CRACOW VASCULAR SUMMIT

2023

10th INTERNATIONAL MEETING FORPROGRESS
IN ENDOVASCULAR THERAPIES WEST MEETS EAST

8th MEETING OF POLISH FOREIGN VASCULAR SPECIALISTS

The MicroNET-Covered Stent: What is NEW in 2023/2024?

Piotr Musialek

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

Conflicts of Interest

Piotr Musialek

Recipient of public grants for basic and clinical research in atherosclerisis and cardiovascular regeneration

Acted as a proctor, an advisory board member, or a consultant for Abbott Vascular, InspireMD, and Medtronic

Initiator and Principal Investigator in Investigator-Run Clinical Studies in Cardiovascular Interventional Medicine

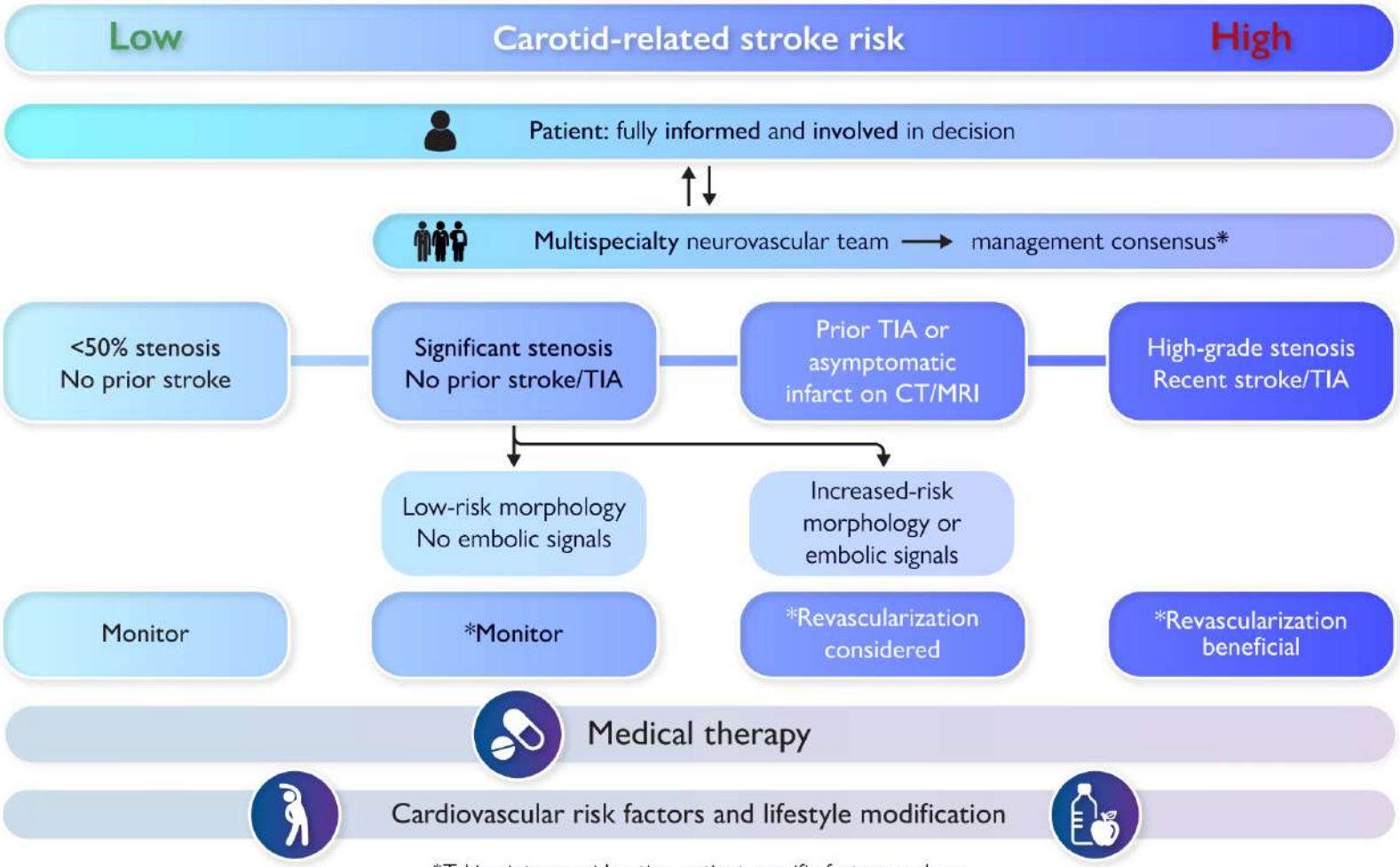
Global Co-PI in the CGuardians FDA IDE Clinical Trial

Cardiovasc Res. 2023 Aug 25:cvad135. doi: 10.1093/cvr/cvad135. Online ahead of print.

Stroke risk management in carotid atherosclerotic disease: A Clinical Consensus Statement of the ESC Council on Stroke and the ESC Working Group on Aorta and Peripheral Vascular Diseases

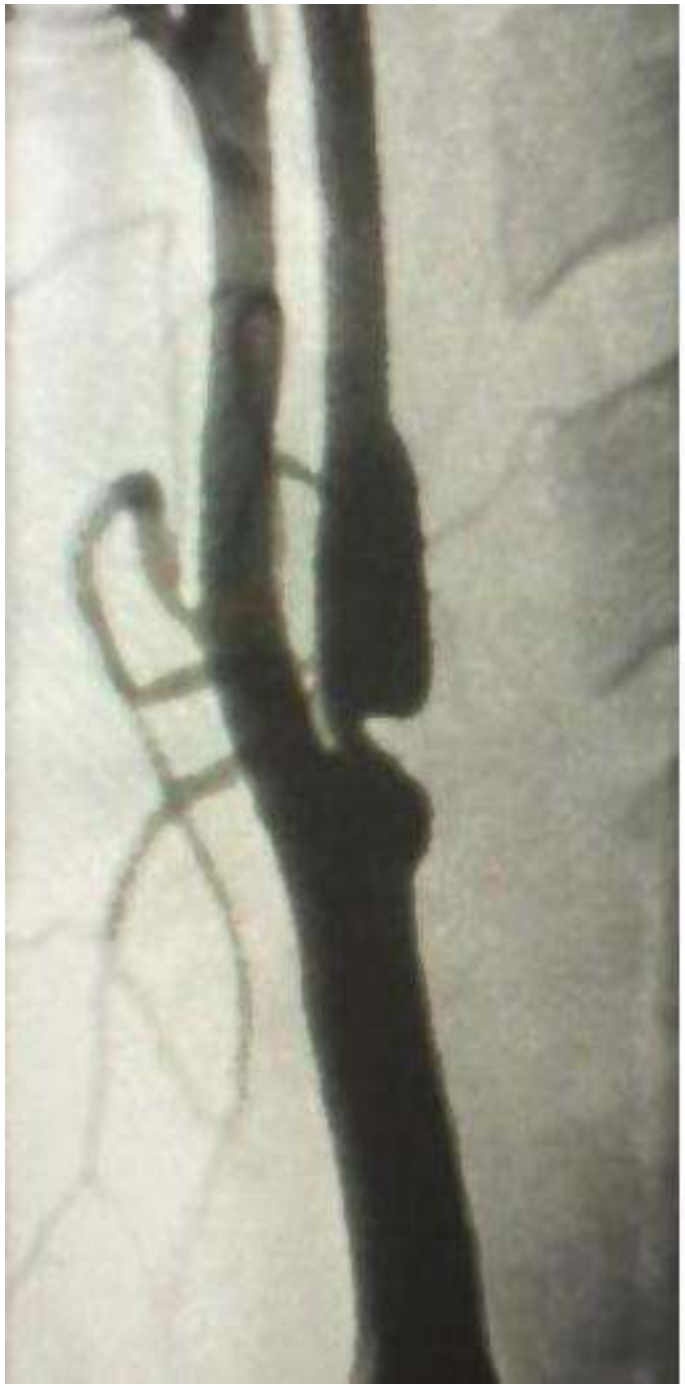
Piotr Musialek [1], Leo H Bonati [2], Richard Bulbulia [3 4], Alison Halliday [4], Birgit Bock [5], Laura Capoccia [6], Hans-Henning Eckstein [7], Iris Q Grunwald [8 9], Peck Lin Lip [10], Andre Monteiro [11], Kosmas I Paraskevas [12], Anna Podlasek [9 13], Barbara Rantner [14], Kenneth Rosenfield [15], Adnan H Siddiqui [16 17], Henrik Sillesen [18], Isabelle Van Herzeele [19], Tomasz J Guzik [20 21], Lucia Mazzolai [22], Victor Aboyans [23], Gregory Y H Lip [22]

The 2023 CONSENSUS Document

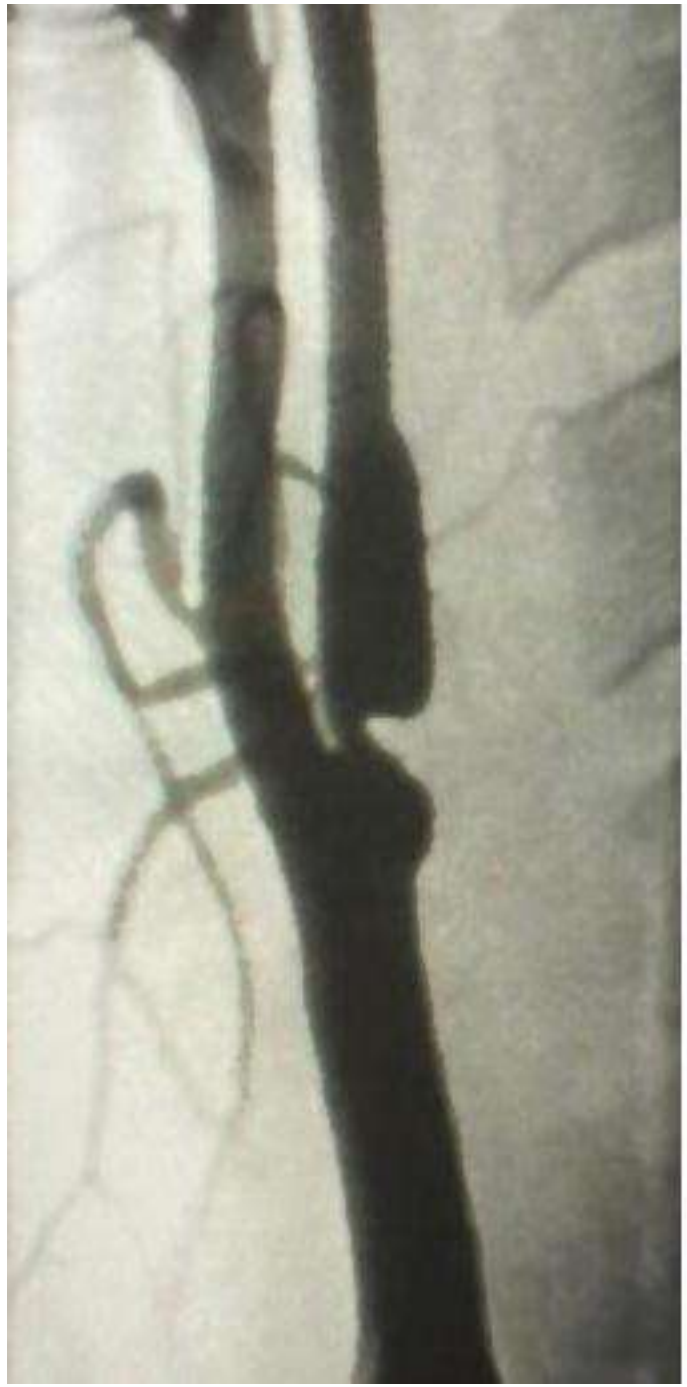


*Taking into consideration patient-specific factors such as:
life expectancy, co-morbidities and patient-specific stroke risk modifiers (e.g. family history of stroke, diabetes)

P Musialek @ CVS 2023




8-9 December 2023.
CVS



Dr. Gary S. Roubin

September 9, 1994

Carotid Stent–Supported Angioplasty: A Neurovascular Intervention to Prevent Stroke

Gary S. Roubin, MD, PhD, Sanjay Yadav, MD, Sri S. Iyer, MD, and Jirri Vitek, MD

Obstructive carotid artery disease is responsible for 60% of strokes in the United States and is the third major cause of death. Stent-supported carotid artery angioplasty has the potential to prevent stroke in thousands of patients and offers a number of potential advantages over surgical revascularization (carotid endarterectomy). Results of the prospective observational study at the University of Alabama at Birmingham indicate that carotid stent–supported angioplasty is safe and probably effective in reducing stroke in patients with high-risk cerebrovascular disease. Technical success was achieved in 99% of 146 procedures; 210 stents were placed in 152 vessels, with only 1 instance of stent thrombosis. The rate of major in-hospital complications was unexpectedly low—only 1 death and 2 major strokes. Seven patients suffered minor strokes, but only 2 were left with minor weakness. When compared with a projected complication rate of 6% had these patients undergone carotid endarterectomy, stenting resulted in fewer major events. At 6-month follow-up, 69 of 74 patients were evaluated by angiography or ultrasound, which detected 8 cases of stent deformation and a restenosis rate of <5%. Because of these instances of stent deformation, use of the Palmaz (biliary) stent was discontinued. Although 1 patient had a transient ischemic attack, no strokes occurred during follow-up. To date, carotid stenting is an investigational procedure. Cardiovascular interventionalists, industry, and the FDA are encouraged to validate this approach through clinical testing. However, improvements in technique, devices, and adjunctive therapies are needed before the method can be tested in randomized trials.

