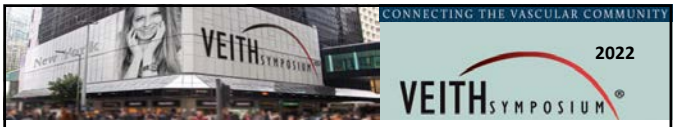


The 3 Micromesh Stents and Their Value In CAS: Do the Design Differences Matter? & Update On Carotid And Other Uses of the MicroNet-Covered Stent (C-Guard)

Piotr Musialek, MD DPhil and **Max Amor**, MD

Jagiellonian University Dept. of Cardiac & Vascular Diseases, John Paul II Hospital, Kraków, Poland
& Clinique Louis Pasteur, Essey-Les-Nancy, France

Conflicts of Interest

PM is a recipient of public grants for basic and clinical research in atherosclerisis and cardiovascular regeneration.
PM has acted as a proctor, an advisory board member, and a consultant for Abbott Vascular, InspireMD, and Medtronic.
PM is an initiator and Principal Investigator in Investigator-Run Clinical Studies in Cardiovascular Interventional Medicine.

PM is Co-PI in the CGuardians FDA IDE Clinical Trial

CGuard™ MicroNET-Covered Stent

is an **INVESTIGATIONAL** device

in the USA

THE **FUNDAMENT**

(aka)

WHY DO WE DO "**THIS**" ?

I. "ASYMPTOMATICS"

Asymptomatic Carotid Stenosis

is **NOT**

"just" (ie. universally) a "**BENIGN**" DISEASE

where Optimized Medical Therapy

would be suficient to prevent stroke

I. "SYMPTOMATICS"

The focus, over the last 3 decades,
has been largely on the **"wrong"**
SYMPTOMATICS
ie., those with mRS≤2 – who "can" be treated
(even that the intervention arrives too late)

I. "SYMPTOMATICS"

The focus, over the last 3 decades,
has been largely on the "wrong"
SYMPTOMATICS
ie., those with mRS≤2 – who "can" be treated
(even that the intervention arrives too late)

The REAL (medical, societal) PROBLEM
are those with mRS >2
who do NOT enter any "carotid" attention/stats etc. †

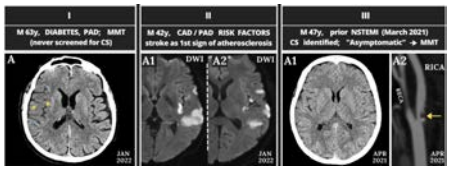
Asymptomatic carotid stenosis 2022

Atherosclerotic Carotid Disease is NOT a "benign" condition

Musialek Rosenfield Siddiqui Grunwald *Thromb Haemost.* 2022

Asymptomatic carotid stenosis 2022

Atherosclerotic Carotid Disease is NOT a "benign" condition



Musialek Rosenfield Siddiqui Grunwald *Thromb Haemost.* 2022

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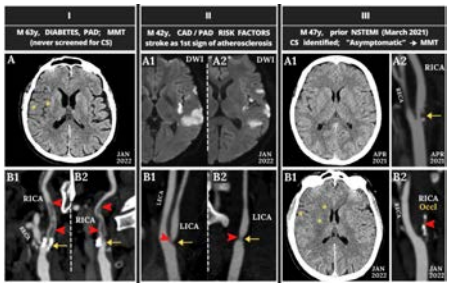

Musialek Rosenfield Siddiqui Grunwald *Thromb Haemost.* 2022

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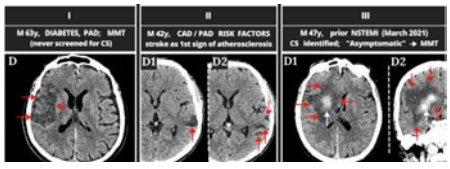
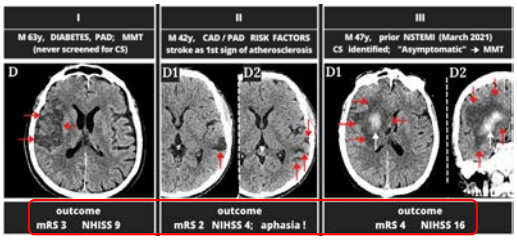


Musialek Rosenfield Siddiqui Grunwald *Thromb Haemost.* 2022

Asymptomatic carotid stenosis 2022



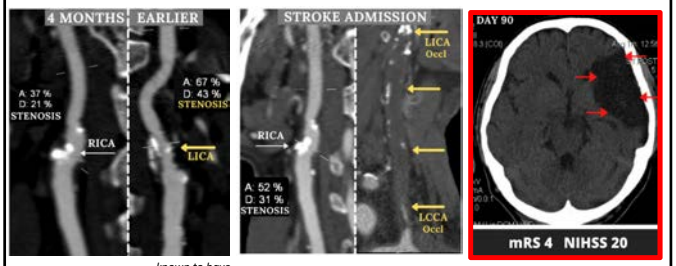
Too late to treat !

Stented - 2nd gen stent (plaque-sequestration)

Too late to treat !

Musialek Rosenfield Siddiqui Grunwald *Thromb Haemost.* 2022

M, 59y, mRS 0, NIH-SS 0

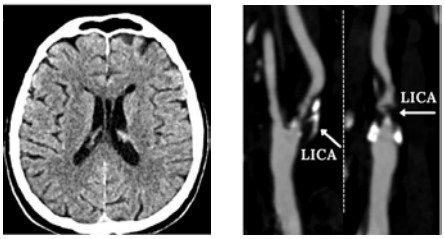


known to have
"67%"
LICA stenosis

⟶ "OMT"

M, 74y, mRS 0

Evaluated for carotid bruit
"*concerned*" (sister post-stroke)

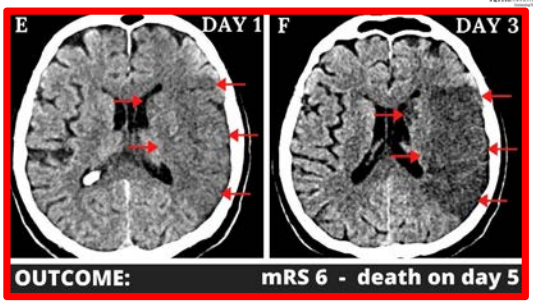


⟶ "OMT"
(current best medical therapy)

Dzierwa et al. 2022 (in press)

M, 74y, mRS 0

3 months later



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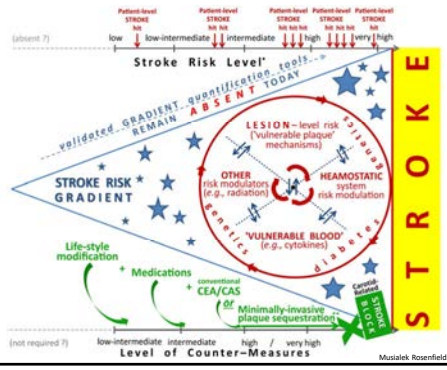
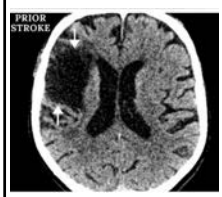


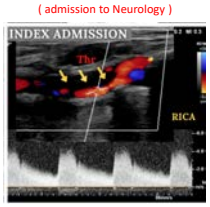
Decision-making
ROULETTE
Table

M, 60y, mRS 1

New TIA
(admission to Neurology)



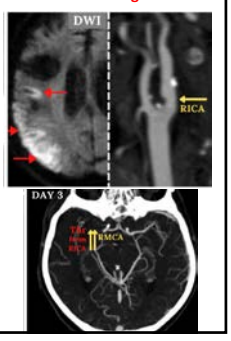
known to have
"borderline"
carotid stenosis



"*observation* "

NOT referred
for urgent/emergent
intervention
(CAS and CEA available locally)

Day 3 morning



Dzierwa et al. 2022 (at review)

M, 60y, mRS 1

New TIA
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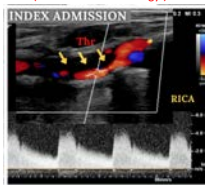
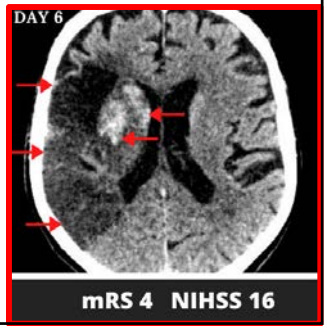


TIA is not considered a cerebral emergency



Dzierwa et al. 2022 (at review)

Asymptomatic carotid stenosis 2022

Five Year Outcomes in Men Screened for Carotid Artery Stenosis at 65 Years of Age: A Population Based Cohort Study

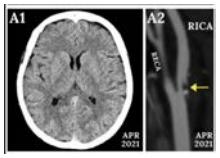
Dominika Högberg [a,b,*], Martin Björck [a], Kevin Mani [a], Sverker Svensjö [b,c], Anders Wanhainen [a]
[a] Department of Surgical Sciences, Section of Vascular Surgery, Uppsala University, Uppsala, Sweden
[b] Department of Hybrid and Interventional Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden
[c] Department of Surgery, Falun County Hospital, Falun, Sweden

Among men participating in carotid screening at age 65, 3,057 were re-screened at age 70

Symptomatic transformation
occurred in
42% participants
with 80-99% stenosis !

