh-Covered Carotid Stent

The CGuard CARENET Trial

(Carotid Embolic Protection Using MicroNet)

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VOL. 8, NO. 9, 2015
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Per-Protocol DW-MRI cere
P/[illegible]CAS, a

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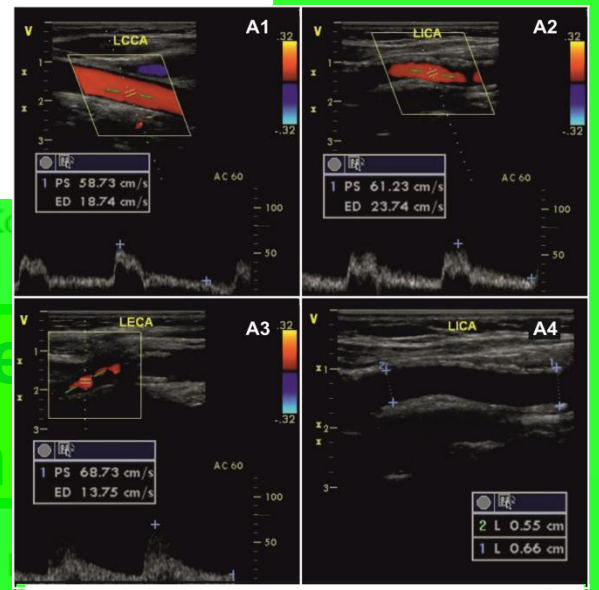
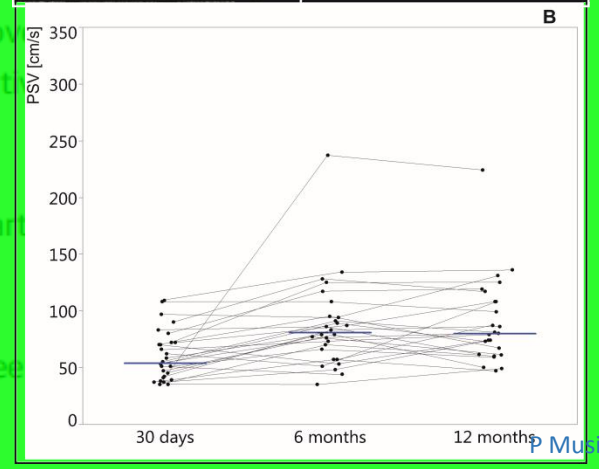
METHODS A total of 30 consecutive patients (age 71.6 ± 7.6 years, 63% male) me
stenting inclusion criteria were enrolled in 4 centers in Germany and Poland.

- No stroke(s)/TIA(s)
- No ISR





PARADIGM-Extend = **P**rospective evaluation of **A**ll-comer pe**R**cutaneous c**A**roti**D** revascularization in symptomatic and **I**ncreased-stroke-risk asymptomatic carotid artery stenosis using C**G**uard™ **M**icronet-covered embolic prevention stent system – clinical trial multi-centre extension

EuroIntervention 2016;12-online publish-ahead-of-print May 2016

CLINICAL RESEARCH

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

Prospective evaluation of **A**ll-comer pe**R**cutaneous c**A**roti**D** revascularization in sympto-matic and **I**ncreased-risk asymptomatic carotid artery stenosis using the C**G**uard™ **M**icronet-covered embolic prevention stent system

The PARADIGM Study

euro PCR 2016 LATE BREAKING TRIALS

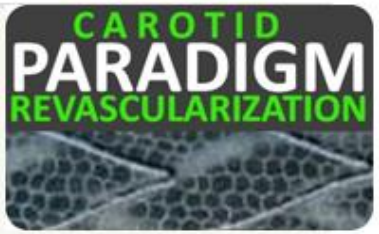
CAROTID PARADIGM REVASCULARIZATION

Objective

- to evaluate feasibility and outcome of routine **anti-embolic stent system** use in unselected, consecutive patients referred for carotid revascularization ('all-comer' study)

PARADIGM study: referrals flow chart

139 carotid stenosis patient referrals



Neuro Vascular Team

- Neurologist
- Interventional angiologist
- Vascular surgeon
- Cardiologist

for carotid revascularisation
108 patients

NOT for carotid revascularisation
31 patients

n=24: increased stroke risk and/or lesion severity criteria not met
n=2: ICA totally occluded on verification
n=2: ICA functional occluded + h/o prior ipsilateral large cerebral infarct with haemorrhagic transformation
n=1: major post-stroke disability, ICA functionally occluded
n=1: severe circulatory failure (ICA stenosis asympt.)
n=1: malignancy with limited life expectancy (ICA stenosis asympt.)

P. Musialek, A. Mazurek et al. *EuroIntervention* 2016;12:e658-70

PARADIGM study: revascularisation flow chart

108 patients for carotid revascularisation

(93%) → **CAS** in n=100 patients (bilateral in 5)

(1%) → **CAS+CEA** in n=1 patient (LICA-CEA and RICA-CAS) hybrid management

(6%) → **CEA** in n=7 patients

- n=1 eGRF 14 → no contrast
- n=2 hostile access
- n=1 major ICA kink/loop
- n=1 severe aortic valve disease +calcific LICA (AVR+CEA)
- n=1 floating thrombus in CCA
- n=1 ICA diameter <2.0 mm +contralateral ICA occlusion