(Am J Cardiol 1996;78(suppl 3A):8–12)

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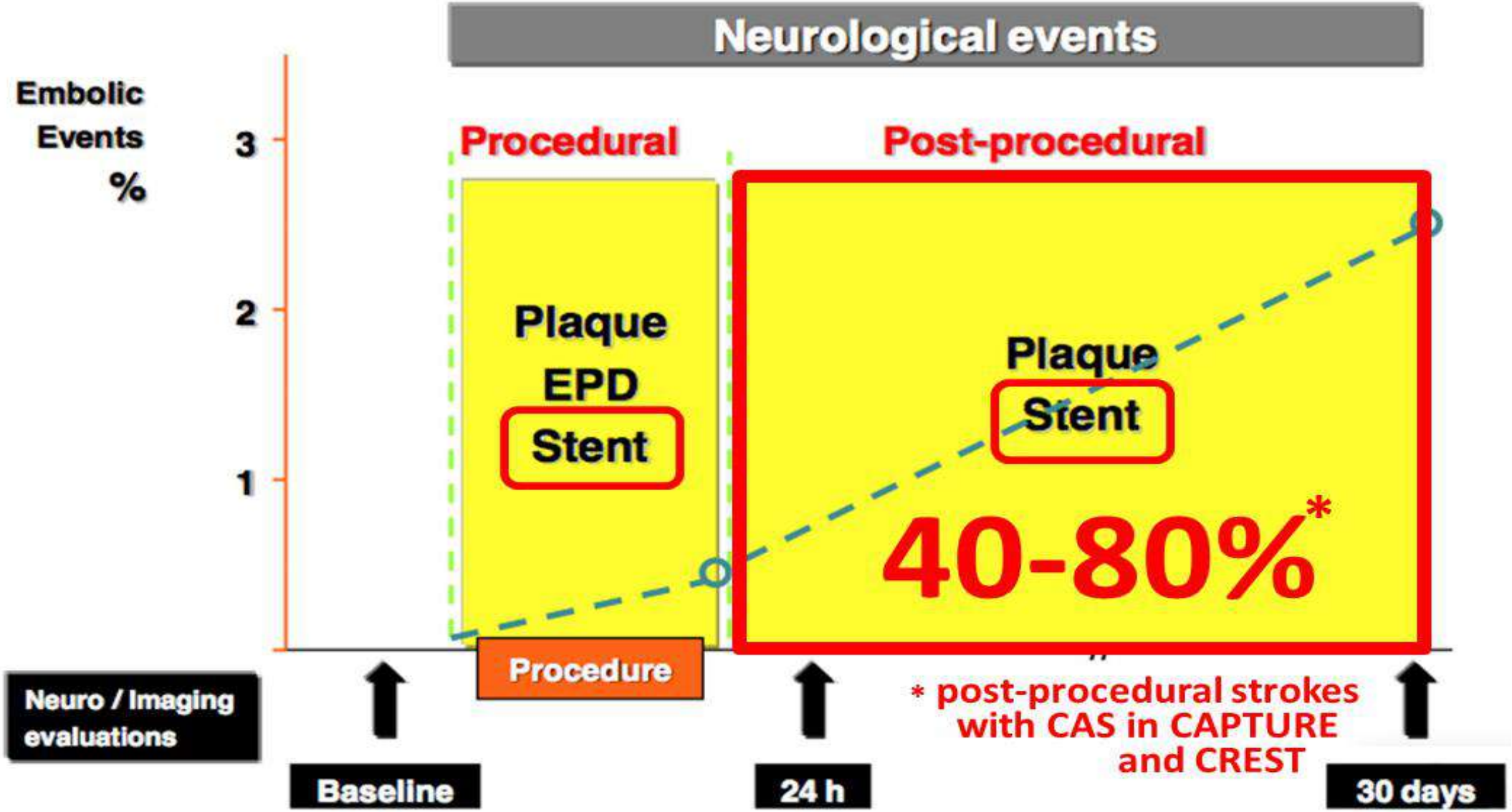
Mechanisms to explain the poor results of carotid artery stenting (CAS) in symptomatic patients to date and options to improve CAS outcomes

Kosmas I. Paraskevas, MD,[a] Dimitri P. Mikhailidis, MD, FFPM, FRCPath, FRCP,[b] and Frank J. Veith, MD, FACS,[c,d] *Athens, Greece; London, United Kingdom; Cleveland, Ohio; and New York, NY*

Background: Carotid artery stenting (CAS) is considered by many as an alternative to carotid endarterectomy (CEA) for the management of carotid artery stenosis. However, recent trials demonstrated inferior results for CAS in symptomatic patients compared with CEA. We reviewed the literature to evaluate the appropriateness of CAS for symptomatic carotid artery stenosis and to determine the pathogenetic mechanism(s) associated with stroke following the treatment of such lesions. Based on this, we propose steps to improve the results of CAS for the treatment of symptomatic carotid stenosis.
Methods: PubMed/Medline was searched up to March 25, 2010 for studies investigating the efficacy of CAS for the management of symptomatic carotid stenosis. Search terms used were "carotid artery stenting," "symptomatic carotid artery stenosis," "carotid endarterectomy," "stroke," "recurrent carotid stenosis," and "long-term results" in various combinations.
Results: Current data suggest that CAS is not equivalent to CEA for the treatment of symptomatic carotid stenosis. Differences in carotid plaque morphology and a higher incidence of microemboli and cerebrovascular events during and after CAS compared with CEA may account for these inferior results.
Conclusions: Currently, most symptomatic patients are inappropriate candidates for CAS. Improved CAS technology referable to stent design and embolic protection strategies may alter this conclusion in the future. (J Vasc Surg 2010;52: 1367-75.)

Timing of neuro-embolic events after CAS



D. McCormick TCT 2012, modified

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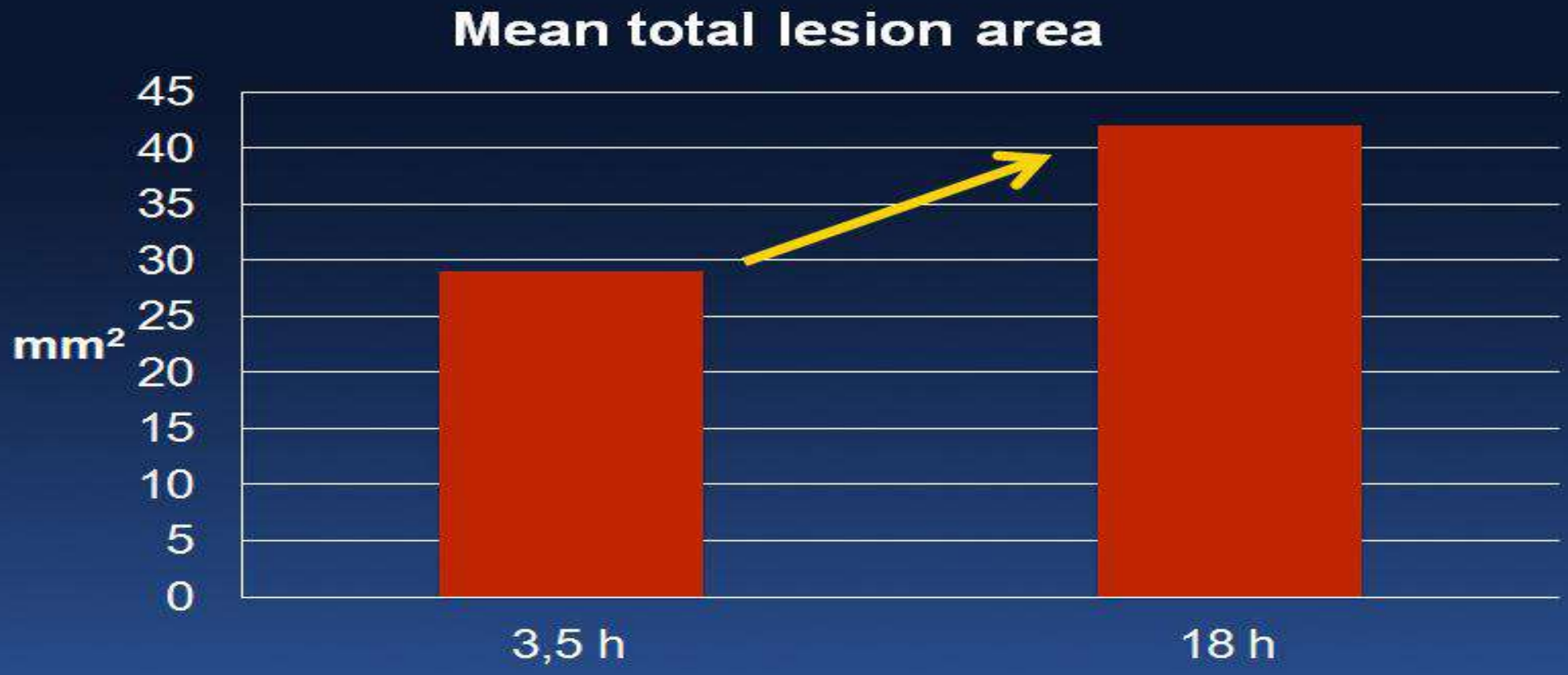
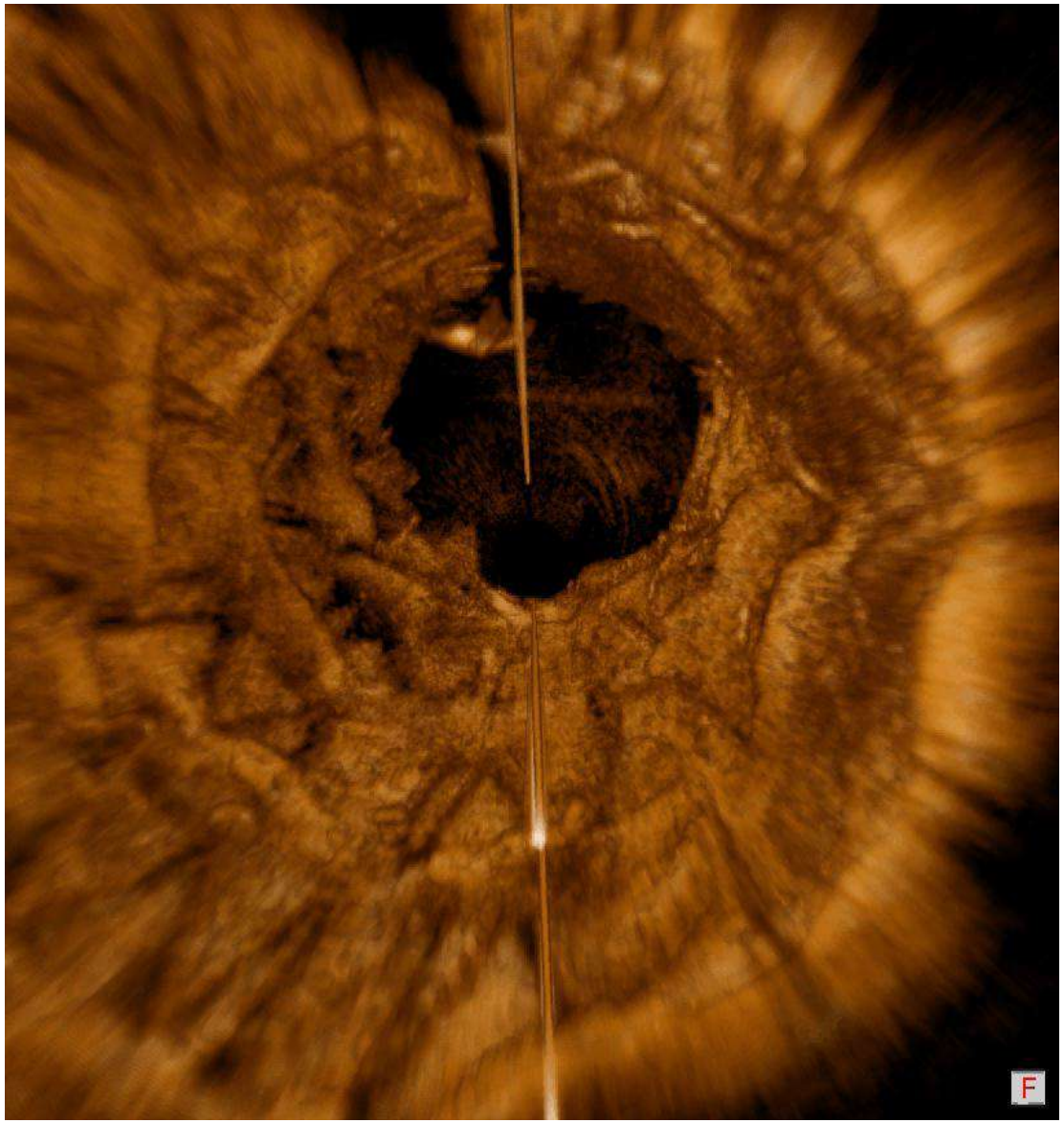
Post-procedural Embolization with conventional carotid stents