Eur J Vasc Endovasc Surg 2019

Asymptomatic carotid stenosis 2022



2023^{+}

– time to **STOP** "OBSERVING"

the natural history of the disease?

in increased-risk individuals

Asymptomatic carotid stenosis 2022

A/S Carotid Stenosis Decision-making

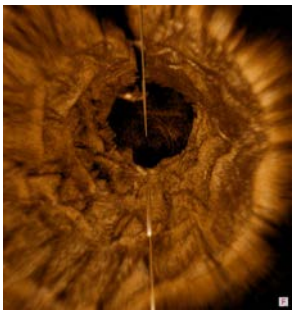
Podlasek , Grunwald, Musialek 2021

Carotid 'mesh' stents 2022

Gore Hybrid Stent | Casper/RoadSaver | CGuard

P Musialek, G deDonato
Carotid Artery Revascularization Using the Endovascular Route
In: **Carotid Interventions - Practical Guide 2022** (in press)

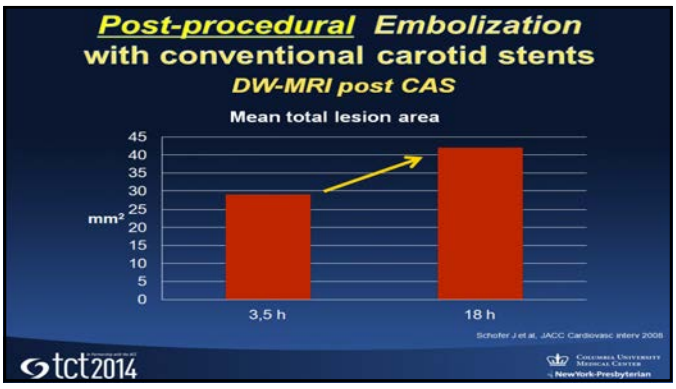
The Problem of Conventional (Single-layer) Carotid Stents



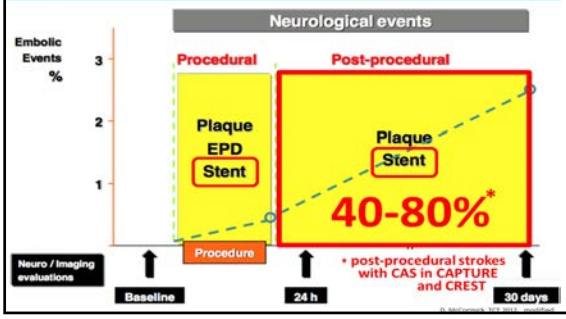
P Musialek, G deDonato
Carotid Artery Revascularization Using the Endovascular Route
In: **Carotid Interventions - Practical Guide 2022** (in press)

Post-procedural Embolization with conventional carotid stents

DW-MRI post CAS



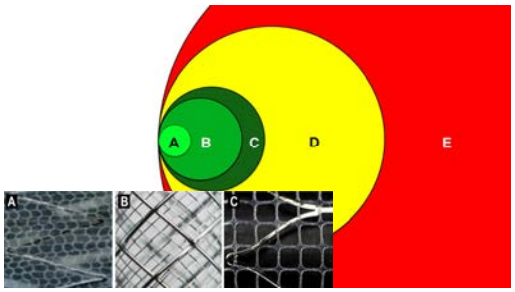
Timing of neuro-embolic events after CAS



Carotid 'mesh' stents 2022

Name	RoadSaver *aka* Casper	Gore® Carotid Stent	CGuard™ Embolic Prevention Stent
Stent frame	closed-cell Nitinol	open-cell Nitinol	open-cell Nitinol
Mesh position in relation to frame	inside	outside	outside
Mesh material	Nitinol	PTFE	PET
Mesh structure	braided	inter-woven	single-fiber knitted
Pore size	375 µm	500 µm	150 - 180 µm

Carotid 'mesh' stents vs. First-generation stents: The pore size



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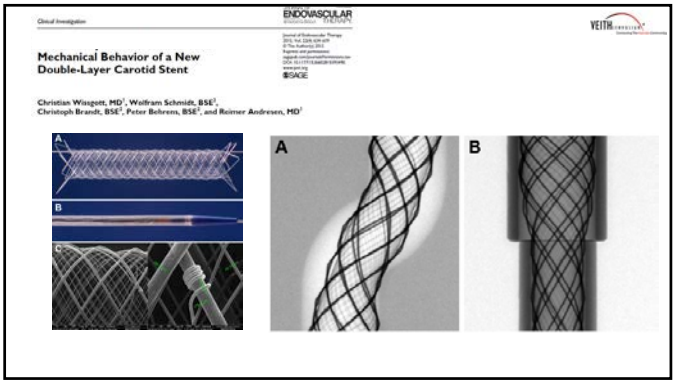
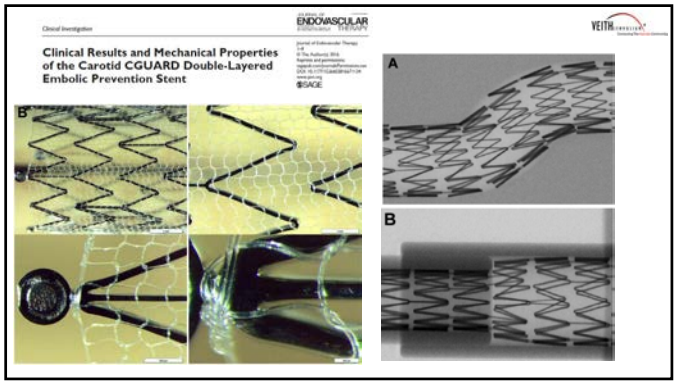
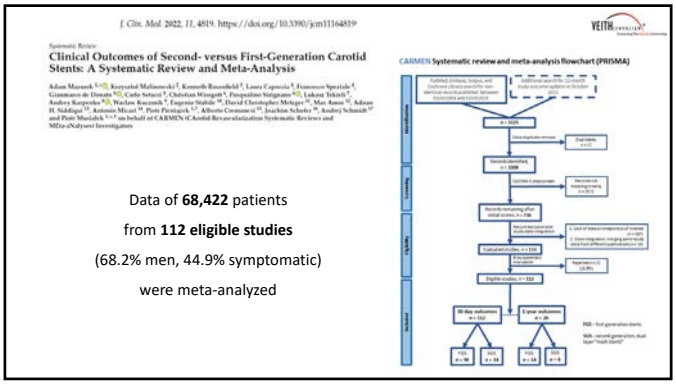
not marketed







Data of **68,422** patients

from **112 eligible studies**

(68.2% men, 44.9% symptomatic)

were meta-analyzed

CARMEN SGS vs FGS Meta-Analysis 2022: Patient Characteristics

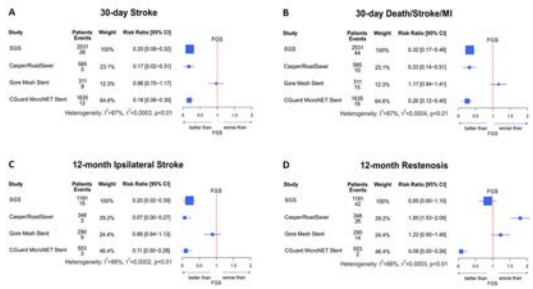
Table 1. Clinical characteristics of meta-analyzed groups.

	FGS	SGS	*p* FGS vs SGS	Open-Cell FGS	Closed-Cell FGS	*p* Open-Cell vs. Closed-Cell FGS	*p* Open-Cell FGS vs. SGS	*p* Closed-Cell FGS vs. SGS
No. of studies	98	14	-	29	12	-	-	-
No. of patients	65,891	2531	-	21,353	7598	-	-	-
Age (SD)	70.1 (2.8)	71.9 (2.5)	0.02	70.4 (3.2)	69.3 (3.4)	0.60	0.32	0.13
Male	68%	73%	0.046	68%	66%	0.92	0.12	0.15
Symptomatic	45%	41%	0.40	43%	50%	0.61	0.94	0.45
Diabetic	34%	32%	0.43	35%	36%	0.71	0.88	0.61
CAD	51%	47%	0.55	48%	55%	0.59	0.98	0.98
AF	6%	3%	0.37	3%	ND	-	0.99	-
Contralateral occlusion	10%	16%	0.22	10%	12%	0.87	0.63	0.99
Embolic protection in CAS	95.8%	97.1%	0.656	97.3%	99.4%	0.09	0.85	0.2

Data are shown as absolute number, mean (SD), or weighted proportion (%) as appropriate.

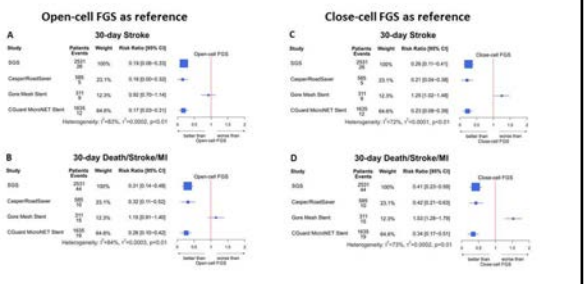
Mazurek… Musialek 2022

CARMEN SGS vs FGS Meta-Analysis 2022: Main Findings



Mazurek… Musialek 2022

CARMEN SGS vs FGS Meta-Analysis 2022: Main Findings



Mazurek… Musialek 2022

CARMEN SGS vs FGS Meta-Analysis 2022: Main Findings

Table 2. The 30-day and 12-month event rates by stent type (random-effect model).