106 ICAs treated endovascularly in 101 patients
using exclusively the MicroNet-covered embolic prevention stent system

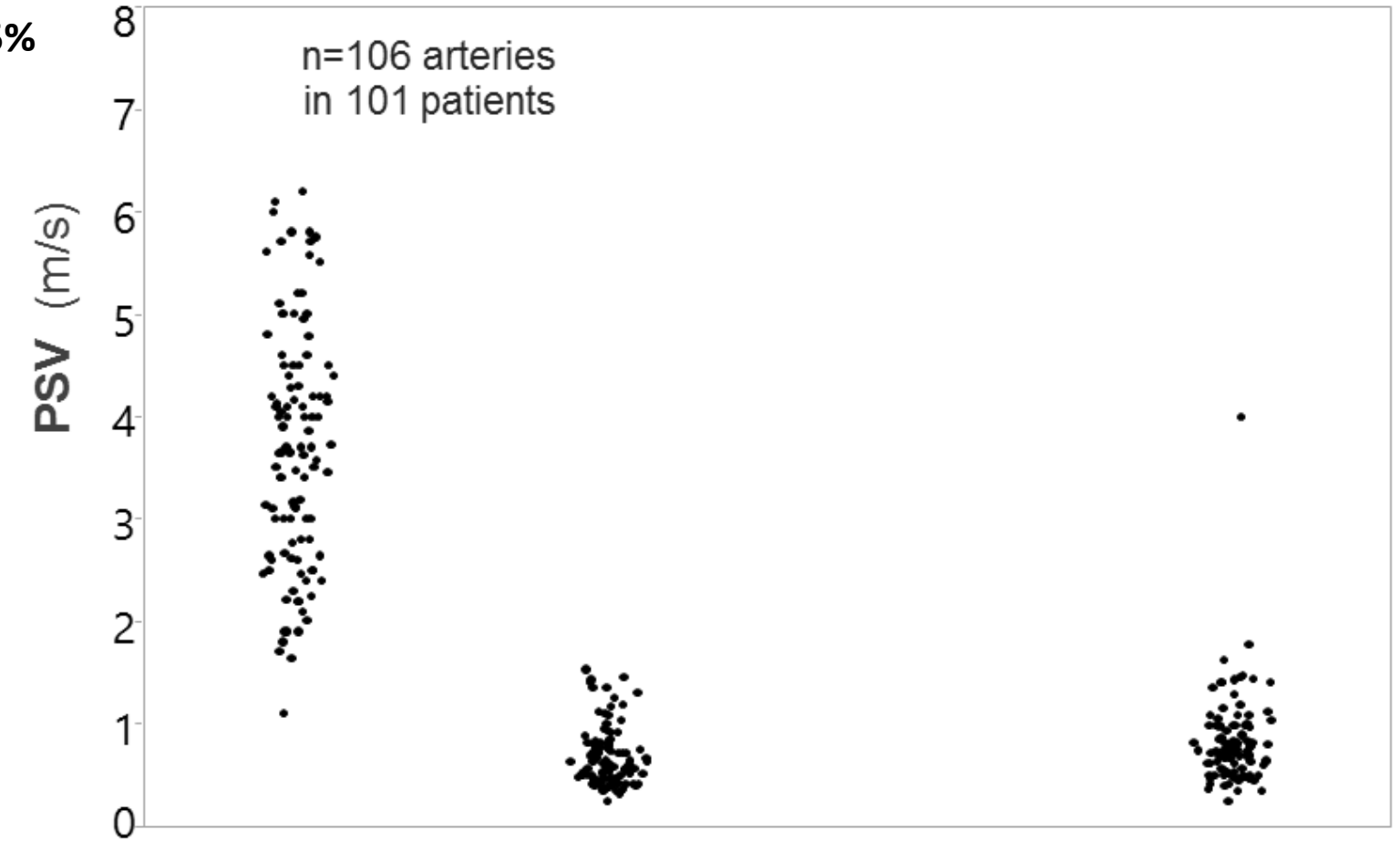
P. Musialek, A. Mazurek et al. *EuroIntervention* 2016;12:e658-70

CGuard™ EPS Carotid **PARADIGM** Study
12mo Duplex Ultrasound Data

CAROTID PARADIGM REVASCULARIZATION

12month data

Symptomatic – 54.5%



ECA* **patency**

ECA

100/106 ECAs were patent prior to CAS

baseline	30 days	12 months
97.0% 3 ECAs occluded at CAS	**97.0%** 97/100 ECAs patent	**96.9%** 93/96 ECAs patent

PARADIGM – Extend

continues as an **ALL-Comer Multi-Centre Study**

⟶ No exclusion criteria

other than absence of carotid stenosis that requires revascularization by NVT reccomendation

PARADIGM – Extend

continues as an ALL-Comer Multi-Centre Study

31 July 2019

- 402 patients / 436 arteries
  NeuroVascular Team decision-making on endovascular revascularization

PARADIGM – Extend

continues as an ALL-Comer Multi-Centre Study

31 July 2019

- 402 patients / 436 arteries
  NeuroVascular Team decision-making on endovascular revascularization
- Age 48-87 years, 56.4% symptomatic
- Crossed the trial first follow-up window (30d)

PARADIGM – Extend

continues as an ALL-Comer Multi-Centre Study

31 July 2019

- 402 patients / 436 arteries
  NeuroVascular Team decision-making on endovascular revascularization
- Age 48-87 years, 56.4% symptomatic
- Crossed the trial first follow-up window (30d)
- 100% CGuardEPS use, Proximal/distal EPD ≈ 50% : 50%

PARADIGM – Extend

continues as an ALL-Comer Multi-Centre Study

31 July 2019

- 402 patients / 436 arteries
  NeuroVascular Team decision-making on endovascular revascularization
- Age 48-87 years, 56.4% symptomatic
- Crossed the trial first follow-up window (30d)
- 100% CGuardEPS use, Proximal/distal EPD ≈ 50% : 50%
- Angiographic diameter stenosis was reduced from 84±8% to only 6.9±5% (p<0.001, 'CEA-like' effect of CAS)

PARADIGM – Extend

402 patients / 436 arteries

31 July 2019

- *Peri-procedural outcome*

0 death/major stroke – 0%
1 minor stroke – 0.25%
1 MI (type2) **– 0.25%**

PARADIGM – Extend

402 patients / 436 arteries

31 July 2019

- *Peri-procedural outcome*

  0 death/major stroke – 0%
  1 minor stroke – 0.25%
  1 MI (type2) **– 0.25%**

- *By 30 days*

  1 haemorrhagic transformation of prior ischaemic cerebral infarct leading to **death – 0.25%**

  1 bleeding-related death – 0.25%

PARADIGM – Extend

402 patients / 436 arteries

31 July 2019

- **Total**

  30-day death/MI/any stroke – **0.995 %** (4/402)

- **no post-proc. ischaemic stroke by 30 days – 0.0 %** (0/402)

PARADIGM – Extend

402 patients / 436 arteries

31 July 2019

- **Total**

  30-day death/MI/any stroke – **0.995 %** (4/402)

- **no post-proc. ischaemic stroke by 30 days – 0.0 %** (0/402)