DW-MRI post CAS



Schofer J et al, JACC Cardiovasc interv 2008

The Problem of <u>Conventional</u> (Single-layer) Carotid Stents



P Musialek, G deDonato
Carotid Artery Revascularization Using the Endovascular Route
In: **Carotid Interventions - Practical Guide 2023**

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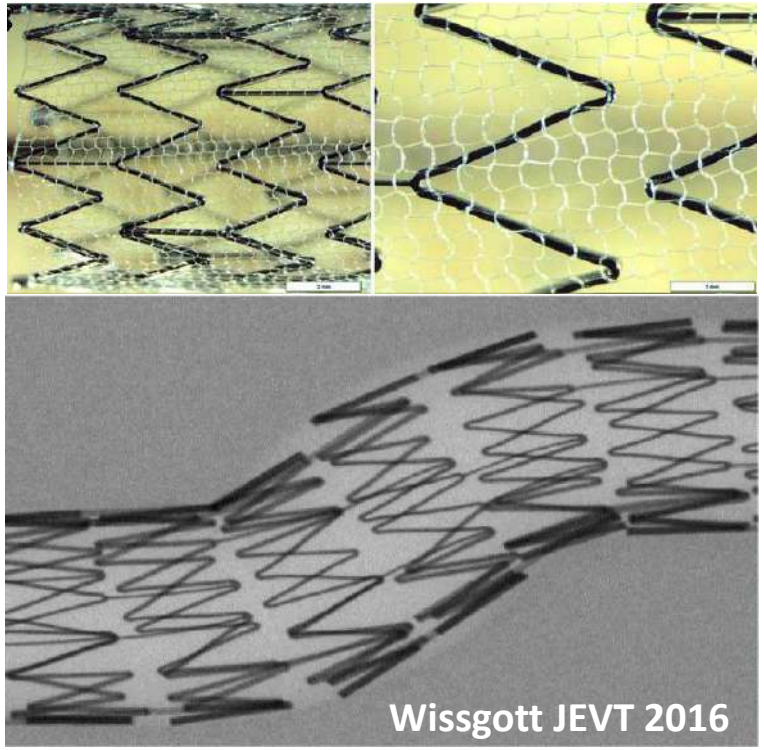
The **MOST 'open'** amongst open-cell stents (metallic FRAME) & the **MOST 'close'** amongst close-cell stents (MicroNET mesh)

CGuard MicroNET – covered
2nd generation self-adjusting stent

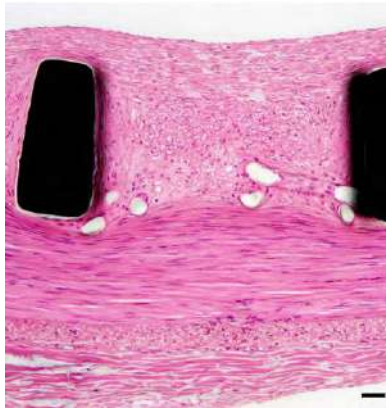
UNIQUE mechanical properties

RESPECT of anatomy

FULL apposition



NORMAL healing



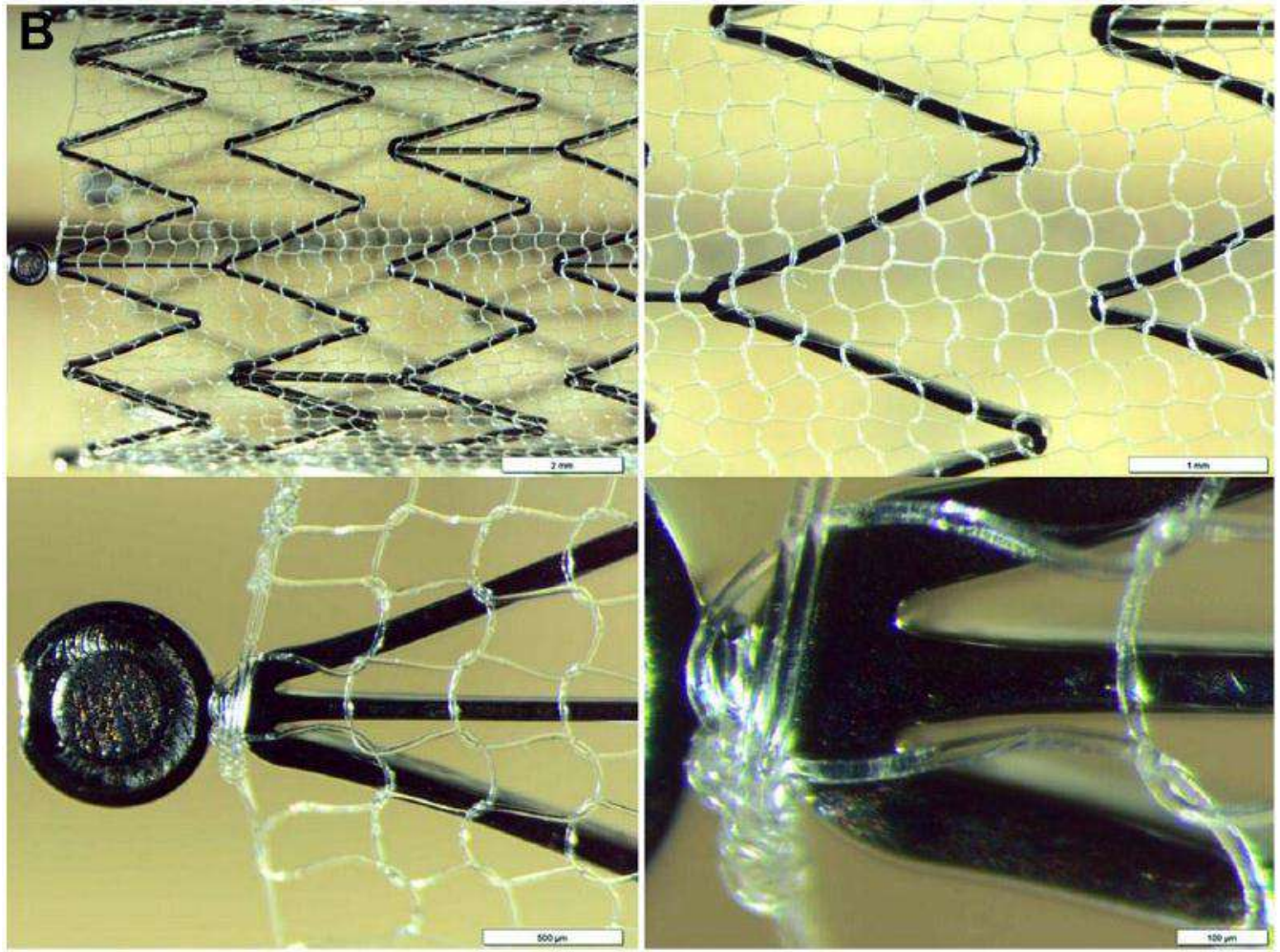
Clinical Investigation

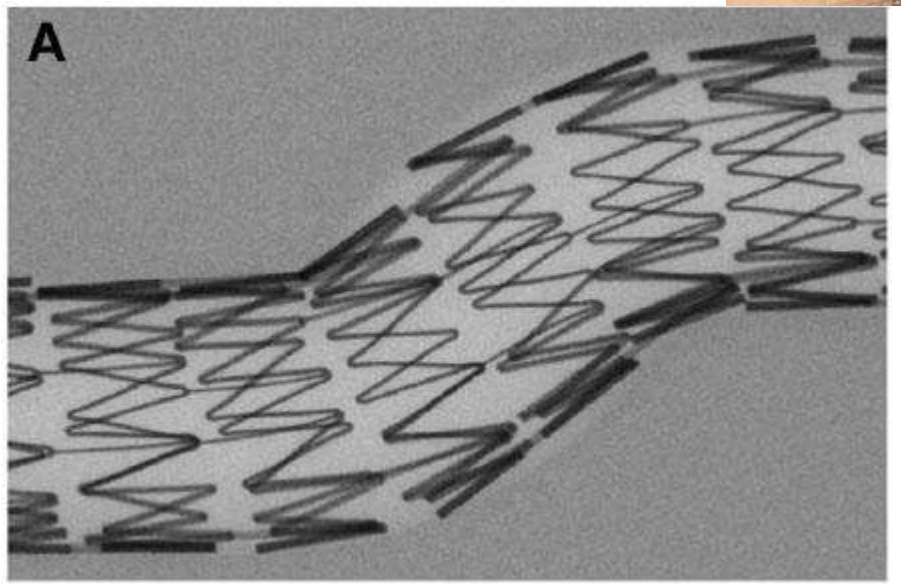
JOURNAL OF ENDOVASCULAR THERAPY

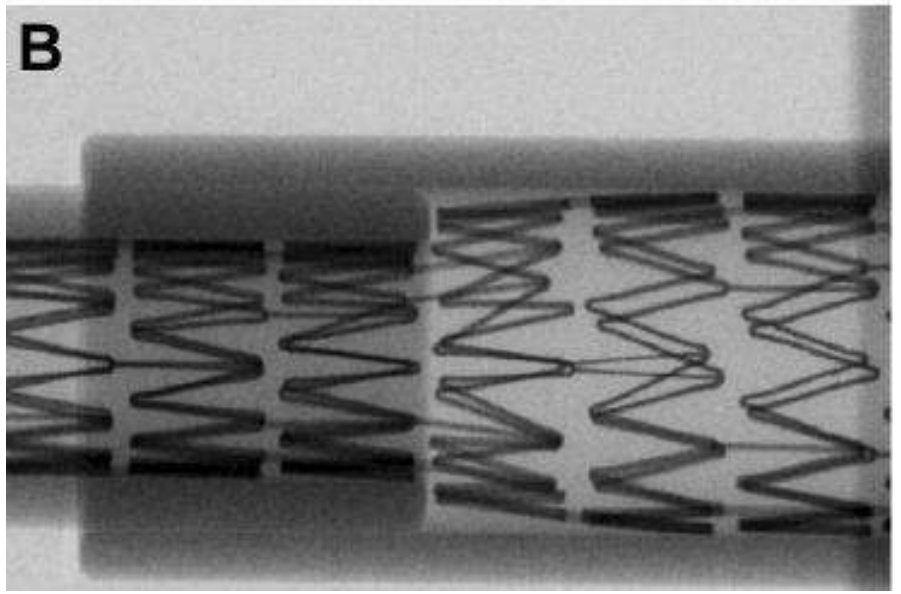
Journal of Endovascular Therapy
1–8

DOI: 10.1177/1526602816671134
www.jevt.org
SAGE

Clinical Results and Mechanical Properties of the Carotid CGUARD Double-Layered Embolic Prevention Stent