	FGS	SGS	Casper/ Roadsaver	Gore	CGuard
30-day Stroke (%) (95% CI)	3.01 (2.63–3.38)	0.60 (0.28–0.92)	0.50 (0–1.15)	2.89 (1.03–4.76)	0.54 (0.17–0.92)
30-day Death/Stroke/MI (%) (95% CI)	4.11 (3.65–4.56)	1.30 (0.64–1.96)	1.33 (0–2.66)	4.82 (2.44–7.2)	1.08 (0.55–1.60)
12-mo Ipsilateral Stroke (%) (95% CI)	3.51 (2.52–4.50)	0.7 (0–1.47)	0.26 (0–1.27)	3.1 (1.11–5.1)	0.38 (0–0.9)
12-mo Restenosis (%) (95% CI)	3.97 (0.28–5.14)	3.38 (1.39–5.37)	7.16 (5.45–9.86)	4.83 (2.36–7.29)	0.34 (0–0.82)
12-mo Ipsilateral Stroke/Restenosis (%) (95% CI)	8.15 (6.63–9.96)	5.12 (3.14–6.10)	7.86 (5.04–10.68)	7.93 (4.82–11.04)	0.73 (0–1.44)

Mazurek… Musialek 2022

CARMEN SGS vs FGS Meta-Analysis 2022: Main Findings

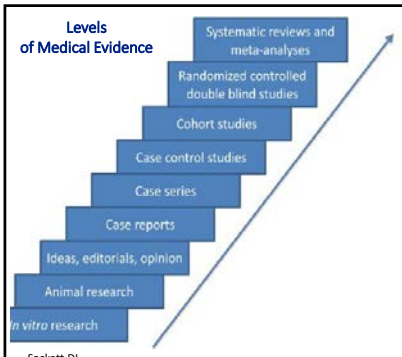
J. Clin. Med. 2022, 11, 4819 6 of 24

Table 3. The *p*-values for 30-day and 12-mo SGS event rate comparisons against FGS (for the meta-analytic model raw event rates, see Table 2).

	p FGS vs. SGS	*p* FGS vs. Roadsaver	*p* FGS vs. Gore	*p* FGS vs. CGuard
30-day Stroke	<0.001	0.011	0.954	0.002
30-day Death/Stroke/MI	<0.001	0.022	0.750	<0.001
12-mo Ipsilateral Stroke	0.001	0.007	0.846	0.013
12-mo Restenosis	0.569	0.041	0.658	0.009
12-mo Ipsilateral Stroke/Restenosis	0.027	0.998	0.961	0.001

Mazurek… Musialek 2022

Levels of Medical Evidence



Sackett DL

P Musialek @ VEITH 2022

J. Clin. Med. 2022, 11, 4819. https://doi.org/10.3390/jcm11164819

Clinical Outcomes of Second- versus First-Generation Carotid Stents: A Systematic Review and Meta-Analysis

Data of **68,422** patients

from **112 eligible studies**

(68.2% men, 44.9% symptomatic)

- SGSs significantly improved 30-day clinical outcomes compared with closed-cell FGS (30-day stroke 0.6% vs. 2.32%, p=0.014; DSM 1.3% vs. 3.15%, p < 0.01).
- Among SGS, both Casper/Roadsaver and CGuard reduced 30-day DSM (by 2.78 and 3.03 absolute percent, p=0.02 and p<0.001), whereas the Gore stent was neutral.
- At 12 months, in relation to FGS, Casper/Roadsaver reduced IS (–3.25%, p < 0.05) but increased ISR (+3.19%, p = 0.04), CGuard showed a reduction in both IS and ISR (–3.13%, –3.63%; p=0.01, p<0.01), whereas the Gore stent was neutral.

Mazurek… Musialek 2022

J. Clin. Med. 2022, 11, 4819. https://doi.org/10.3390/jcm11164819

Clinical Outcomes of Second- versus First-Generation Carotid Stents: A Systematic Review and Meta-Analysis

Data of **68,422** patients

from **112 eligible studies**

(68.2% men, 44.9% symptomatic)

- Pooled SGS use was associated with improved short- and long-term clinical results of CAS.
- Individual SGS types, however, differed significantly in their outcomes, indicating a lack of a "mesh stent" class effect.
- Findings from this meta-analysis may provide clinically relevant information.

Mazurek… Musialek 2022

CEA vs SGS meta-analysis

Major RCTs Involving CEA

1. CEA pooled data

SAPPHIRE
EVA 3S
SPACE-1
ICSS
CREST
ACST-1
ACT-1
Manhaim
SPACE-2

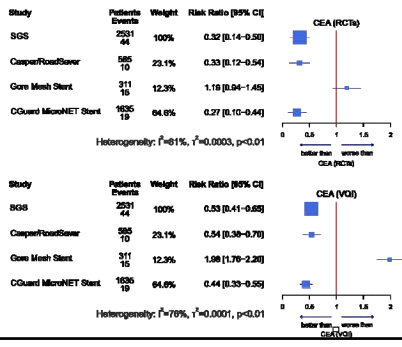
CEA in Contemporary Clinical Practice

2. CEA in Vascular Quality Initiative (VQI) database*

* Dakour-Aridi H, et al. *Ann Vasc Surg.* 2020;65:1-9
Columbo JA, et al. *J Vasc Surg.* 2019;69:104-109

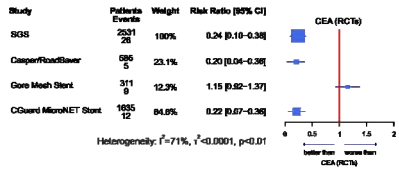
CARMEN Collaborators 2022

30-day Death/Stroke/MI



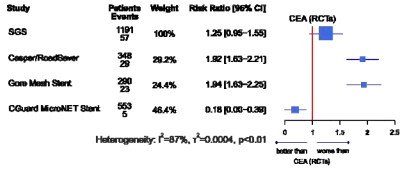
CARMEN Collaborators 2022

30-day Stroke

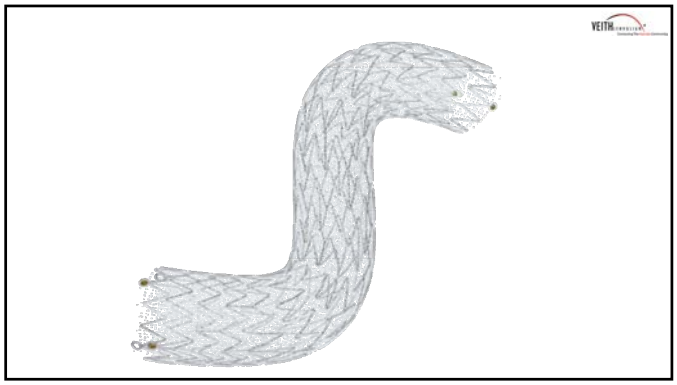


CARMEN Collaborators 2022

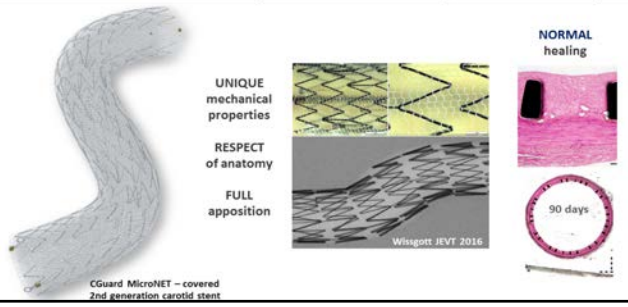
12-month Ipsilateral Stroke/Restenosis



CARMEN Collaborators 2022



The MOST 'open' amongst open-cell stents (metallic FRAME) & the MOST 'close' amongst close-cell stents (MicroNet mesh)



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

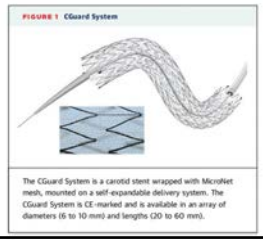
The CGuard CARENET Trial
(Carotid Embolic Protection Using MicroNet)

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

DW-MRI: prior to CAS, 48h post-procedure, and at 30 days

- minimized peri-procedural cerebral embolism
- eliminated post-procedural embolism

JACC Intv 2015



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

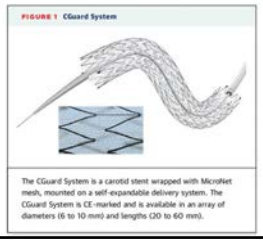
The CGuard CARENET Trial
(Carotid Embolic Protection Using MicroNet)

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

DW-MRI: prior to CAS, 48h post-procedure, and at 30 days

- minimized peri-procedural cerebral embolism
- eliminated post-procedural embolism

JACC Intv 2015



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JACC Intv 2015

FIGURE 1 CGuard System

The CGuard System is a carotid stent wrapped with MicroNet mesh, mounted on a self-expandable delivery system. The CGuard System is CE-marked and is available in an array of diameters (6 to 10 mm) and lengths (20 to 60 mm).

OK…

….”but”

…. long-term?

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

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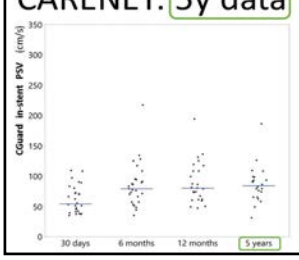
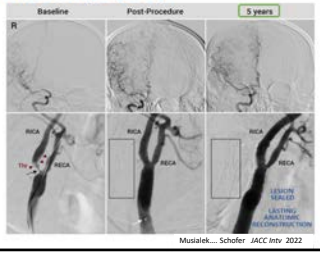
JACC Intv 2015

CARENET: 5y data

JACC Intv 2022





Musialek…. Schofer *JACC Intv* 2022

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

The CGuard CARENET Trial
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DW-MRI: prior to CAS, 48h post-procedure, and at 30 days

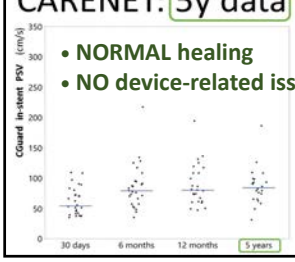
- minimized peri-procedural cerebral embolism
- eliminated post-procedural embolism

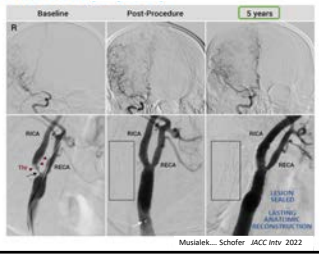
JACC Intv 2015

CARENET: 5y data

JACC Intv 2022

- NORMAL healing
- NO device-related issues

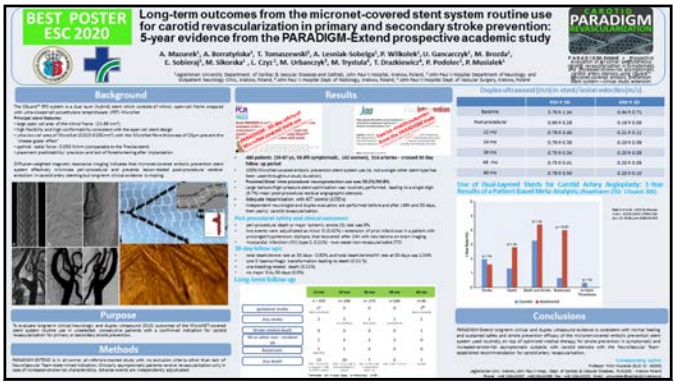




Musialek…. Schofer *JACC Intv* 2022

BEST POSTER ESC 2020

Long-term outcomes from the micronet-covered stent system routine use for carotid revascularization in primary and secondary stroke prevention: 5-year evidence from the PARADIGM-Extend prospective academic study