- *Then clinical (inc. Neurology exam) and Duplex follow-up every 12 months*

PARADIGM – Extend

NB. ALL–Comer, Unselected Population
(eg. AFib 8.9%)

	1-12 mo	13-24 mo	25-36 mo	37-48 mo
	n=311	n=205	n=108	n=61
ipsilateral stroke	**0**	**0**	**0**	**0**
any stroke	**0**	**2** 1 cerebellal 1 contralat.	**1** brain stem	**2** 1 contralateral 1 under adjudiaction
stroke-related death	**0**	**1**	**0**	**1**
MI or other non-cerebral VA	**3**	**3**	**2**	**2**
any death	**13** CHF-4, Ca-3, PE-1, MI-2 COPD-1,uroseps -1, surg-1	**10** CHF-3, Ca-2, MI-2 surg-2, intrac. bleed-1	**6** CHF-2, Ca-2, MI-1 urosepsis -1	**4** CHF-2, Ca-2, MI-2
in-stent velocities	PSV **0.79**±0.41m/s EDV **0.21**±0.11 m/s	PSV **0.75**±0.36 m/s EDV **0.19**±0.09 m/s	PSV **0.75**±0.36 m/s EDV **0.20**±0.09 m/s	PSV **0.74**±0.28 m/s EDV **0.20**±0.07 m/s

PARADIGM – Extend

By 48 months

NB. ALL–Comer Unselected Population
(eg. AFib 8.9%)

	1-12 mo	13-24 mo	25-36 mo	37-48 mo
	n=311	n=205	n=108	n=61
ipsilateral stroke	0	0	0	1
any stroke	2	2	1	2
		1 cerebellar 1 contralat.		1 contralateral 1 under adjudiaction
stroke-related death	0	1	0	1
MI or other non-cerebral VA	3	3	1	2
any death	15	10	6	4
	CHF-4, Ca-3, PE-1, MI-2 COPD-1,uroseps -1, surg-1	CHF-3, Ca-2, MI-2 surg-2, intrac. bleed-1	CHF-2, Ca-2, MI-1 urosepsis -1	CHF-2, Ca-2, MI-2
in-stent velocities	PSV **0.79**±0.41m/s EDV **0.21**±0.11 m/s	PSV **0.75**±0.36 m/s EDV **0.19**±0.09 m/s	PSV **0.75**±0.36 m/s EDV **0.20**±0.09 m/s	PSV **0.74**±0.28 m/s EDV **0.20**±0.07 m/s

Normal healing

No Stent Thrombosis

No abnormal ISR signal

(Per-vessel ISR 0.92% - 4/436; DEB-PTA)

SIVEC /SIE
SIENA VASCULAR AND ENDOVASCUL
SEPTEMBER 2019

CGUARD™
Carotid Embolic Prevention System

PARADIGM–EXTEND

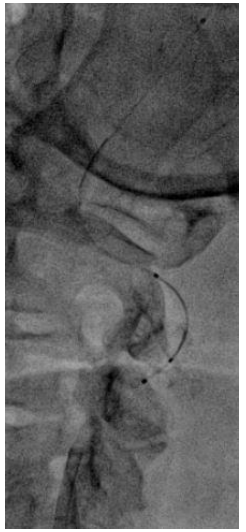
@ 48 months

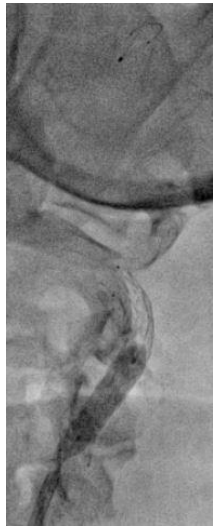
Favourable Cerebral Outcome

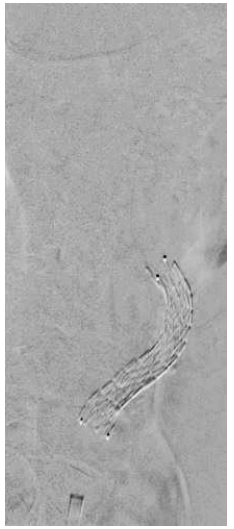
- NO device-related adverse events
- NO procedure-related events