CGuard MicroNet-Covered Stent

Expanding Clinical Evidence: 2023

CGUARDIANS	**FDA-IDE**	NCT04900844
OPTIMA	**Intravascular Evaluation of Sympt. plaque exclusion**	NCT04234854
PARADIGM 500/533…	**High-Risk All-comers with indication, No exclusions**	NCT04271033
SIMGUARD	**Greatest-Risk Patients: SIMULTANEOUS Urgent Cardiac Surgery+CGuard**	NCT04973579
FLOWGUARD	**MicroNET stent in high-risk lesions beyond carotid bif.**	NCT04461717
C-HEAL	**Flow-Diverter: Aneursym exclusion-and-healing**	NCT04434456
SAFEGUARD-STROKE	**CGuard in Carotid-Related Acute Stroke**	NCT05195658
TOPGUARD	**CGuard in Transcervical Flow Reversal CAS**	NCT04547387

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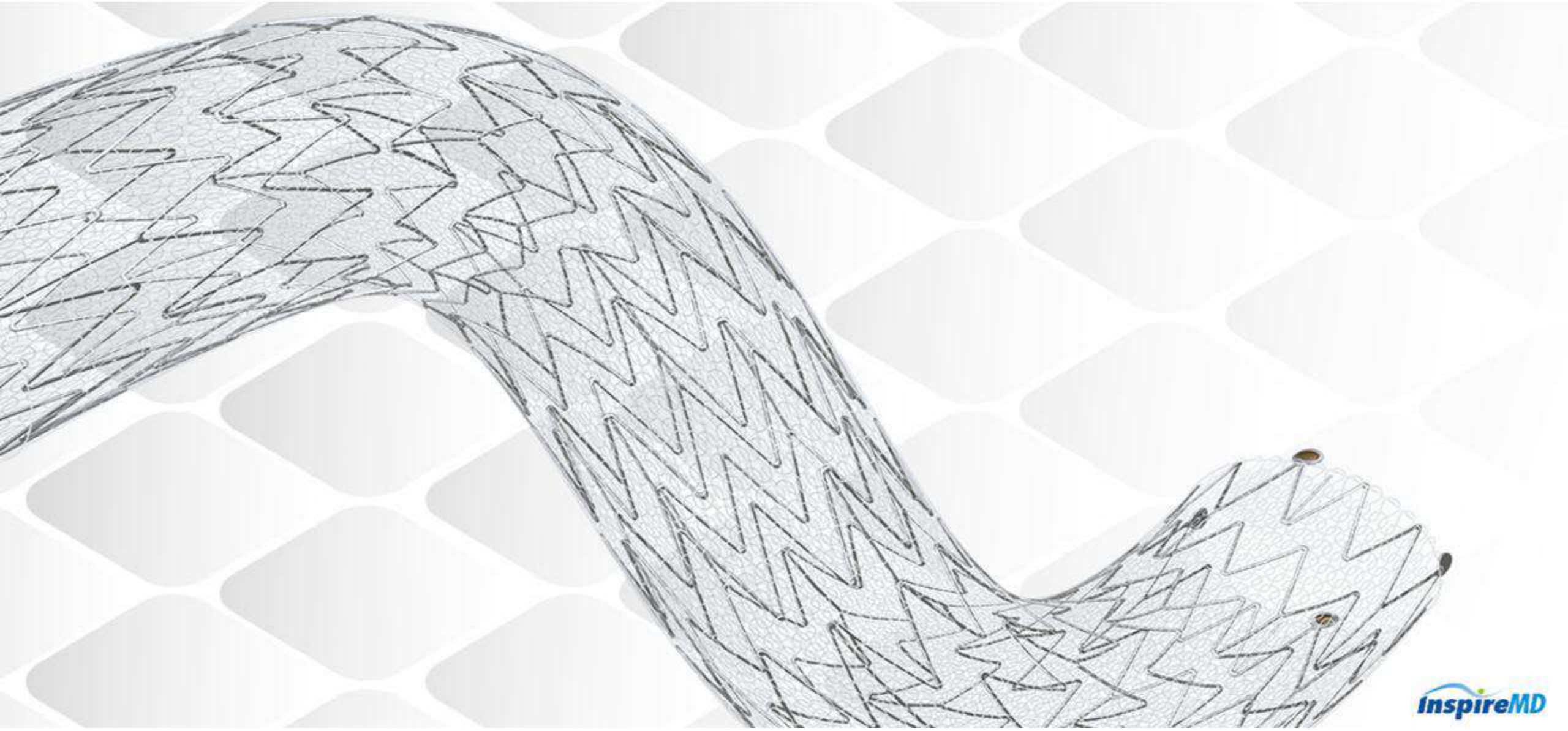
FDA-IDE Clinical Trial:

CGUARDIANS

NCT 04900844



InspireMD

C-GUARDIANS Study Design	Prospective, multicenter, single- armed IDE Pivotal trial
Sample size/ Sites	316 Patients; 25 US and European Sites
Primary Endpoint	***Composite of death, stroke, MI (DSMI) at 30 days*** or ipsilateral stroke at 1 year
Sponsor	INSPIRE MD
Principal Investigator **Co- Principal Investigator**	D. Chris Metzger, MD Piotr Musialek, MD
Study Enrollment Period	July, 2021 to June, 2023 (23 months)
Monitor/ CRO	Hart Clinical Consultants

D Chris Metzger @ VIVA 2023

P Musialek @ CVS 2023

Patient Demographics

Characteristic	ITT (N = 316)
Age (mean ± SD)	69.0 ± 6.6
% Symptomatic	24.3%
% Male	63.9%
Diabetes Mellitus	41.8%
Hypertension	92.6%
Dyslipidemia	90%
CAD	52.1%
COPD	23.8%
Current Smoker	26.4%
PVD	28.6%

D Chris Metzger @ VIVA 2023

P Musialek @ CVS 2023

Embolic Protection Utilized

Emboshield NAV 6 Distal embolic protection	**261**
MoMA Proximal embolic protection	78
Both (Nav6 and MoMa)	24
None	1

C-GUARDIANS 30-day Results

ITT Analysis (N = 316)	Event rate in % (n)
Death, Stroke or MI*	0.95%(3)
Death#	0.32% (1)
Any stroke#	0.95% (3)
Major Stroke#	0.63% (2)
Minor Stroke#	0.32% (1)
MI	0.0% (0)
Death or any stroke*	0.95% (3)
Death or major stroke*	0.63% (2)

D Chris Metzger @ VIVA 2023

* Hierarchical: patient count (each patient first occurrence of the most serious event).

Non-hierarchical: event count (multiple events in each patient are counted individually).

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Levels of Medical Evidence

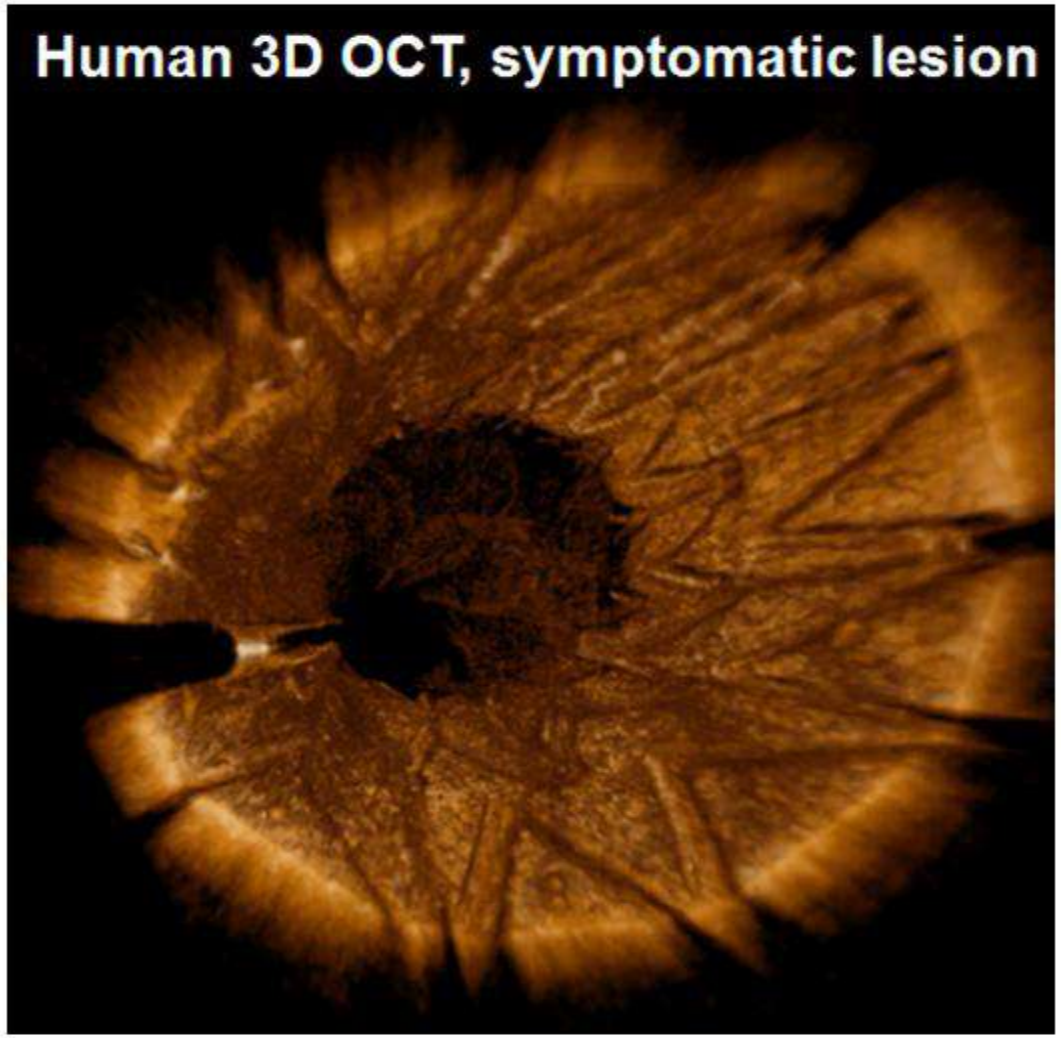
Sackett DL

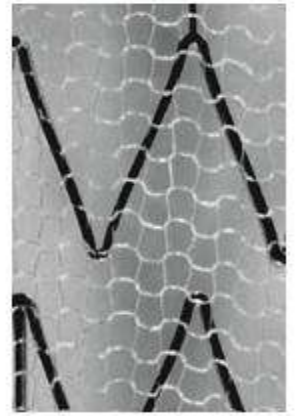
MicroNet-Covered Stent System

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 2023**

P Musialek @ CVS 2023

JACC: CARDIOVASCULAR INTERVENTIONS

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

Andrey Karpenko, MD, PhD,[a] Savr Bugurov, MD,[a] Pavel Ignatenko, MD, PhD,[a] Vladimir Starodubtsev, MD, PhD,[a]
Irina Popova, MD, PhD,[a] Krzysztof Malinowski, MSc,[b] Piotr Musialek, MD, DPhil.[c]