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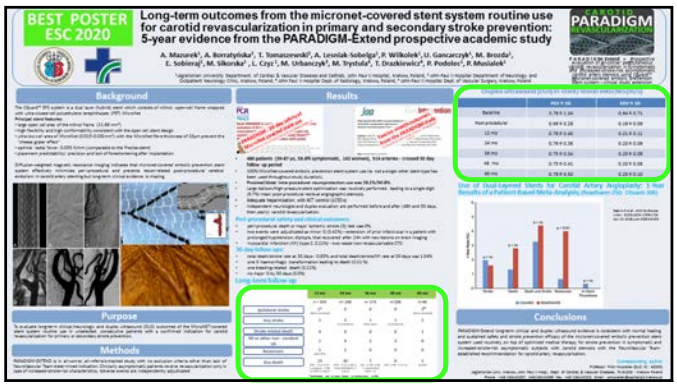
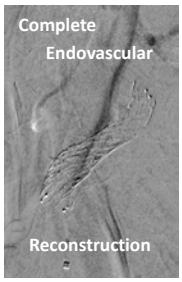
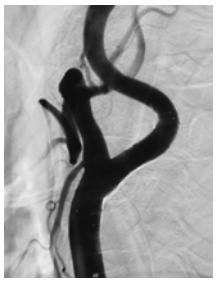


”Coronary-like”
CAS Optimization

Reconstructing Anatomy





MicroNet Embolic Prevention

PARADIGM-500

Study Population:

500 Consecutive, Unselected, Patients with

- SYMPTOMATIC

or

- Increased-Stroke-Risk ASYMPTOMATIC

atherosclerotic carotid stenosis

PARADIGM-500

Hypotheses:

#1 30-d Death/Stroke **<1%**

#2 12-mo procedure*/device-related events **<1%**

*inclusive of any failure to prevent ipsilateral carotid-related stroke

PARADIGM-500

Externally – monitored (CRO)
ISO14155(v2020)-compatible

Methods:

- Primarily-intended TF* CAS
- "Tailored" use of distal / proximal EPD
- Routine coronary-like stent optimization

*other access routes Protocol-accepted if/when TF unfeasible or failed

Mazurek… Musialek 2022 *(manuscript in preparation)*

PARADIGM-500

Demographic characteristics of subjects

Variable	Measure/Level	Value
Age	n	500
	Mean(±SD)	69.96 (±8.14)
Gender:	n	500
	Female	137 (27.4%)
	Male	363 (72.6%)
Symptomatic status	n	500
	no	201 (40.2%)
	yes	299 (59.8%)

Medical history

	PARADIGM 500 (n=500)
Prior CABG	56 (11%)
Prior PCI	137 (27%)
Prior myocardial infarction	152 (30%)
Atrial fibrillation	68 (13%)
Previous neck or chest radiotherapy	35 (7%)

Mazurek… Musialek 2022 *(manuscript in preparation)*

PARADIGM-500

 # Arteries/Procedures – 533

TF	**– 514**	**96.4%**
TR/TCR	**– 19**	**3.6%**
Prox EPD	**– 259**	**48.6%**
Dist EPD	**– 274**	**51.4%**

Study device use – 100%

Mazurek… Musialek 2022 *(manuscript in preparation)*

	Total	Asymptomatic	Symptomatic	p
n (%)	533	219 (41.1)	314 (58.9)	
RICA (%)	261	112 (42.9)	149 (57.1)	0.402
LICA (%)	272	107 (39.3)	165 (60.7)	0.402
Predilatation, n (%)	459 (86.1)	194 (88.6)	265 (84.4)	0.169
Balloon diameter range (min-max)	1.5-6.0	2.0-6.0	1.5-5.5	
Mean balloon diameter, ± SD	3.46 (±0.72)	3.63 (±0.68)	3.34 (±0.73)	<0.001
MCS Stent size*				
6.0x40 mm, n (%)	1 (0.19)	1 (0.46)	0 (0)	0.231
7.0x20 mm, n (%)	5 (0.94)	5 (2.28)	0 (0)	0.007
7.0x30 mm, n (%)	45 (8.44)	14 (6.39)	31 (9.87)	0.155
7.0x40 mm, n (%)	7 (1.31)	3 (1.37)	4 (1.27)	0.924
8.0x20 mm, n (%)	5 (0.94)	4 (1.83)	1 (0.32)	0.076
8.0x30 mm, n (%)	137 (25.70)	60 (27.40)	77 (24.52)	0.455
8.0x40 mm, n (%)	52 (9.76)	17 (7.76)	35 (11.15)	0.195
9.0x20 mm, n (%)	6 (1.13)	2 (0.91)	4 (1.27)	0.698
9.0x30 mm, n (%)	123 (23.08)	54 (24.66)	69 (21.98)	0.469
9.0x40 mm, n (%)	63 (11.82)	24 (10.96)	39 (12.42)	0.607
10.0x20 mm, n (%)	9 (1.69)	2 (0.91)	7 (2.23)	0.246
10.0x30 mm, n (%)	39 (7.32)	14 (6.39)	25 (7.96)	0.494
10.0x40 mm, n (%)	37 (6.94)	17 (7.76)	20 (6.37)	0.534
10.0x60 mm, n (%)	4 (0.75)	2 (0.91)	2 (0.64)	0.716
>1 stent use, n (%)	18 (3.38)	5 (2.28)	13 (4.14)	0.243
Stent other than MCS, n (%)	0	0	0	NA

Mazurek… Musialek 2022 *(manuscript in preparation)*

PARADIGM-500

	Total	Asymptomatic	Symptomatic	p
Post-dilatation, n (%)				
Balloon diameter range, (min-max)#	3.5-8.0	4.0-8.0	3.5-8.0	0.334
Mean balloon diameter, ± SD#	5.42 (±0.61)	5.45 (±0.62)	5.40 (±0.61)	0.334
Balloon ≥5.5mm, n (%)#	308 (57.79)	129 (58.90)	179 (57.01)	0.663
Balloon ≥6.0mm, n (%)#	130 (24.39)	55 (25.11)	75 (23.89)	0.745
Balloon ≥6.5mm, n (%)#	38 (5.25)	15 (6.85)	23 (7.32)	0.834
Balloon ≥7.0mm, n (%)#	21 (3.94)	11 (5.02)	10 (3.18)	0.283

Mazurek… Musialek 2022 *(manuscript in preparation)*

PARADIGM-500

	Total	Asymtomatic	Symptomatic	p
n (%)	533	219	314	
Baseline DUS parameters				
PSV (m/s), (±SD)	3.47 (±1.34)	3.36 (±1.22)	3.56 (±1.41)	0.099
EDV (m/s), (±SD)	1.20 (±0.68)	1.11 (±0.61)	1.26 (±0.72)	0.010
30-day DUS in-stent velocities				
PSV (m/s), (±SD)	0.69 (±0.27)	0.72 (±0.30)	0.67 (±0.25)	0.032
EDV (m/s), (±SD)	0.19 (±0.10)	0.20 (±0.09)	0.19 (±0.11)	0.138
12-month DUS in-stent velocities				
PSV (m/s), (±SD)	0.77 (±0.38)	0.79 (±0.33)	0.74 (±0.41)	0.134
EDV (m/s), (±SD)	0.22 (±0.12)	0.22 (±0.11)	0.21 (±0.12)	0.330

PSV – peak systolic velocity, EDV – end-diastolic velocity

Mazurek… Musialek 2022 *(manuscript in preparation)*

PARADIGM-500

Adverse Clinical Events in PARADIGM 500

PARADIGM 500 (n=500)	Periprocedural	48 to 30 days	Up to 30 days (cumulative)	30d to 12 months	Up to 12 months (cumulative)
MACCE (MI, any stroke, death)	3	2	5	19	24
MI	1	0	1	2	3
major stroke – ipsilateral	**0**	**0**	**0**	**0**	**0**
major stroke – contralateral	0	0	0	1	1
minor stroke – ipsilateral	**2**	**0**	**2**	**0**	**2**
minor stroke – contralateral	0	0	0	0	0
retinal stroke	0	0	0	1	1
death	0	2	2	16	18

Deaths:
sepsis/urosepsis - 2, MI -1, PE -1 , CHF -1, SCD -2, brain stem stroke -1, cancer -4, bleeding -1, multiple organ failure -1, sepsis -1, COVID-19 -3

ISR: 2
1 asympt. occlusion – larynx cancer relapse with RadioTx 2 months after CAS, 1 asymptomatic restenosis @12 – treated with DEB-PTA (no relapse)

Mazurek… Musialek 2022 *(manuscript in preparation)*

PARADIGM-500

OUTCOMES

Device success	533/533	100 %
Procedure success	529/533	99.2%
30-d Death/Stroke	4/533	0.75%
30-d Death/Stroke/MI	5/533	0.94%
12-mo freedom from ipsi stroke	480/482	99.6%
12-mo freedom from ISR/TLR	480/482	99.6%
12-mo freedom from procedure*/device-related events	478/482	99.2%

*inclusive of any failure to prevent ipsilateral carotid-related stroke (**4 events**: 2 perip. minor strokes, 1 bleeding-related death, 1 TLR)

" OK

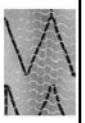
…but

Give us a randomized study"

Randomized Controlled Trial

The CREST Study stent

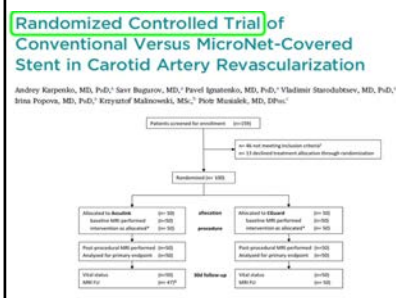
MicroNet-Covered Stent

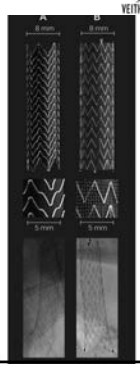


OCT Images in: P Musialek, G deDonato
Carotid Artery Revascularization Using the Endovascular Route
In: Carotid Interventions - Practical Guide 2022 (in press)

Randomized Controlled Trial of Conventional Versus MicroNet-Covered Stent in Carotid Artery Revascularization

Andrey Karpenko, MD, PsD,[1] Savr Bugurov, MD,[2] Pavel Ignatenko, MD, PsD,[3] Vladimir Starodubtsev, MD, PsD,[3] Irina Popova, MD, PsD,[3] Krzysztof Malinowski, MSc,[4] Piotr Musialek, MD, DPsc[5]





JACC: CARDIOVASCULAR INTERVENTIONS VOL. 14, NO. 21, 2021

Randomized Controlled Trial of conventional versus Micronet-covered stent use in percutaneous neuroprotected carotid artery revascularization:

Peri-procedural and 30-day **diffusion-weighted magnetic resonance (DWI) imaging** and clinical outcomes

HEAD-TO-HEAD 100 consecutive increased-risk patients (25% symptomatic) **RANDOMIZED 1 : 1**

Distal EPD (Emboshield) in all

MicroNET-Covered open-cell nitinol frame 2nd generation stent

vs.