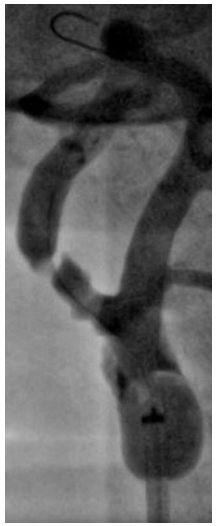
s u s t a i n e d
stroke prevention

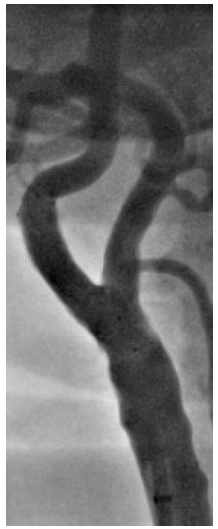
Endovascular Solution for All-Comers







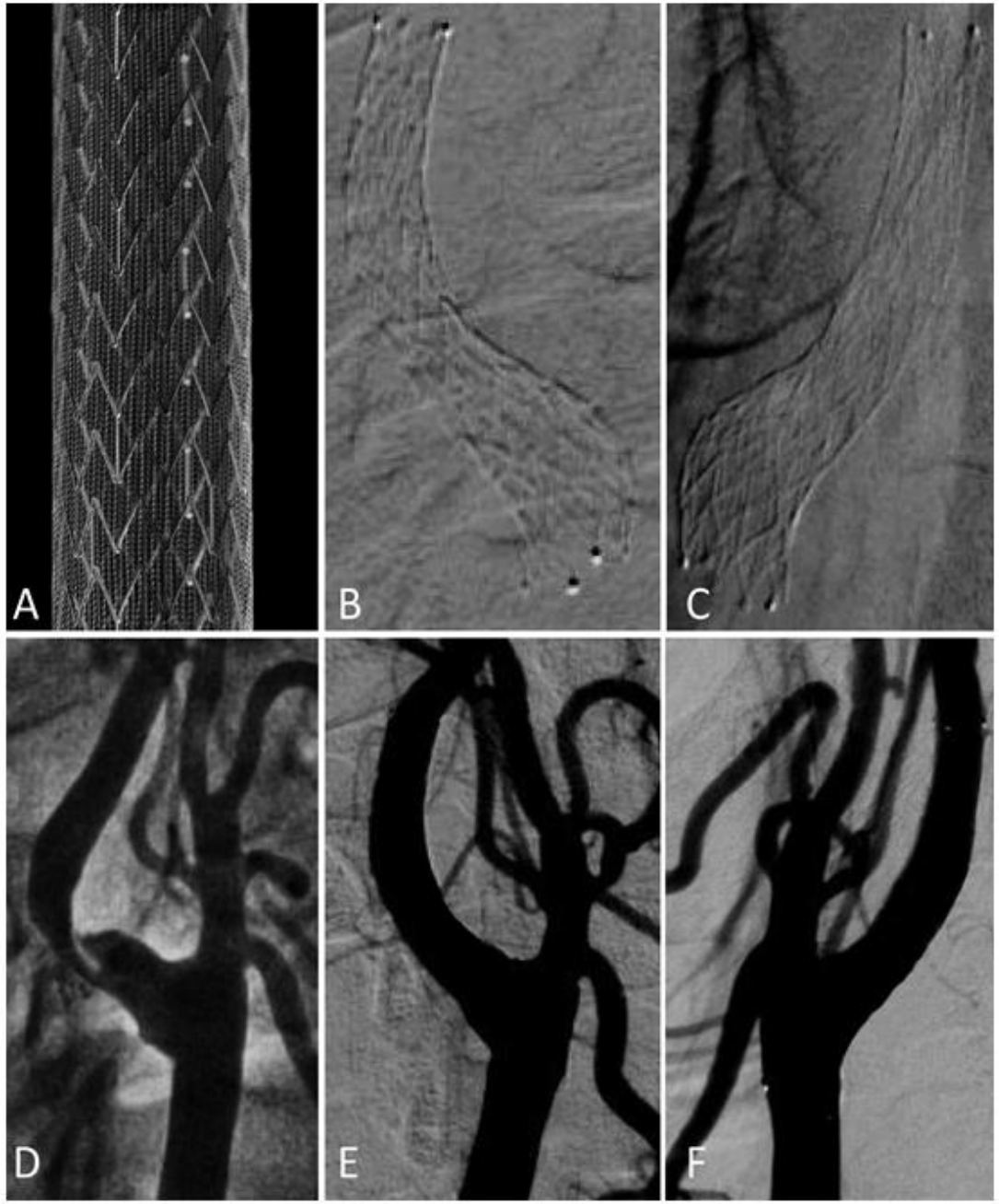




Endovascular Reconstruction of the Carotid Bifurcation

Prevention of embolism, High radial force, Conformability

PARADIGM



CAROTID PARADIGM REVASCULARIZATION

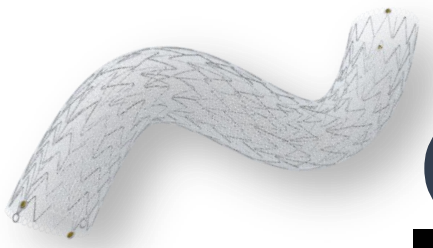
systematic

CEA-like effect of CAS

ESC Congress
Paris 2019

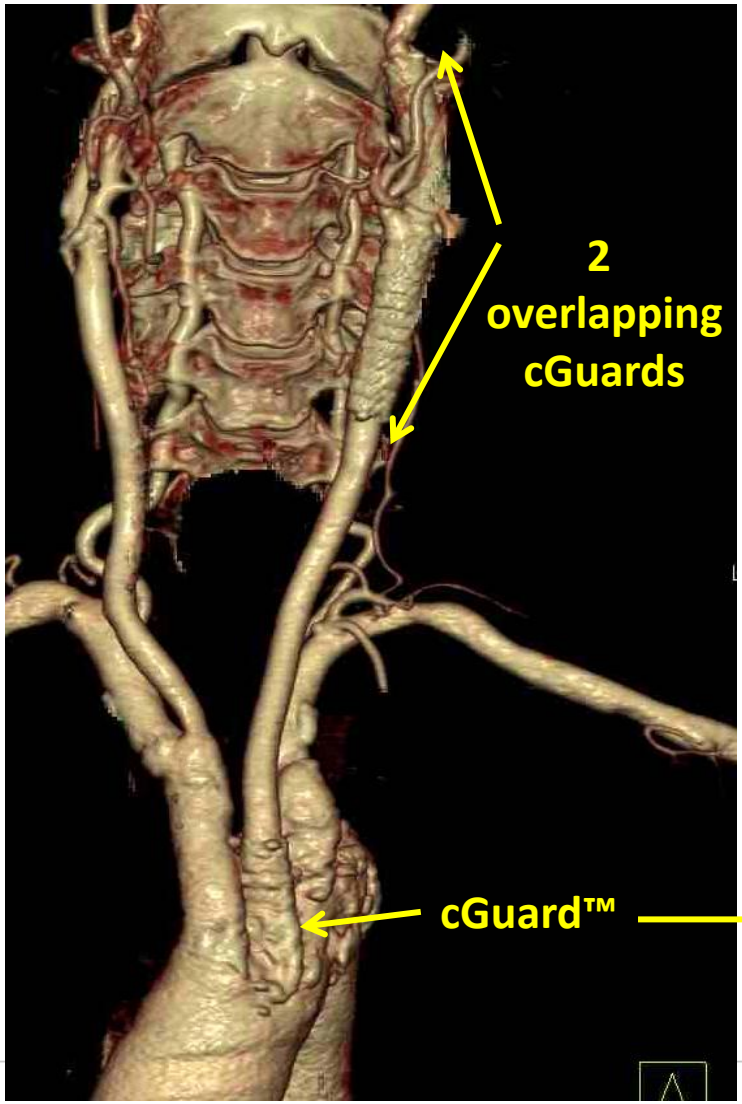
CGuard™ EPS Trials

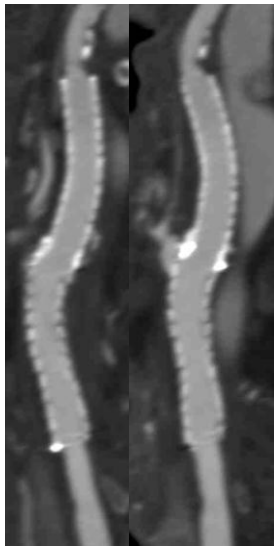
Study	2200 pts		Specialist	Status
CARENET	30 pts	DW-MRI	Multi	Published
PARADIGM	100 pts	All comer	Multi	Published
IRON-Guard	200 pts	Real World	Vasc Surgery	Published
TORIN (MRI)	30 pts	DW-MRI	INR	Published
Wissgott	30 pts	Mechanics	Angiology	Published
Casana	80 pts	Real World	Vasc Surgery	Published
Wissgott NG	20 pts	New Gen		Finish
IRON-Guard 2	500 pts	Real World	Vasc Surgery	On-going