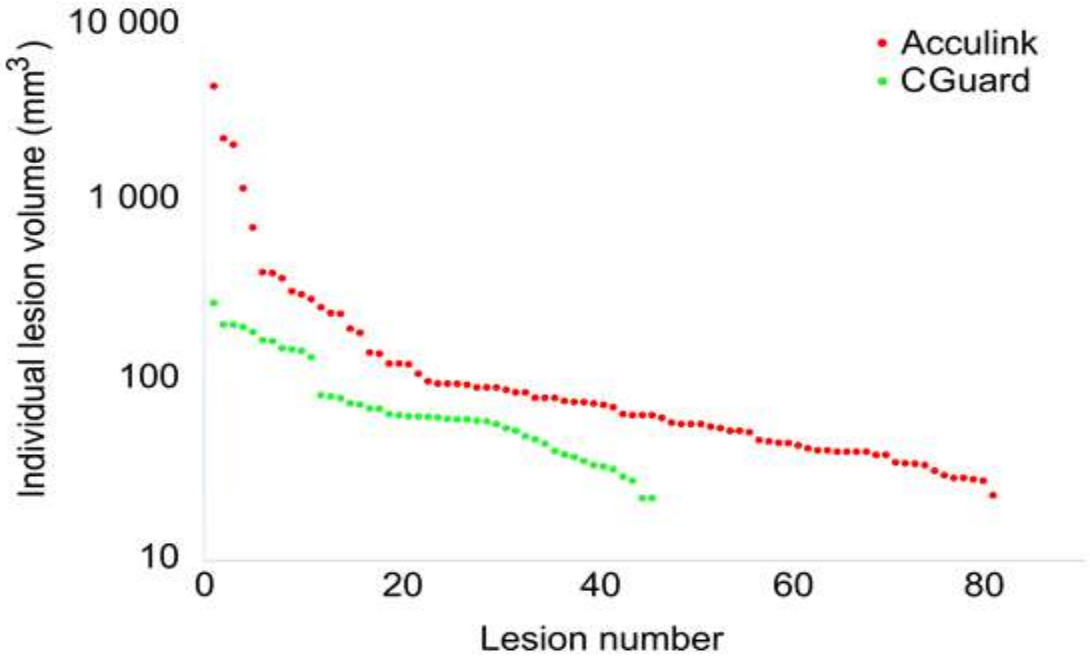
Embolic Load to the Brain

Acculink (CREST study device)

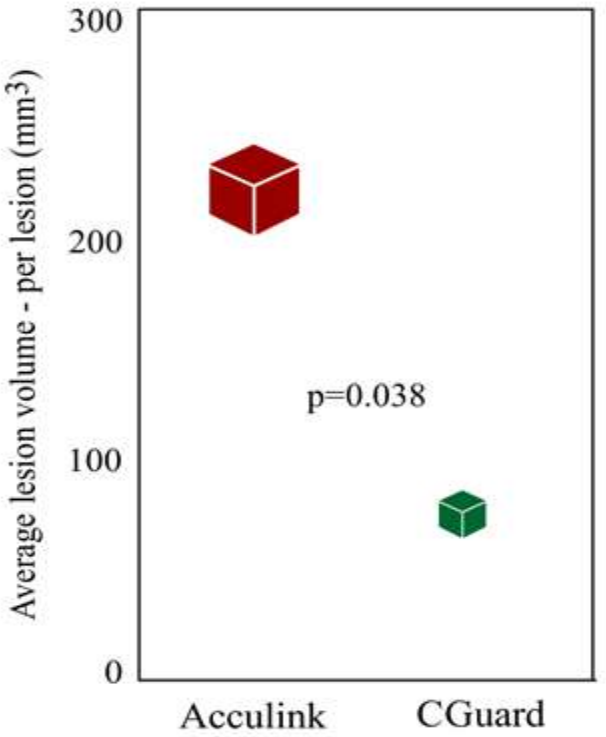
MicroNet-Covered Stent - CGuard

DW-MRI Embolism

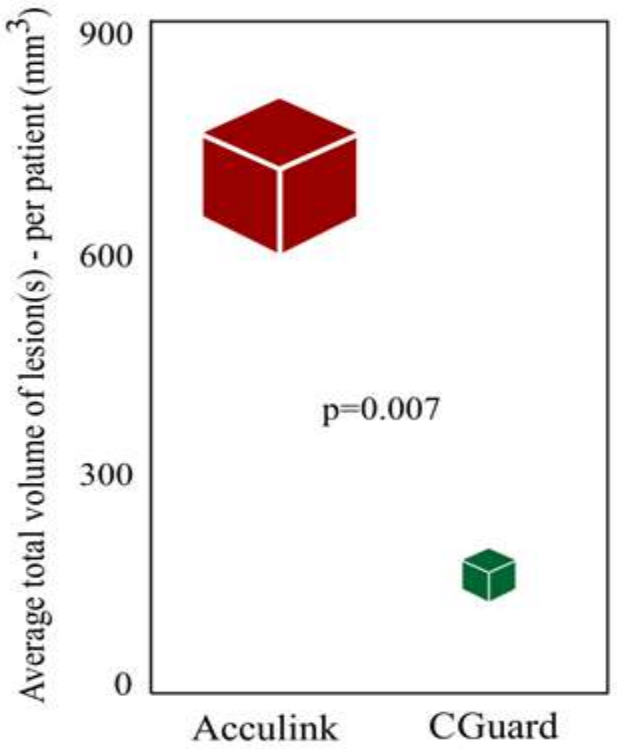
raw data



Per Lesion



Per Ipsil Haemisphere

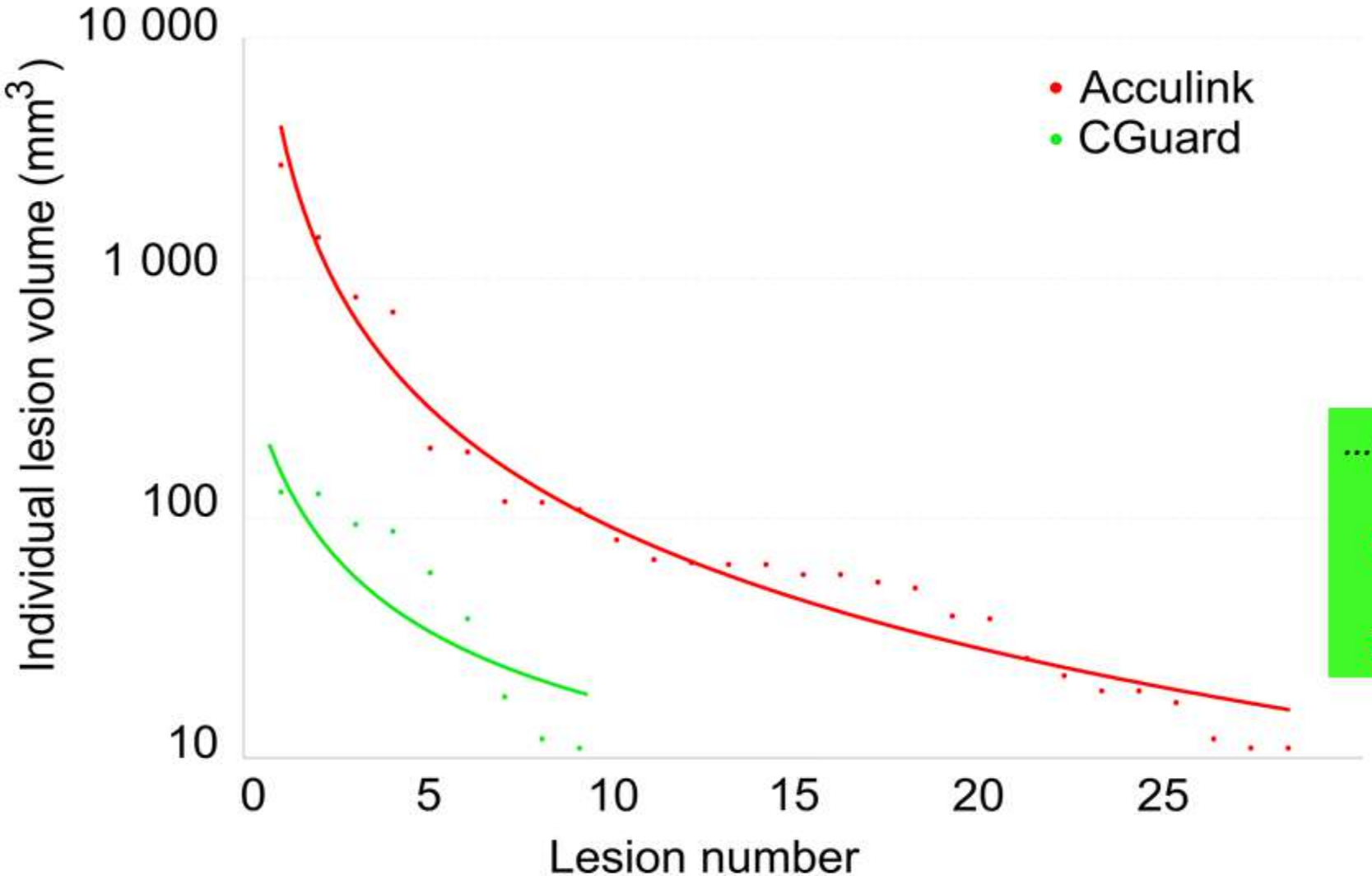


Emboshield NAV in ALL CAS

Blinded CoreLab independent anaysis

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

CAS LESIONS that became PERMANENT (FLAIR, 30 days)