Conventional (workhorse) open-cell nitinol 1st generation stent

JACC Intv 2021

JACC: CARDIOVASCULAR INTERVENTIONS
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Randomized Controlled Trial of Conventional Versus MicroNet-Covered Stent in Carotid Artery Revascularization

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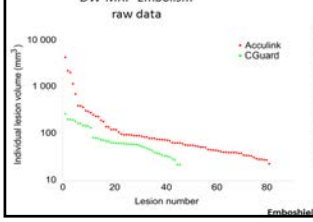
Embolic Load to the Brain

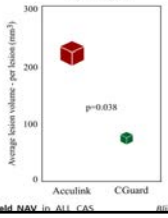
Acculink (CREST study device)

MicroNet-Covered Stent - CGuard

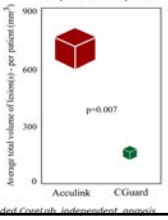
DW-MRI Embolism
raw data



Per Lesion



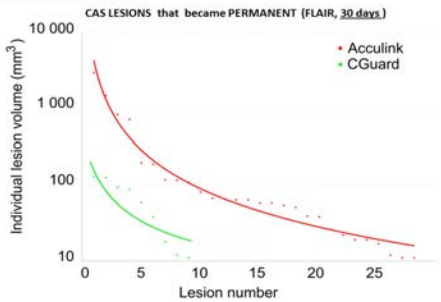
Per Ipsil Haemisphere



Emboshield NAV in ALL CAS *Blinded CoreLab independent analysis*

Randomized Controlled Trial of Conventional Versus MicroNet-Covered Stent in Carotid Artery Revascularization

CAS LESIONS that became PERMANENT (FLAIR, 30 days)



JACC Intv 2021

Randomized Controlled Trial of Conventional Versus MicroNet-Covered Stent in Carotid Artery Revascularization

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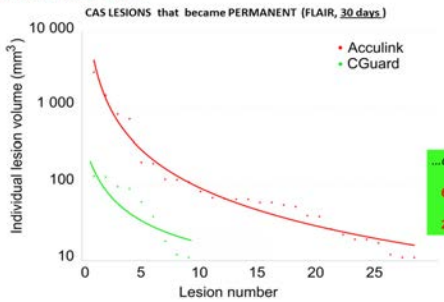
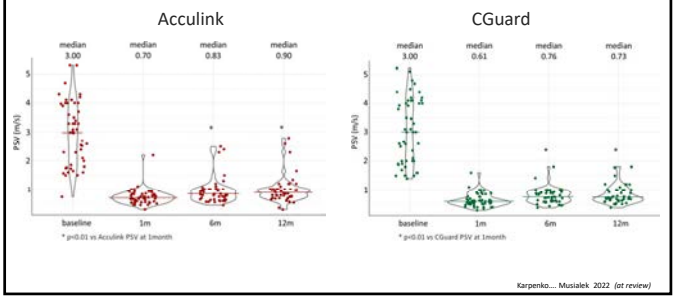


JACC Intv 2021

Randomized Controlled Trial of Conventional Versus MicroNet-Covered Stent in Carotid Artery Revascularization

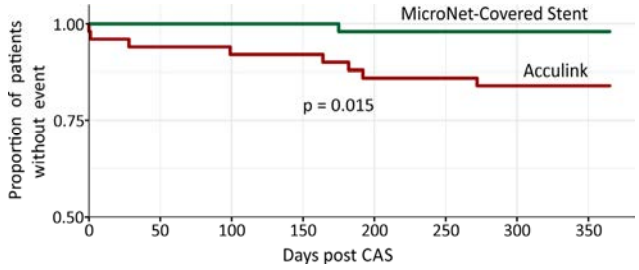
12-month data



Karpenko.... Musialek 2022 *(at review)*

Randomized Controlled Trial of Conventional Versus MicroNet-Covered Stent in Carotid Artery Revascularization

12-month data



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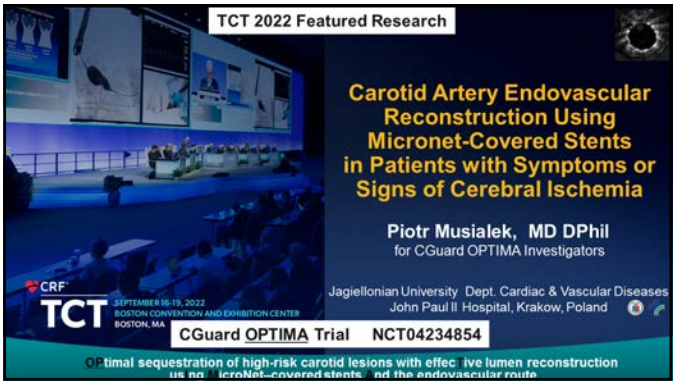


Methods: IIS

- Multi-centric
- Multi-specialty (IC, VS, A/VM, IR/INR)
- Muli-national

8 countries

- All-Comer Patients
  with Symptoms or Signs of cerebral injury, no age or other limits
- Classic lesion severity criteria (50% / 80%)
- EPD recommended
- Vascular access by Operator choice
- Study Device angiographic optimization recommended
- Final IVUS run (motorized pullback 1mm/s)
- Standard Medications, intraprocedural ACT >250s (IFU)

Angiographic Core Lab & IVUS Core Lab

CRF TCT

P Musialek @ TCT 2022

Study Population

	Total study group	Carotid-related cerebral symptoms*	Silent cerebral infarct#	p
n (%)	339 (100)	257 (75.81)	82 (24.19)	-
Age	69.77±8.39	68.5±8.69	69.59±7.4	0.272
Female	108 (31.86)	79 (30.74)	29 (35.37)	0.434
Stroke	154 (45.43)	154 (59.92)	0 (0)	-
TIA	91 (26.84)	91 (35.41)	0 (0)	-
Retinal stroke	3 (0.88)	3 (1.17)	0 (0)	-
A. Fugax	9 (2.65)	9 (3.5)	0 (0)	-
Diabetes mellitus	165 (48.67)	128 (49.81)	37 (45.12)	0.460
Hypertension	294 (86.72)	223 (86.77)	71 (86.59)	0.966
Hyperlipidemia	282 (83.19)	215 (83.66)	67 (81.71)	0.681
AF	47 (13.86)	36 (14.01)	11 (13.41)	0.892
Smoker[$]	215 (63.42)	162 (63.04)	53 (64.63)	0.793
CAD	178 (52.51)	131 (50.97)	47 (57.32)	0.316
h/o MI	83 (24.48)	59 (22.96)	24 (29.27)	0.247
LVEF	57.37±9.29	57.43±9.45	57.19±8.83	0.841
LVEF<45%	24 (7.08)	17 (6.61)	7 (8.54)	0.555
h/o PCI or CABG	121 (35.69)	84 (32.68)	37 (45.12)	0.041
PAD^	74 (21.82)	54 (21.01)	20 (24.39)	0.519
h/o contralateral CEA or CAS	31 (9.14)	24 (9.34)	7 (8.54)	0.826
h/o chest/neck radiotherapy	15 (4.42)	12 (4.67)	3 (3.66)	0.698
eGFR	72.87±20.71	73.1±19.19	72.18±24.87	0.761
eGFR 31-59 ml/kg min	108 (31.86)	87 (33.85)	21 (25.61)	0.163