PARADIGM-Extend	300 pts	All comer	Multi	On-going
CGuard Vasc Surg (Poland)	500 pts	Real World	Vasc Surgery	On-going
CGuard vs. Acculink RCT	100 pts	(DW-MRI)	Vasc Surgery	On Going
CGuard PRO	500 pts	Real World	Vasc Surgery	
CGuard OPTIMAL	100 pts	with IVUS	EU KOL	
TBC: FDA	300 pts		Multi	



Ostial CCA lesions

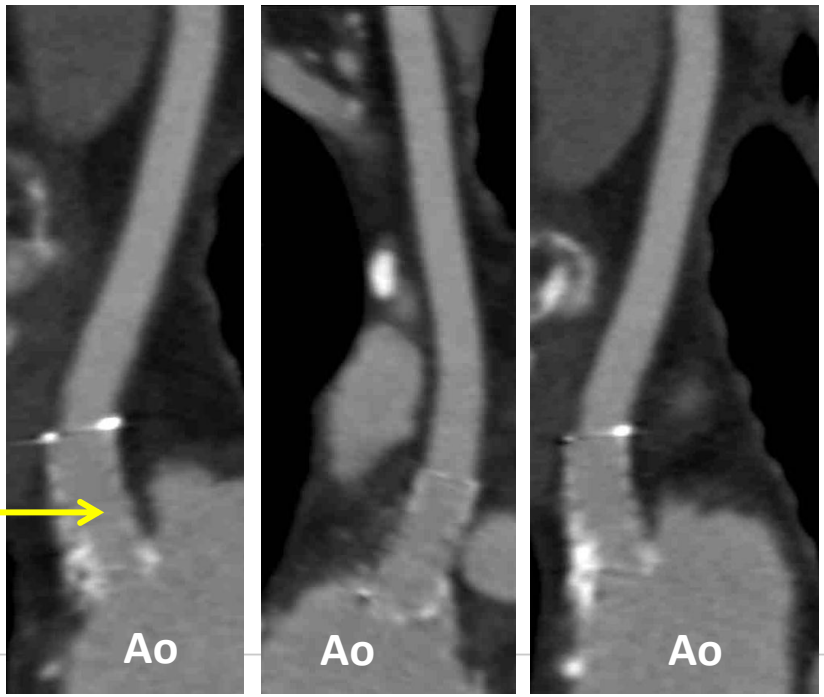
(note adequate radial force and placement percision)



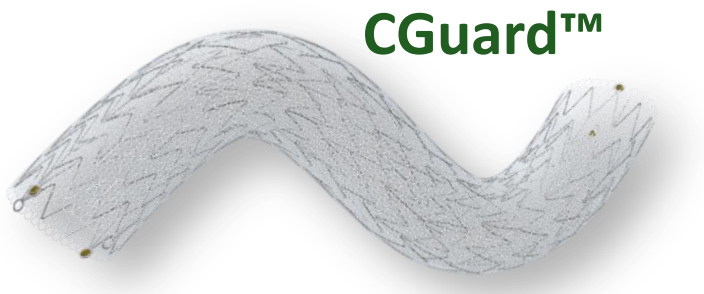


OPTIMAL angiographic + clinical + duplex result @ 12mo

(and LECA patent)



High-ICA Aneurysm
recurrent TIAs



RICA endovascular reconstruction

Immediate SEALING

Patient CURED

High-ICA Aneurysm
recurrent TIAs

Normal CT-angio result @ 6 mo

excellent healing & no more symptoms

CGuard™

RICA
endovascular
reconstruction

√

CONFIRMED
C U R E D ☺

44-year-old woman hairdress model

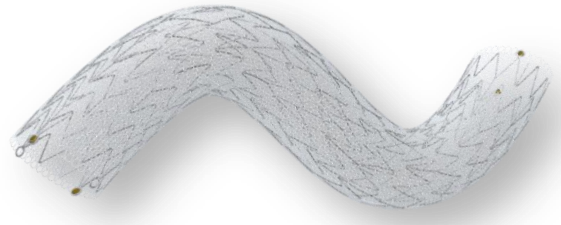
minor stroke then cresc. TIAs…

C1/C2

CGuard™ 6.0x20mm
’ Smart-FIT ’