...and

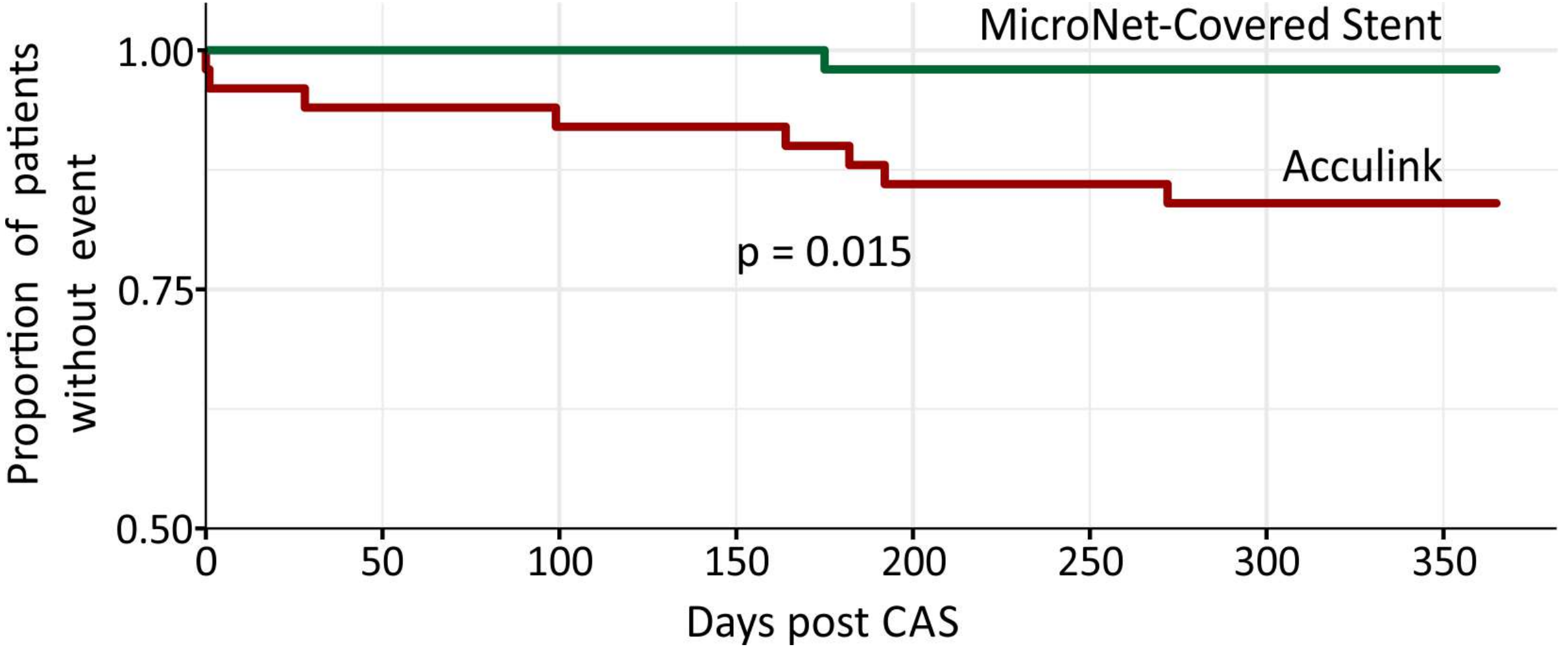
6 vs. 0 ***NEW*** DWI lesions

2 vs. 0 ***strokes*** **@30days**

JACC Intv 2021

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

12-month data



Karpenko…. Musialek *JACC Intv* 2022

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

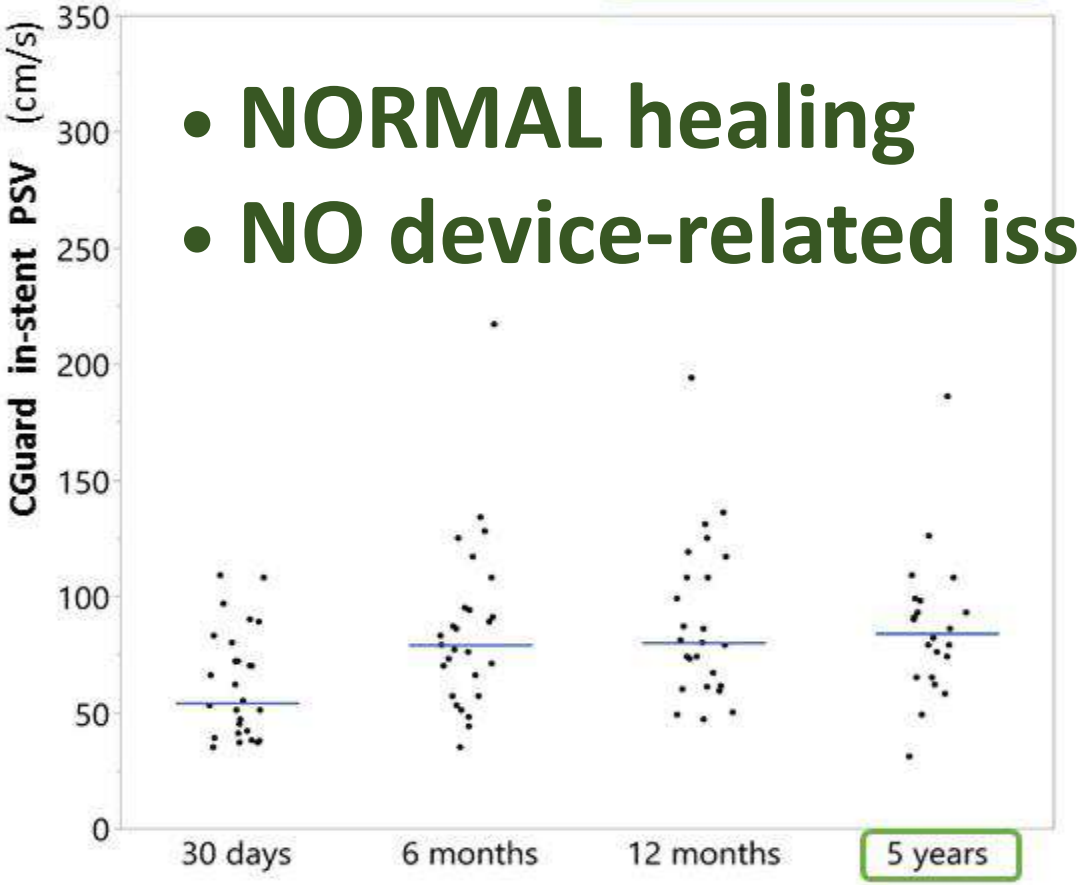
The CGuard CARENET Trial (Carotid Embolic Protection Using MicroNet)

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

2023

MicroNET-covered stent use to seal carotid artery perforation

Márcio Francisco Lehmann[1], Piotr Musialek[2,3]

[1]Neurosurgery Service of the University Hospital, State University of Londrina, Londrina, Paraná, Brazil
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Adv Interv Cardiol 2023; 19, 3 (73): 284–288
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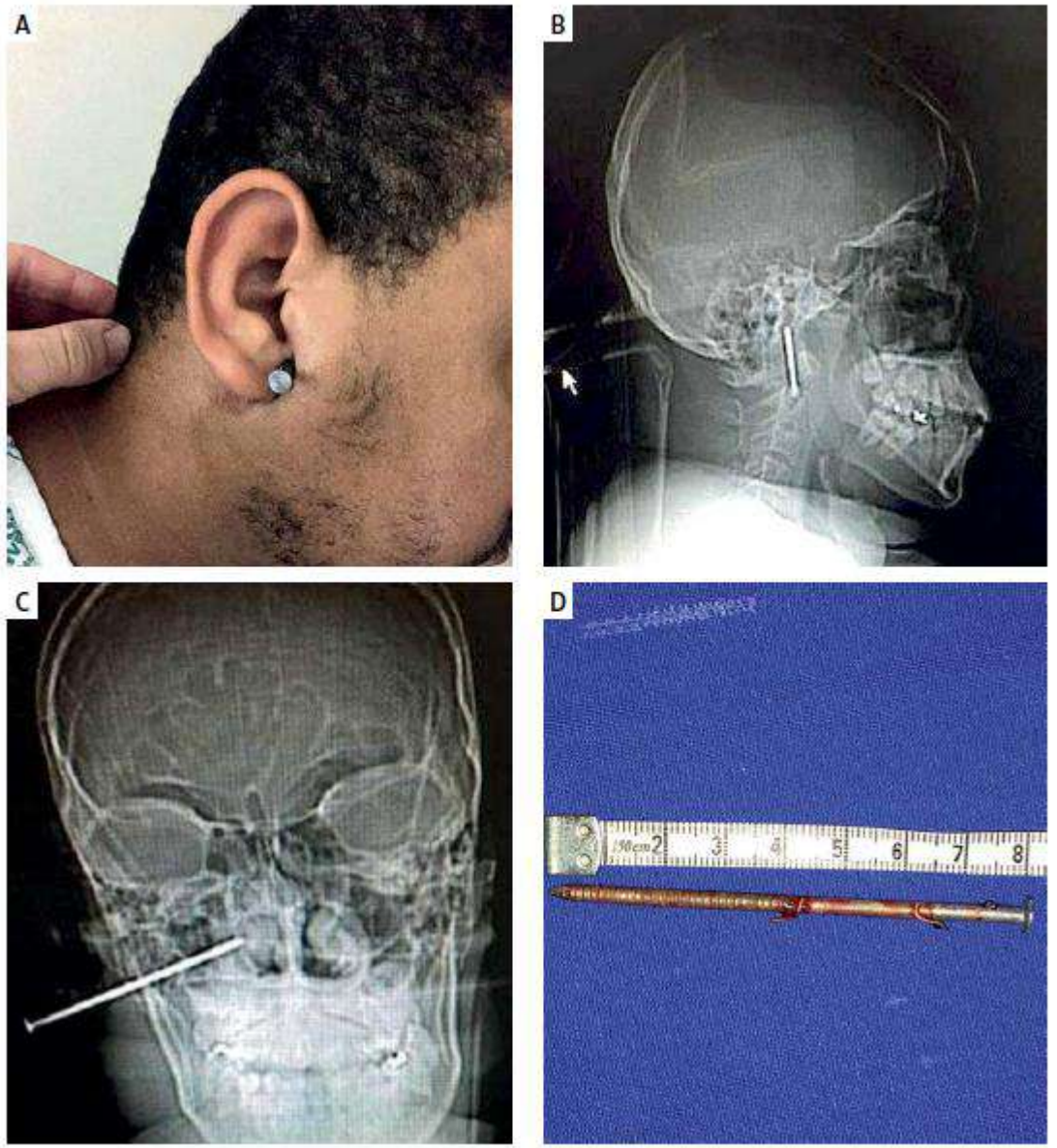

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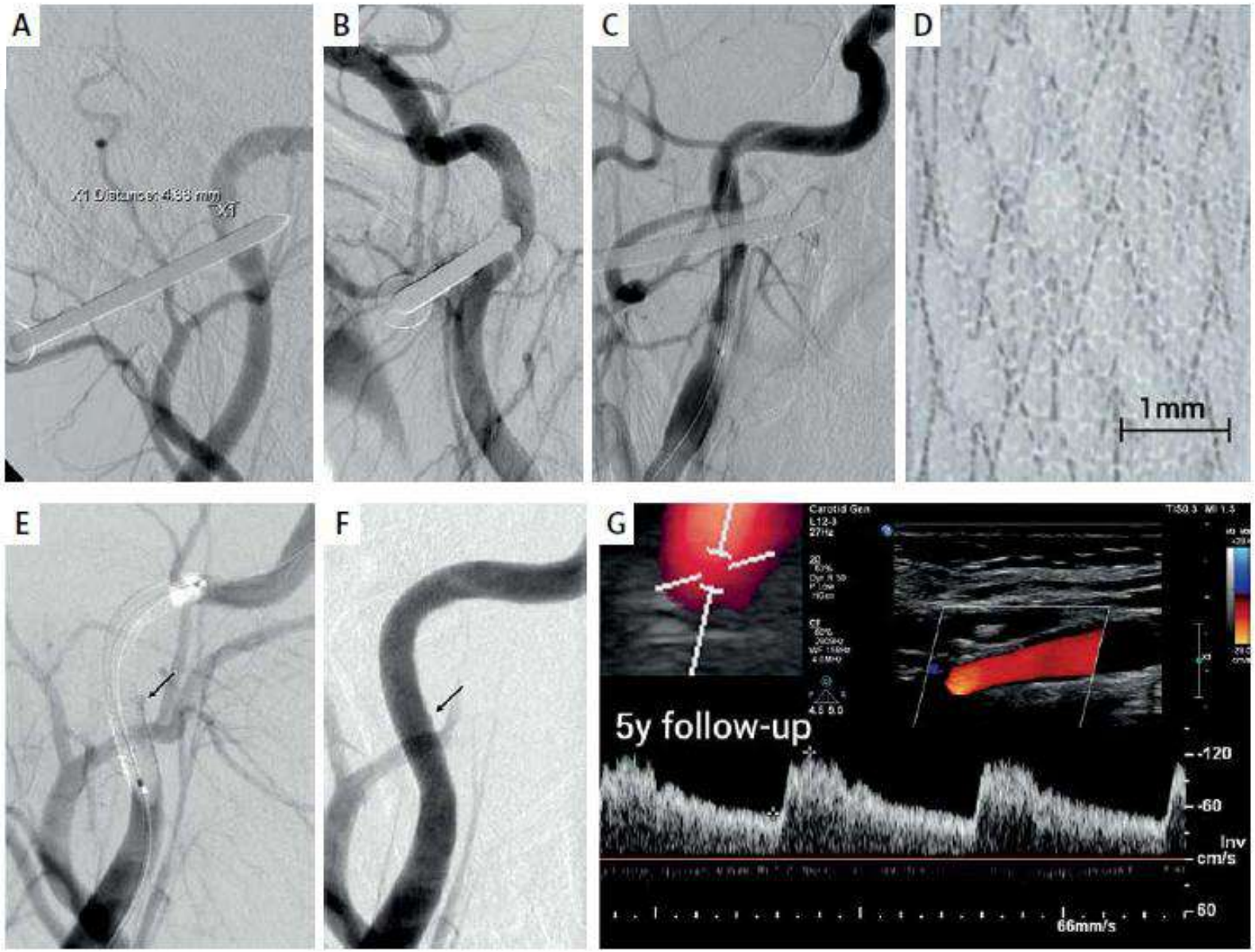
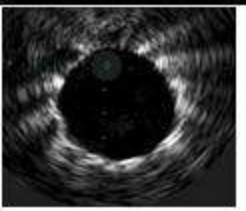