CRF TCT

CGurad OPTIMA Trial

P Musialek @ TCT 2022

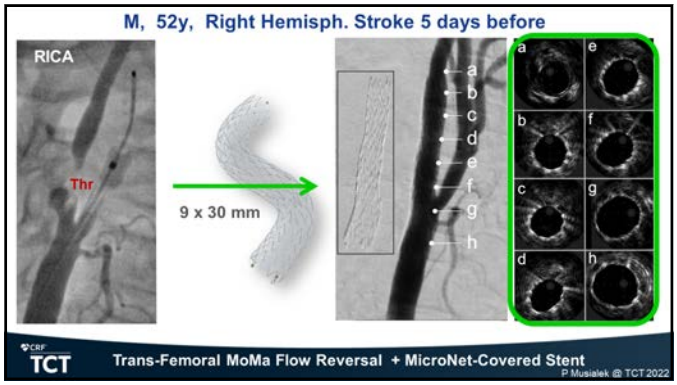
Baseline Characteristics of Lesions

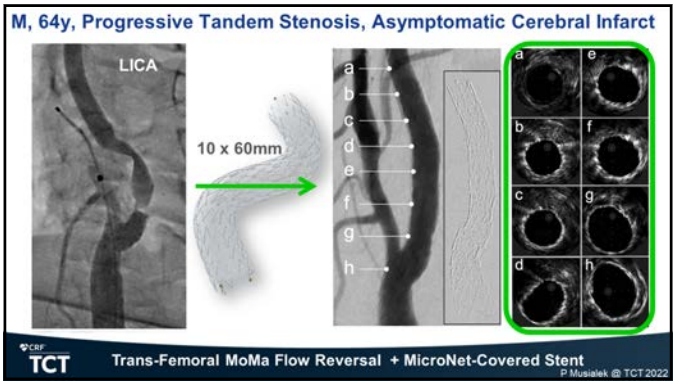
	Total	Carotid-related cerebral symptoms*	Clinically silent cerebral infarct#	p
n (%)	352	257	95	-
RICA	169 (48.01)	128 (49.81)	41 (43.16)	0.145
LICA	183 (51.99)	129 (50.19)	54 (56.84)	0.149
DUS^				
PSV (cm/s)	3.36±1.23	3.38±1.29	3.30±1.09	0.633
EDV (cm/s)	1.15±0.69	1.18±0.75	1.07±0.51	0.176
Angiography#				
DS by QCA (%)	77.90±12.16	78.51±12.61	76.20±10.70	0.100
≥90% DS by QCA	71 (20.17)	56 (21.79)	15 (15.79)	0.213
Thrombus-containing	47 (13.35)	41 (15.95)	6 (6.32)	0.018
Ulcerated	195 (55.40)	143 (55.64)	52 (54.74)	0.879
Severely calcific[$]	28 (7.95)	20 (7.78)	8 (8.42)	0.844
ECA patent	347 (98.57)	254 (98.83)	93 (97.89)	0.440

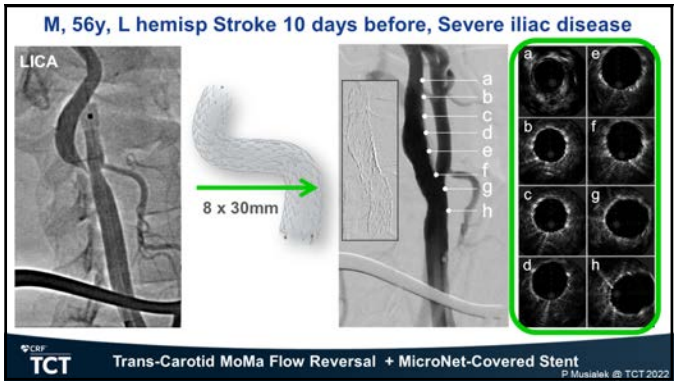
CRF TCT

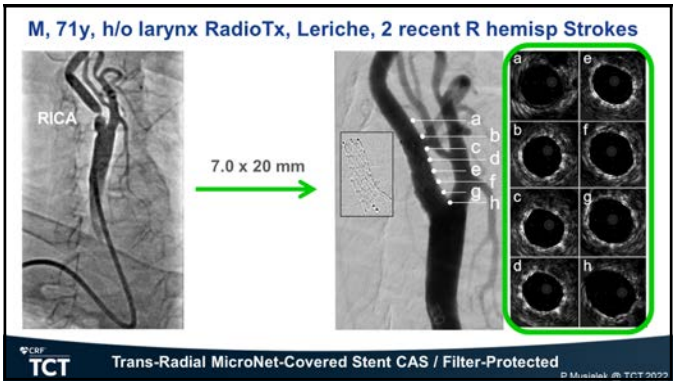
CGurad OPTIMA Trial

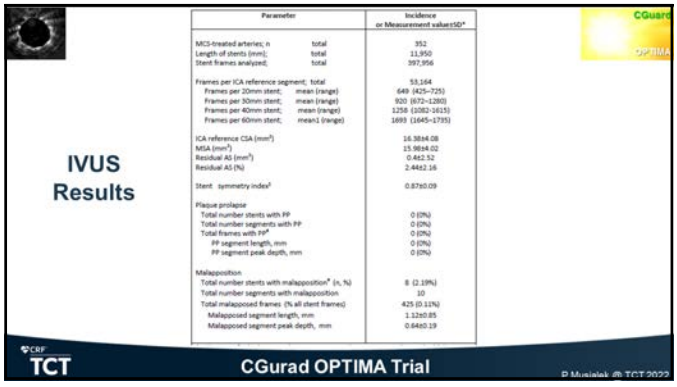
P Musialek @ TCT 2022

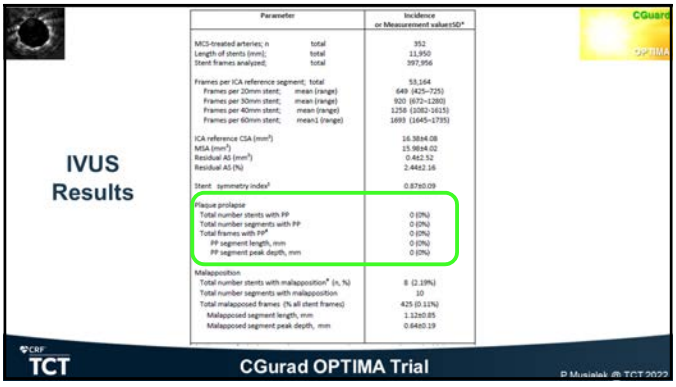

M, 52y, Right Hemisph. Stroke 5 days before
RICA
Thr
9 x 30 mm
a
b
c
d
e
f
g
h
TCT
Trans-Femoral MoMa Flow Reversal + MicroNet-Covered Stent
P Musialek @ TCT 2022


M, 64y, Progressive Tandem Stenosis, Asymptomatic Cerebral Infarct
LICA
10 x 60mm
a
b
c
d
e
f
g
h
TCT
Trans-Femoral MoMa Flow Reversal + MicroNet-Covered Stent
P Musialek @ TCT 2022


M, 56y, L hemisp Stroke 10 days before, Severe iliac disease
LICA
8 x 30mm
a
b
c
d
e
f
g
h
TCT
Trans-Carotid MoMa Flow Reversal + MicroNet-Covered Stent
P Musialek @ TCT 2022


M, 71y, h/o larynx RadioTx, Leriche, 2 recent R hemisp Strokes
RICA
7.0 x 20 mm
a
b
c
d
e
f
g
h
TCT
Trans-Radial MicroNet-Covered Stent CAS / Filter-Protected


IVUS Results
Parameter
Incidence or Measurement value±SD*
MCI-treated arteries; n total 352
Length of stents (mm); total 11,950
Stent frames analyzed; total 397,956
Frames per ICA reference segment; total 53,164
Frames per 20mm stent; mean (range) 649 (425–725)
Frames per 30mm stent; mean (range) 920 (672–1280)
Frames per 40mm stent; mean (range) 1258 (1082–1615)
Frames per 60mm stent; mean1 (range) 1693 (1645–1735)
ICA reference CSA (mm²) 16.38±4.08
MSA (mm²) 15.98±4.02
Residual AS (mm²) 0.46±2.52
Residual AS (%) 2.44±2.16
Stent symmetry index² 0.87±0.09
Plaque prolapse
Total number stents with PP 0 (0%)
Total number segments with PP 0 (0%)
Total frames with PP² 0 (0%)
PP segment length, mm 0 (0%)
PP segment peak depth, mm 0 (0%)
Malapposition
Total number stents with malapposition² (n, %) 8 (2.19%)
Total number segments with malapposition 10
Total malapposed frames (% all stent frames) 425 (0.11%)
Malapposed segment length, mm 1.12±0.85
Malapposed segment peak depth, mm 0.64±0.19
CGuard
OPTIMA
TCT
CGurad OPTIMA Trial
P Musialek @ TCT 2022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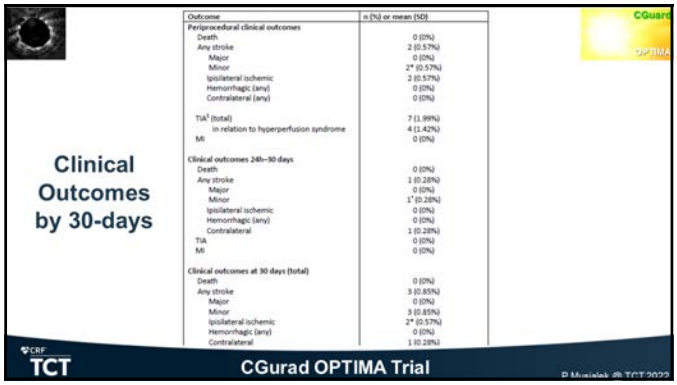
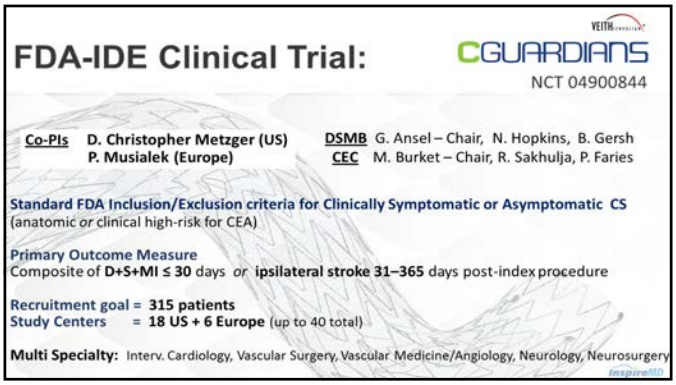


Outcome	n (%) or mean (SD)
Periprocedural clinical outcomes	
Death	0 (0%)
Any stroke	2 (0.57%)
Major	0 (0%)
Minor	2* (0.57%)
Ipsilateral ischemic	2 (0.57%)
Hemorrhagic (any)	0 (0%)
Contralateral (any)	0 (0%)
TIA[1] (total)	7 (1.99%)
in relation to hyperperfusion syndrome	4 (1.42%)
MI	0 (0%)
Clinical outcomes 24h–30 days	
Death	0 (0%)
Any stroke	1 (0.28%)
Major	0 (0%)
Minor	1* (0.28%)
Ipsilateral ischemic	0 (0%)
Hemorrhagic (any)	0 (0%)
Contralateral	1 (0.28%)
TIA	0 (0%)
MI	0 (0%)
Clinical outcomes at 30 days (total)	
Death	0 (0%)
Any stroke	3 (0.85%)
Major	0 (0%)
Minor	3 (0.85%)
Ipsilateral ischemic	2* (0.57%)
Hemorrhagic (any)	0 (0%)
Contralateral	1 (0.28%)