Direct stenting

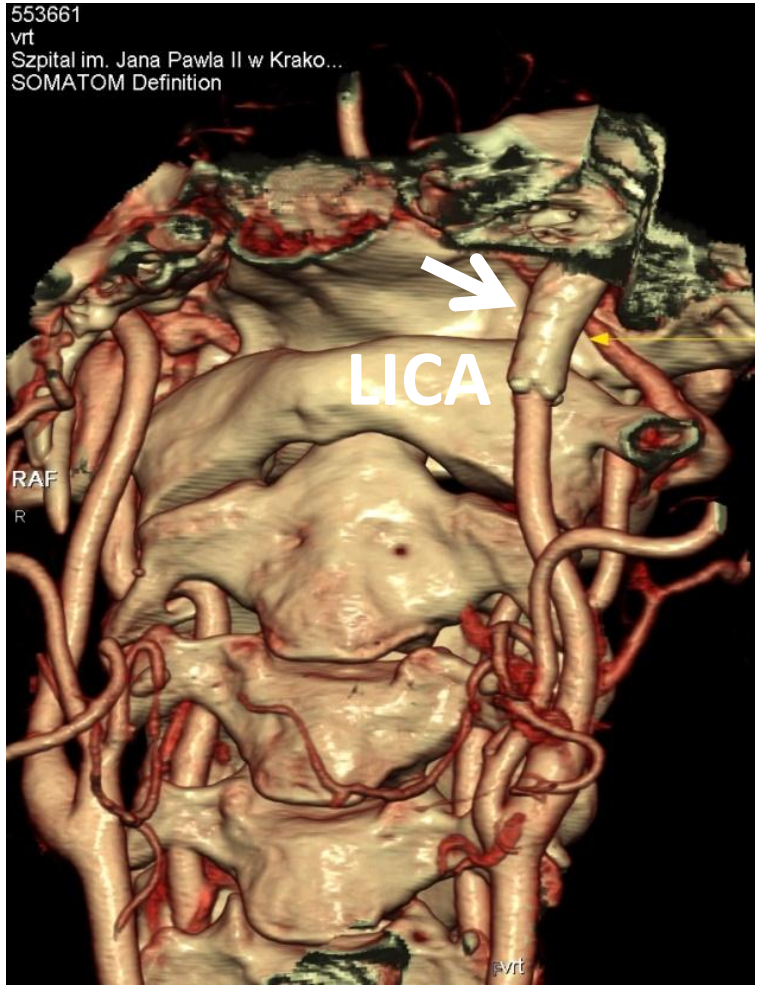
44-year-old woman hairdress model
minor stroke, then TIAs