P Musialek @ CVS 2023

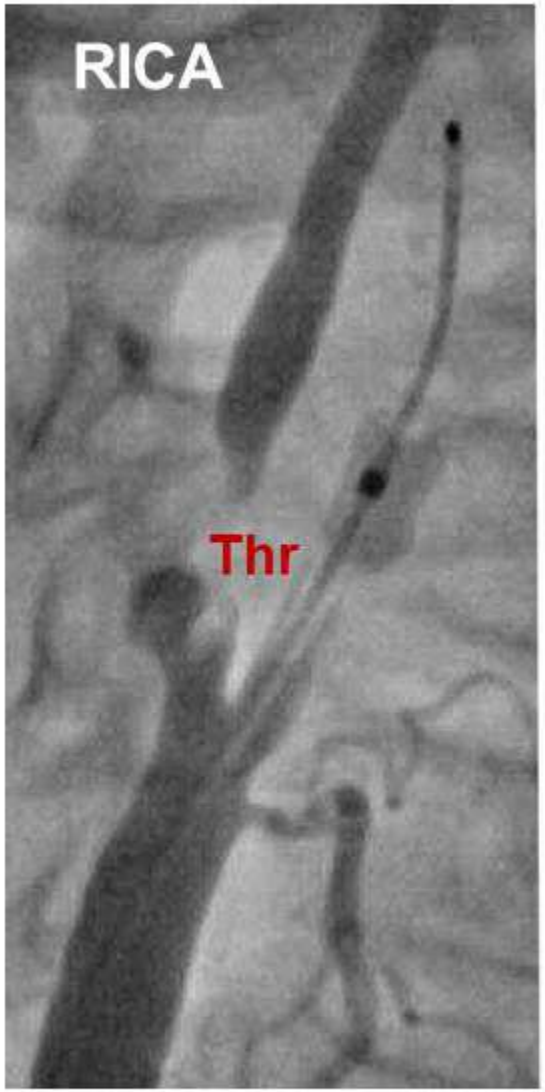


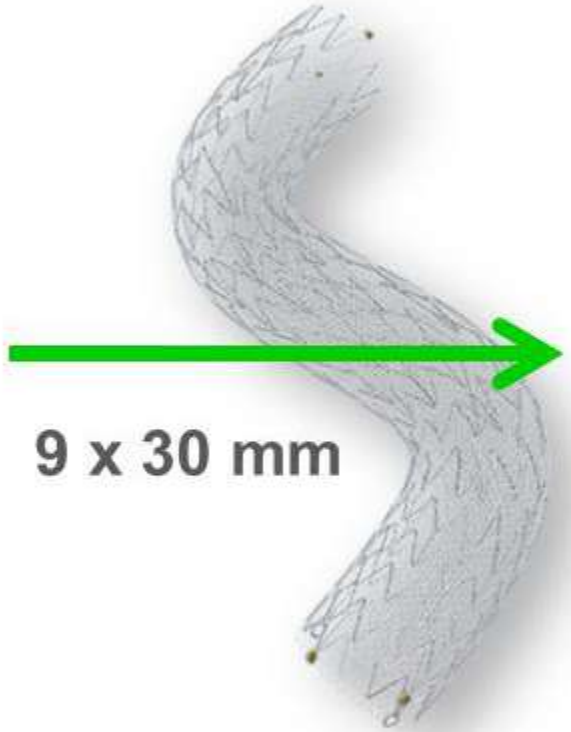
CGuard OPTIMA

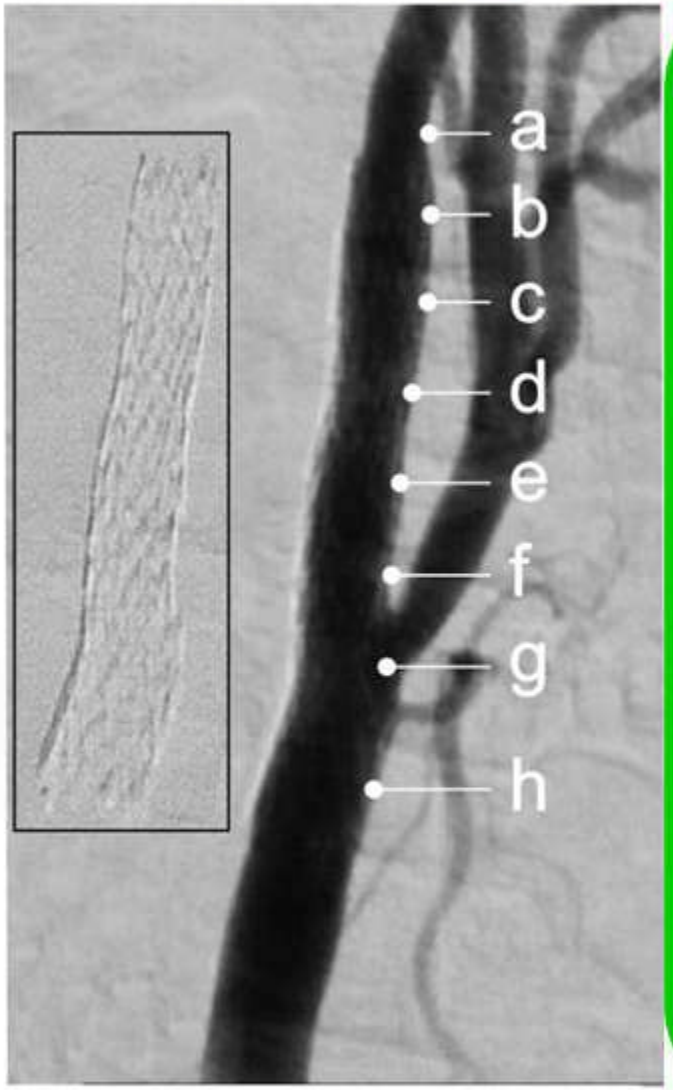
IVUS Results

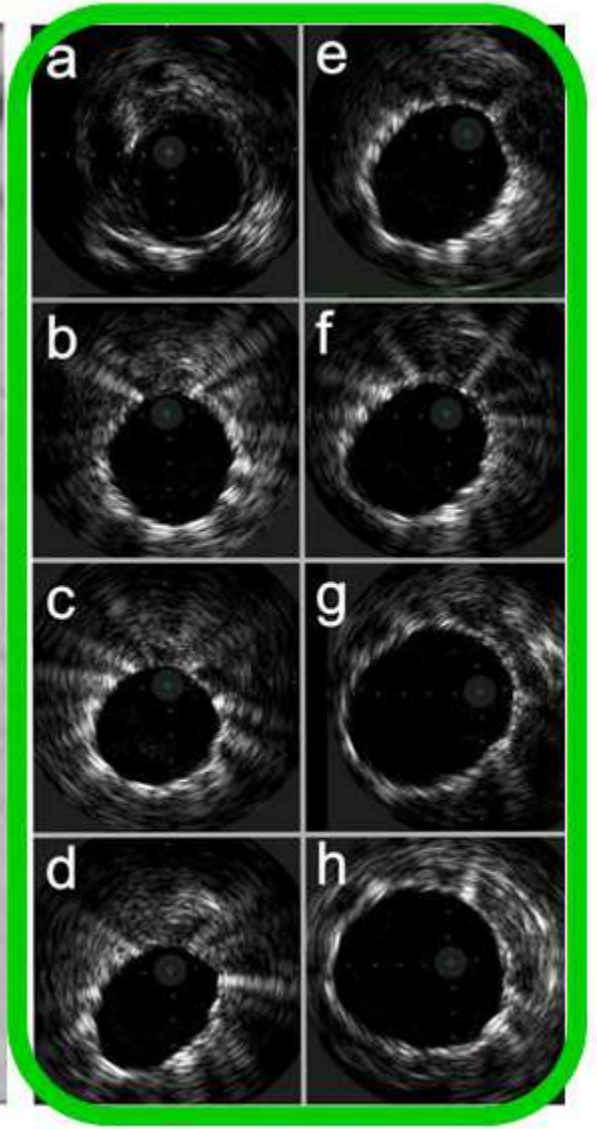
Parameter		Incidence or Measurement value±SD*
MCS-treated arteries; n	total	352
Length of stents (mm);	total	11,950
Stent frames analyzed;	total	397,956
Frames per ICA reference segment;	total	53,164
Frames per 20mm stent;	mean (range)	649 (425–725)
Frames per 30mm stent;	mean (range)	920 (672–1280)
Frames per 40mm stent;	mean (range)	1258 (1082-1615)
Frames per 60mm stent;	mean1 (range)	1693 (1645–1735)
ICA reference CSA (mm^2)		16.38±4.08
MSA (mm^2)		15.98±4.02
Residual AS (mm^2)		0.4±2.52
Residual AS (%)		2.44±2.16
Stent symmetry index[§]		0.87±0.09
Plaque prolapse		
Total number stents with PP		0 (0%)
Total number segments with PP		0 (0%)
Total frames with PP[#]		0 (0%)
PP segment length, mm		0 (0%)
PP segment peak depth, mm		0 (0%)
Malapposition		
Total number stents with malapposition[#] (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