" OK

…but

Give us a FDA Trial "

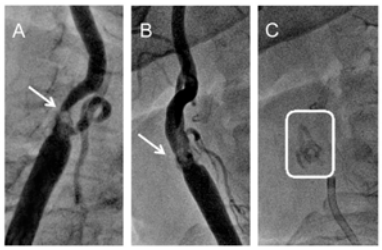


Challenging lesion subsets

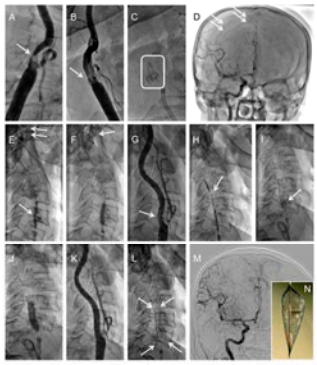
CALCIUM

P Musialek @ VEITH 2021

Highly-calcific carotid lesions endovascular management in symptomatic and increased-stroke-risk asymptomatic patients using the CGuard™ dual-layer carotid stent system: Analysis from the PARADIGM study



P Musialek @ VEITH 2022



HIGHLY-CALCIFIC
Carotid Artery Stenosis

Endovascular Reconstruction

(from PARADIGM-AC)

P Musialek @ VEITH 2022

Challenging lesion subsets

THROMBUS

P Musialek @ VEITH 2022

CGuard MicroNET Stent to treat acute ischaemic stroke

Haemodynamically critical, floating thrombotic lesion

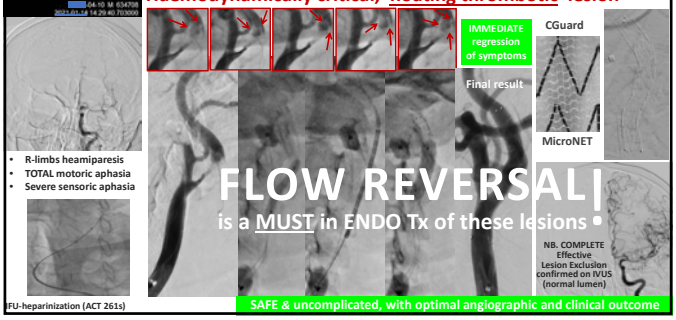
- R-limbs heamiparesis
- TOTAL motoric aphasia
- Severe sensoric aphasia

IFU-heparinization (ACT 261s)

SAFE & uncomplicated, with optimal angiographic and clinical outcome

CGuard MicroNET Stent to treat acute ischaemic stroke

Haemodynamically critical, floating thrombotic lesion



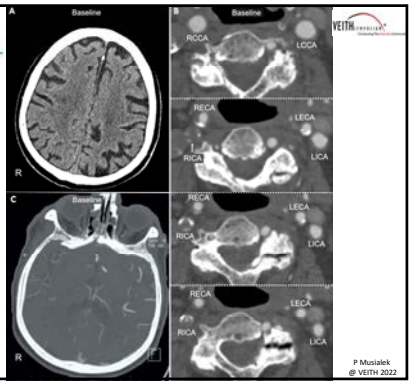
- R-limbs heamiparesis
- TOTAL motoric aphasia
- Severe sensoric aphasia

FLOW REVERSAL!
is a MUST in ENDO Tx of these lesions

IFU-heparinization (ACT 261s)

SAFE & uncomplicated, with optimal angiographic and clinical outcome

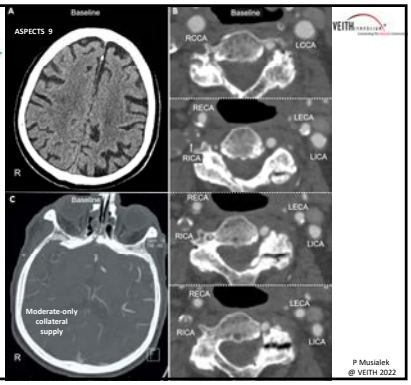
Novel Large-Diameter Controlled-Expansion Stentriever, Embolic-Prevention Stent and Flow Reversal in Large-Thrombus-Burden ICA Proximal Occlusion Stroke



JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 14, NO. 21, 2021

P Musialek @ VEITH 2022

Novel Large-Diameter Controlled-Expansion Stentriever, Embolic-Prevention Stent and Flow Reversal in Large-Thrombus-Burden ICA Proximal Occlusion Stroke



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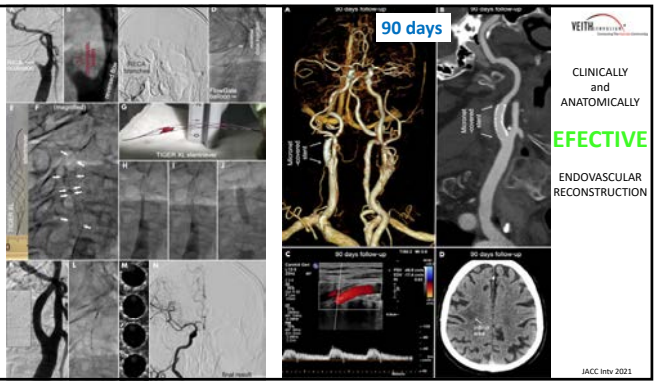


CLINICALLY and ANATOMICALLY

EFECTIVE

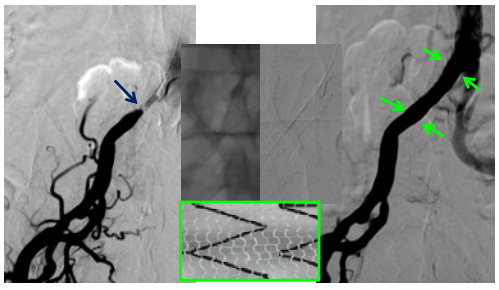
ENDOVASCULAR RECONSTRUCTION

JACC Intv 2021

High-Risk Lesions **beyond** the Carotids (FLOWGUARD)

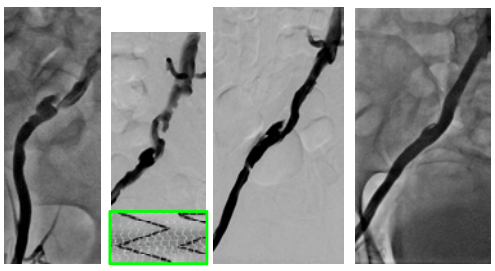
P Musialek @ VEITH 2022

Thrombus-containing/high-embolic risk lesions in iliacs or subclavians



P Musialek @ VEITH 2022

Thrombus-containing/high-embolic risk lesions in iliacs or subclavians



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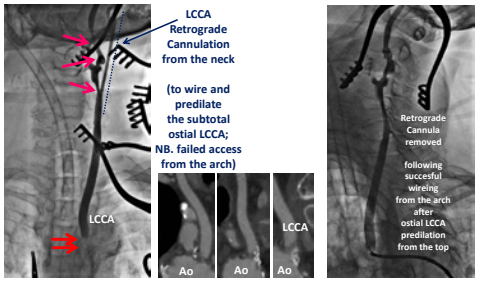
Ostial CCA lesions

(note adequate radial force and placement percision need)



Lady 68 yo, retinal TIAs followed by retinal stroke while on OMT (mother to cathlab nurse)

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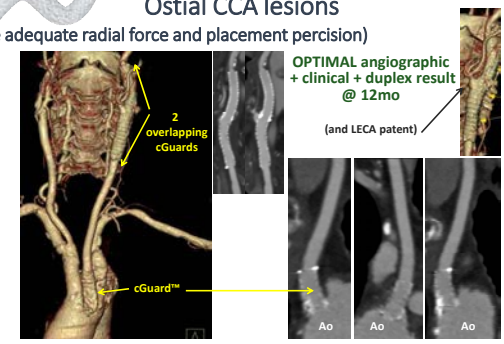
Ostial CCA lesions

(note adequate radial force and placement percision)



P Musialek @ VEITH 2022

Conventional Carotid Stent Design Permits Atherosclerotic Plaque In-Stent Progression

Precise Stent 5.0x30mm (implanted 2005)
increasing " in-stent restenosis" → 2016 SYMPTOMATIC

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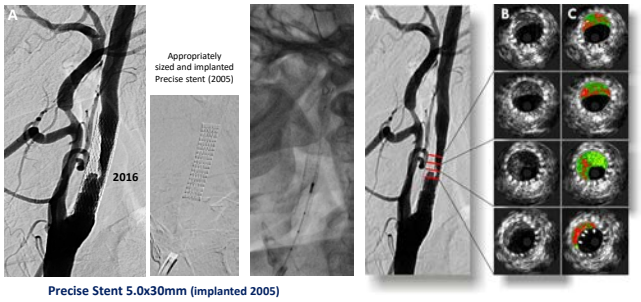
Conventional Carotid Stent Design Permits Atherosclerotic Plaque In-Stent Progression



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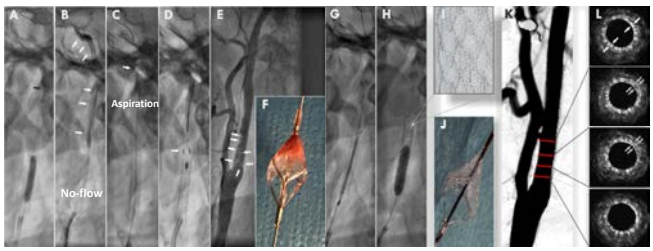
Tekieli et al. *Eur Heart J* 2021