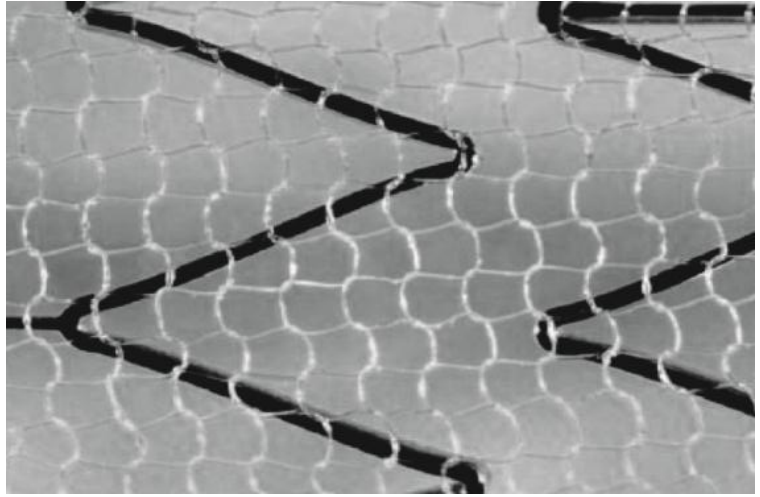
CGuard™
Smart-FIT

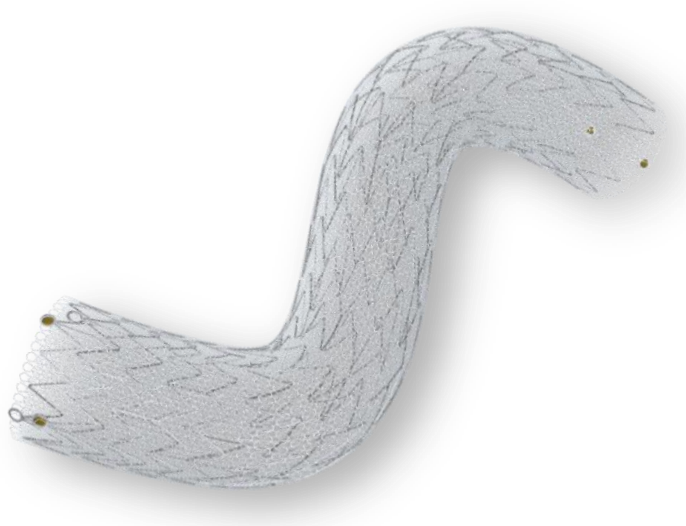
Totally SEALED @ 24h

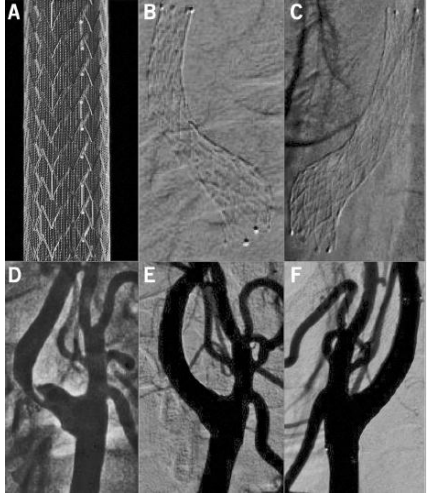
C1/C2 endovascular reconstruction



Patient C U R E D ☺ ☺

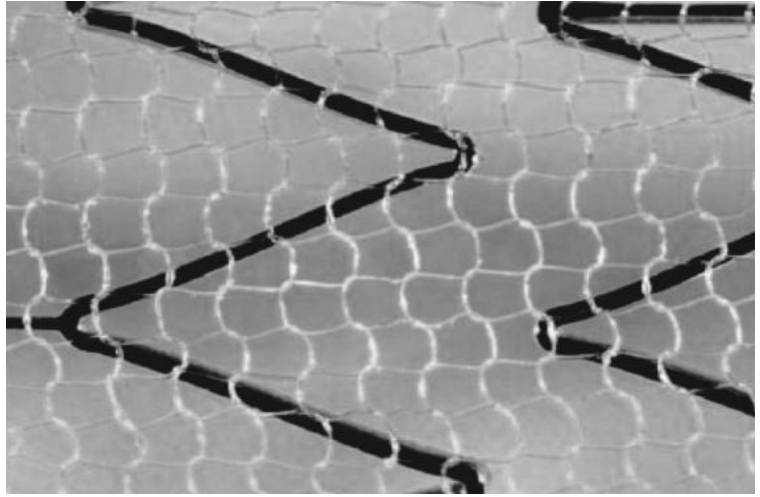


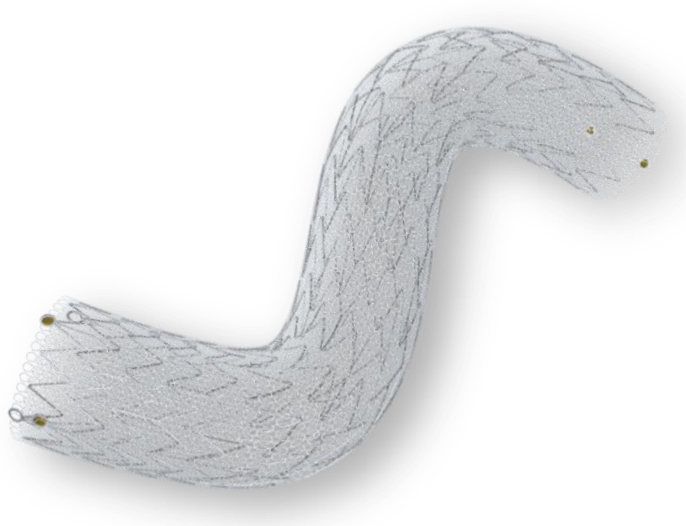


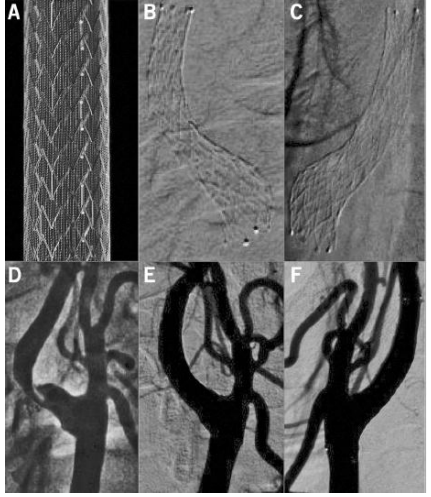


This concept has been desired.

And it works.







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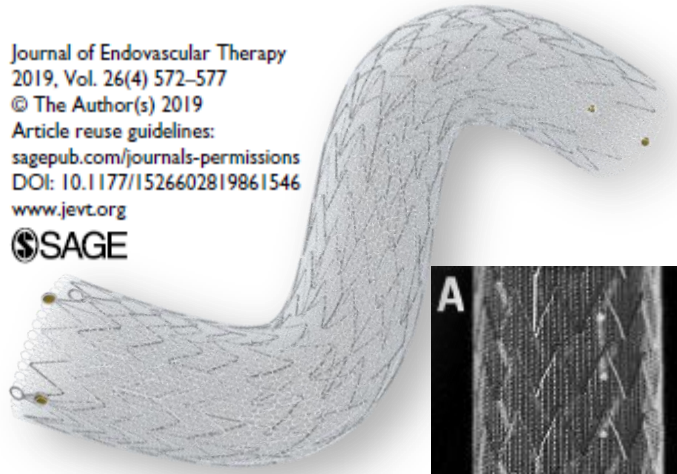
This is the future

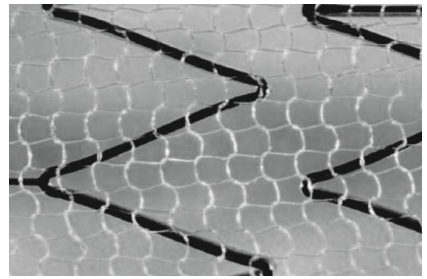
of Carotid Artery Stenting

Double-Layer Carotid Stents: From the Clinical Need, through a Stent-in-Stent Strategy, to Effective Plaque Isolation… the Journey Toward Safe Carotid Revascularization Using the Endovascular Route