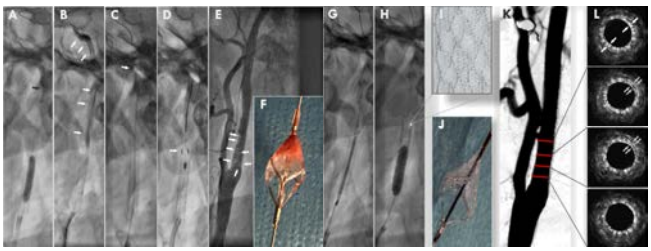
Conventional Carotid Stent Design Permits Atherosclerotic Plaque In-Stent Progression



→ TREATED with MICRONET-COVERED STENT **PLAQUE SEQUESTRATION** (2016)

Tekieli et al. *Eur Heart J* 2021

Conventional Carotid Stent Design Permits Atherosclerotic Plaque In-Stent Progression



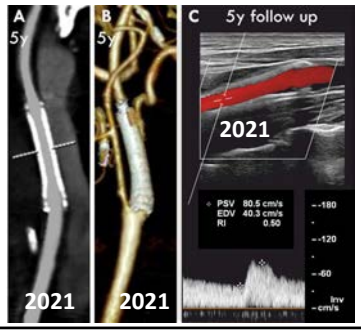
→ TREATED with MICRONET-COVERED STENT **PLAQUE SEQUESTRATION** (2016)

EFFECTIVE RECONSTRUCTION OF NORMAL ANATOMY

Tekieli et al. *Eur Heart J* 2021

Conventional Carotid Stent Design Permits Atherosclerotic Plaque In-Stent Progression
→ TREATED with MICRONET-COVERED STENT **PLAQUE SEQUESTRATION** (2016)

ANATOMIC & CLINICAL RESULT MAINTAINED LONG-TERM



PATIENT CURED

Tekieli et al. *Eur Heart J* 2021

Conventional Carotid Stent Design Permits Atherosclerotic Plaque In-Stent Progression
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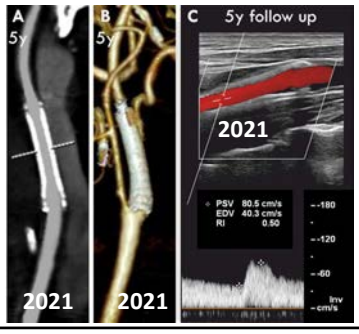

Tekieli et al. *Eur Heart J* 2021

Aneurysms: Physiological Healing (Flow-Divertion)

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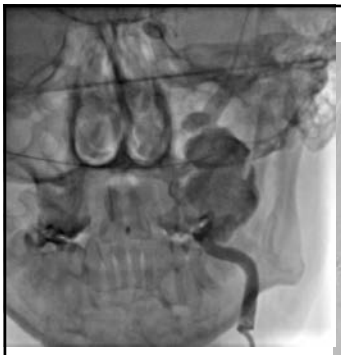
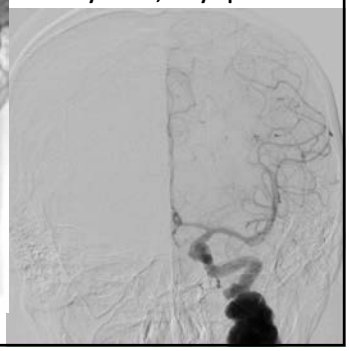
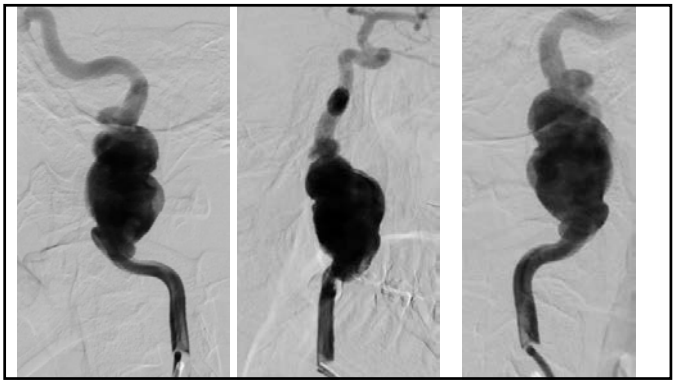
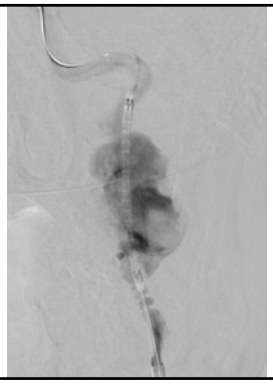


43 yo Man, h. symptomatic



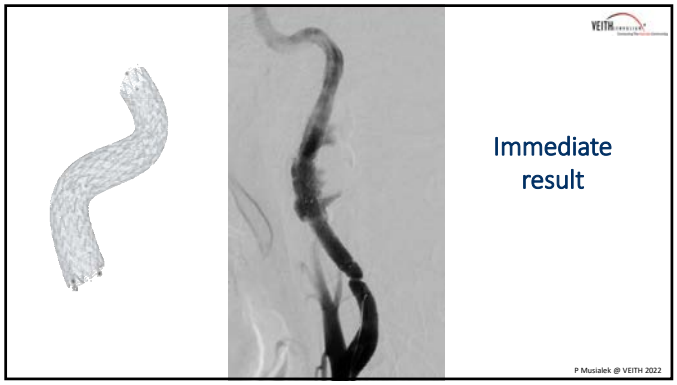


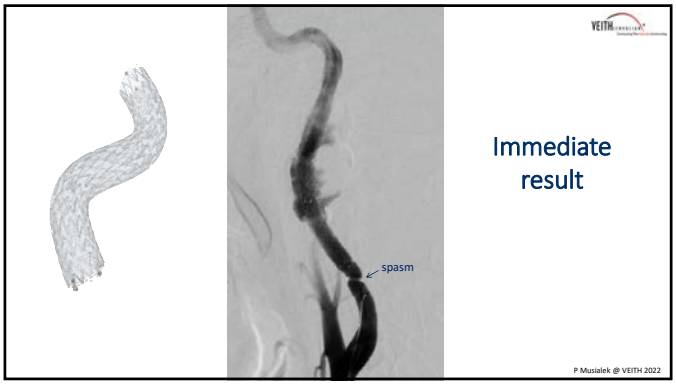
C-HEAL STUDY

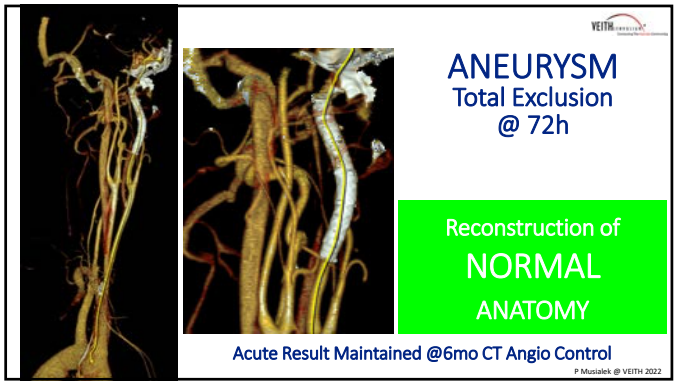


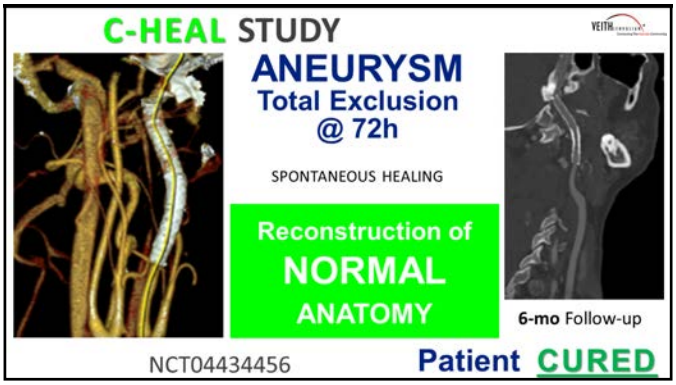
NCT04434456

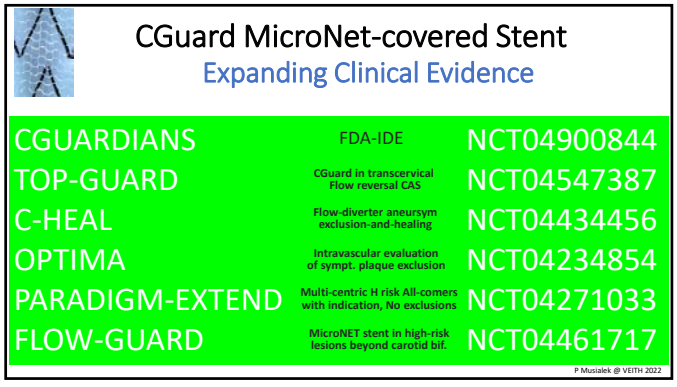
P Musialek @ VEITH 2022


Immediate result
P Musialek @ VEITH 2022


spasm
Immediate result
P Musialek @ VEITH 2022


ANEURYSM
Total Exclusion
@ 72h
Reconstruction of
NORMAL
ANATOMY
Acute Result Maintained @6mo CT Angio Control
P Musialek @ VEITH 2022


C-HEAL STUDY
ANEURYSM
Total Exclusion
@ 72h
SPONTANEOUS HEALING
Reconstruction of
NORMAL
ANATOMY
6-mo Follow-up
NCT04434456
Patient CURED


CGuard MicroNet-covered Stent
Expanding Clinical Evidence
CGUARDIANS FDA-IDE NCT04900844
TOP-GUARD CGuard in transcervical Flow reversal CAS NCT04547387
C-HEAL Flow-diverter aneurysm exclusion-and-healing NCT04434456
OPTIMA Intravascular evaluation of sympt. plaque exclusion NCT04234854
PARADIGM-EXTEND Multi-centric H risk All-comers with indication, No exclusions NCT04271033
FLOW-GUARD MicroNET stent in high-risk lesions beyond carotid bif. NCT04461717
P Musialek @ VEITH 2022


CGuard MicroNET-Covered Stent
A NEW STANDARD OF CARE