Journal of Endovascular Therapy
2019, Vol. 26(4) 572–577

DOI: 10.1177/1526602819861546
www.jevt.org
SAGE

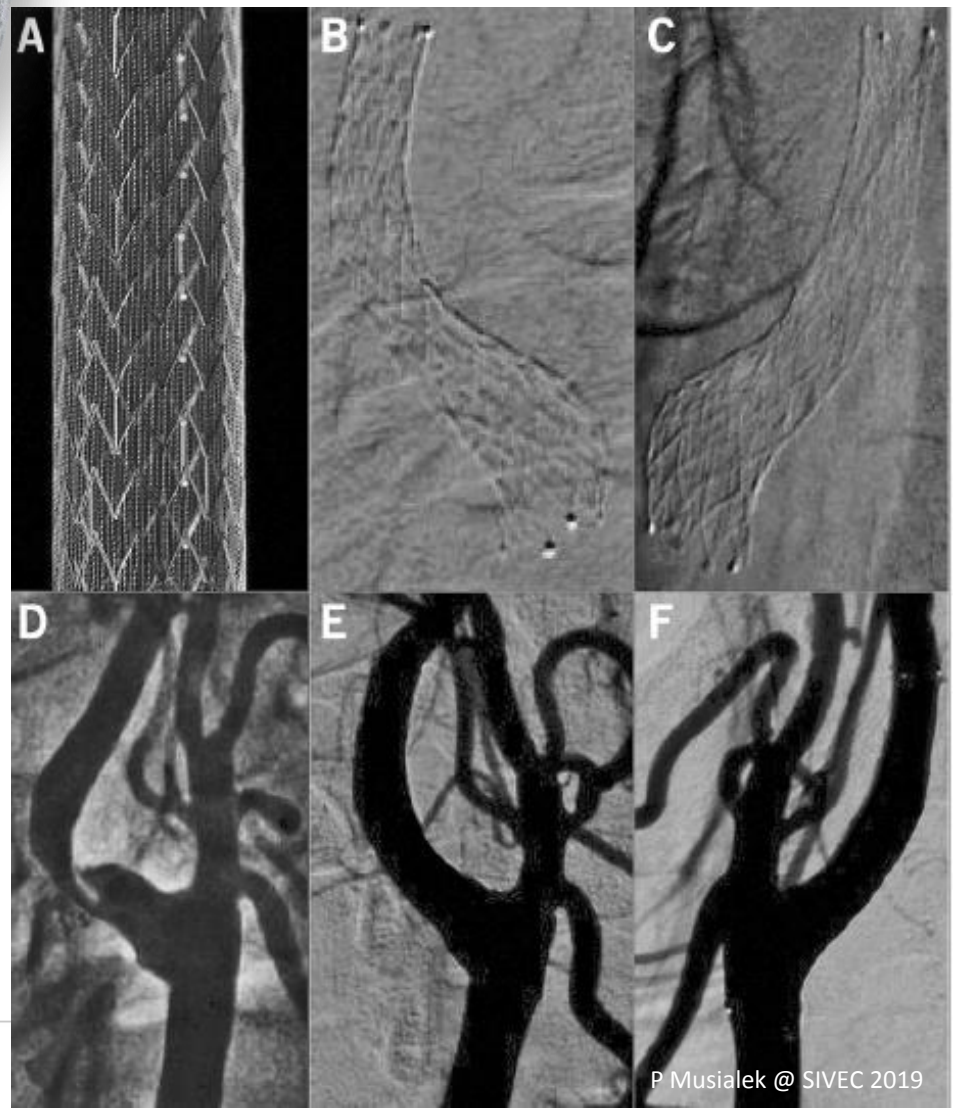


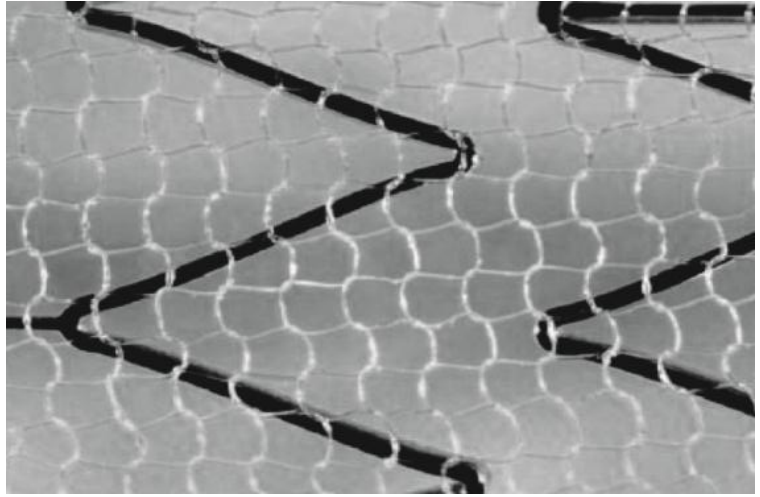


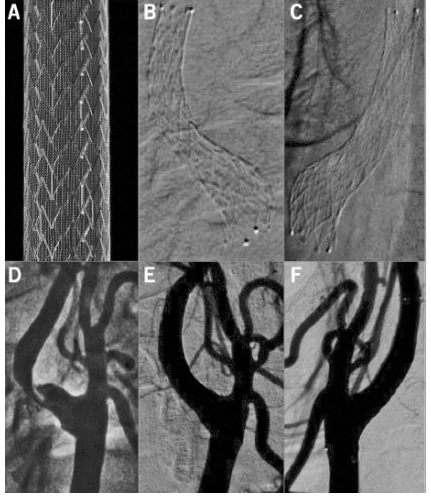
Piotr Musiałek, MD, DPhil[1] and Gary S. Roubin, MD, PhD[2]

Keywords
carotid artery stenosis, carotid artery stenting, carotid endarterectomy, closed-cell stent, MicroNET, open-cell stent, plaque protrusion, stent-graft, restenosis, double-layer stent, unstable plaque

Both surgical and endovascular routes of carotid revascularization are associated with the risk of symptomatic and asymptomatic cerebral embolism.[1-3] Optimized pharmacotherapy, the mainstay of atherosclerosis management, can reduce or delay but not abolish the risk of stroke from atherosclerotic carotid artery stenosis.[4-7] Interventional elimination or sequestration of the thromboembolic carotid plaque[8-10] remains an important consideration in a significant proportion of patients if carotid stenosis–related strokes are to be prevented rather than experienced. This is the focus and the stent free-cell area also affect the risk of embolism after stent placement. Thus, while optimized neuroprotection during CAS may minimize intraprocedural cerebral embolism,[18-20,23,24] the problem of early or delayed postprocedural embolism remains.[3,25-27] With optimal patient selection technique and antiplatelet therapy, post-stent embolic phenomena are largely related to intrastent plaque prolapse, balloon trauma, and subsequent embolization. This may occur after the period of intraprocedural cerebral protection using flow reversal techniques and/or filters.







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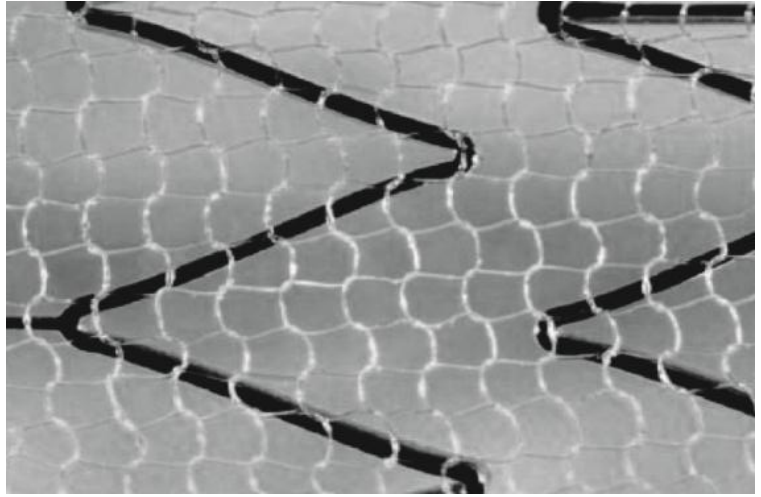
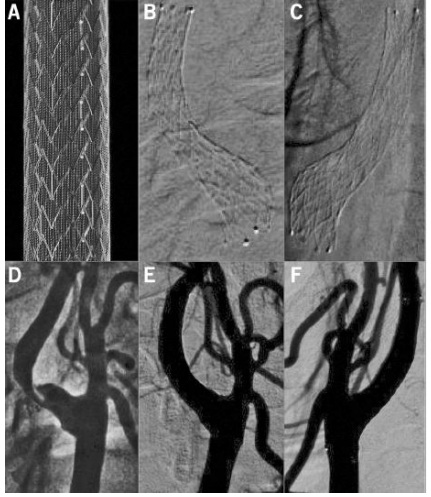
And it works.

This is the future

of Carotid Artery ~~Stenting~~





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This is the future

of Carotid Artery S[illegible]g

revascularization !