M, 52y, Right Hemisph. Stroke 5 days before

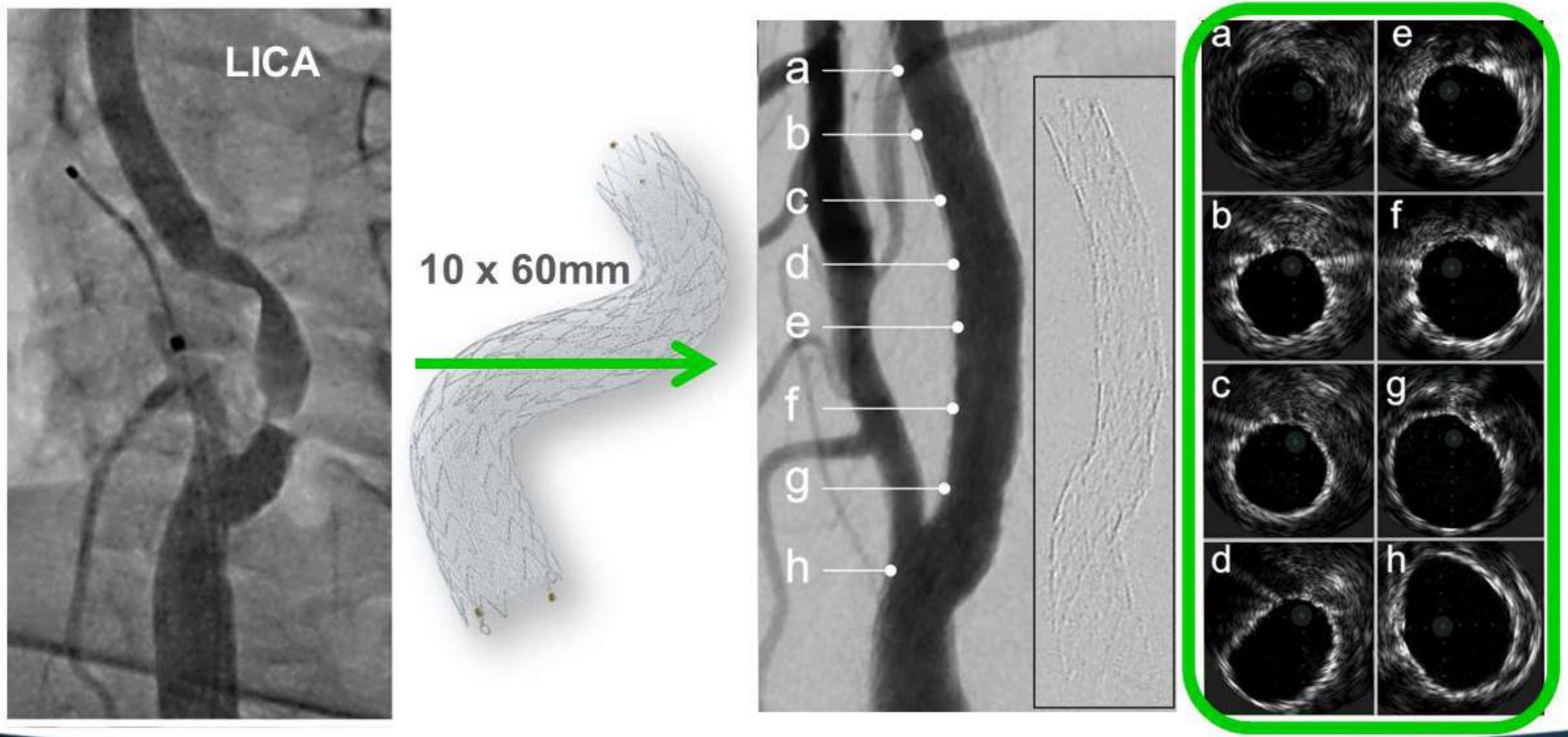




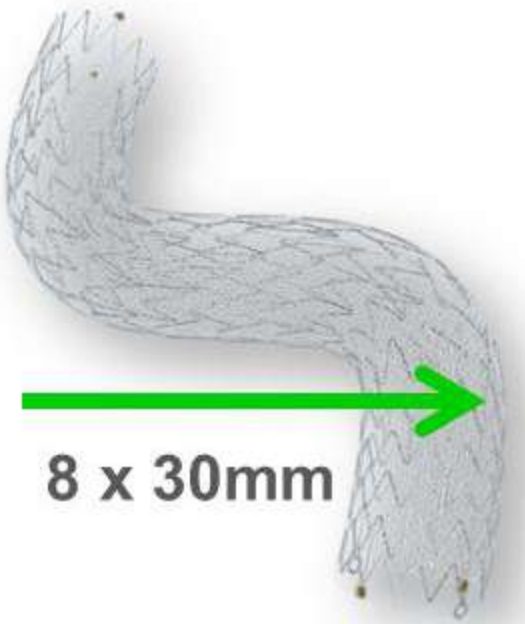


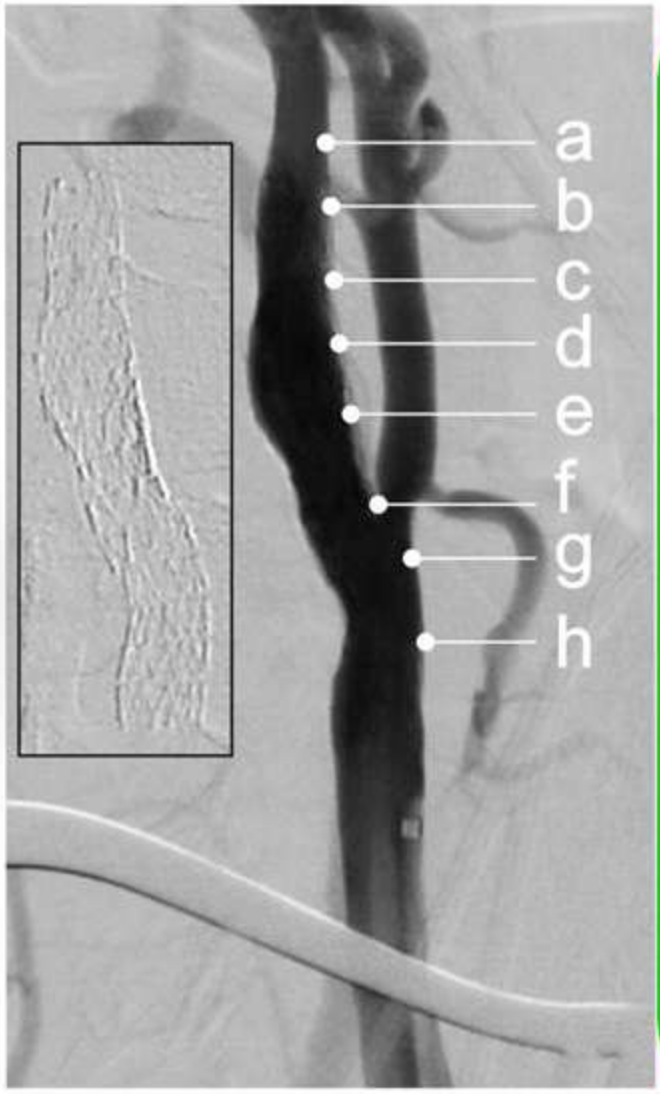


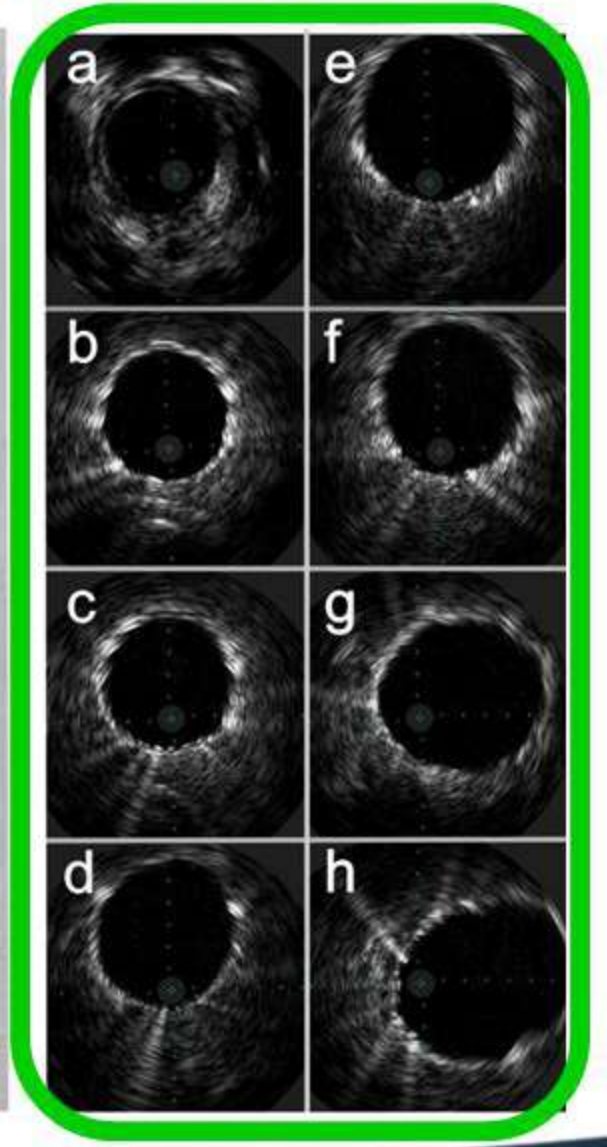
M, 64y, Progressive Tandem Stenosis, Asymptomatic Cerebral Infarct



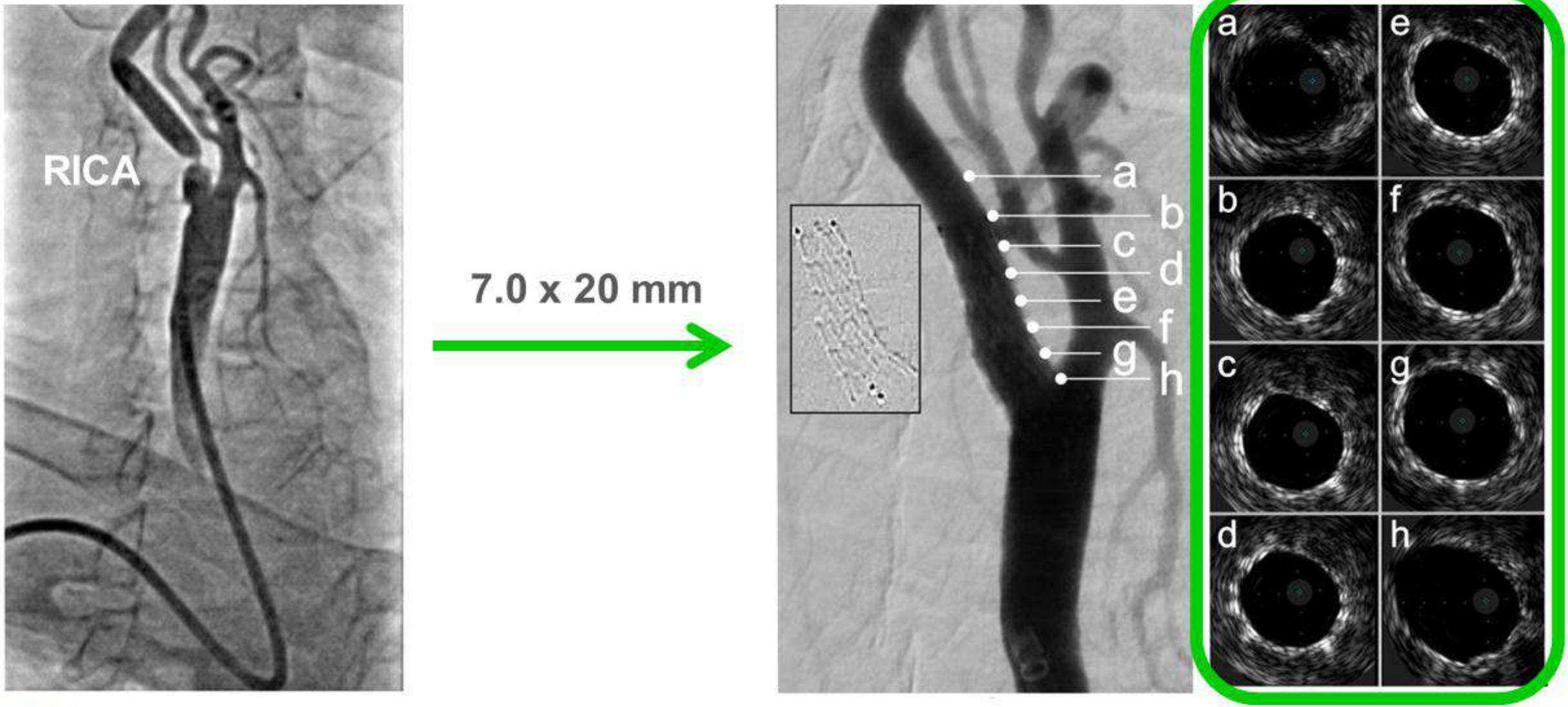
M, 56y, L hemisp Stroke 10 days before, Severe iliac disease

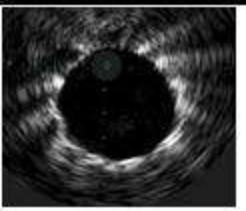






M, 71y, h/o larynx RadioTx, Leriche, 2 recent R hemisp Strokes



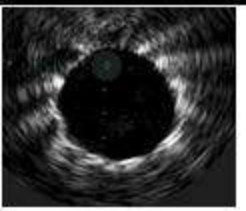


CGuard

OPTIMA

IVUS Results

Parameter		Incidence or Measurement value±SD*
MCS-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 (mm^2)		16.38±4.08
MSA (mm^2)		15.98±4.02
Residual AS (mm^2)		0.4±2.52
Residual AS (%)		2.44±2.16
Stent symmetry index[§]		0.87±0.09
Plaque prolapse		
Total number stents with PP		0 (0%)
Total number segments with PP		0 (0%)
Total frames with PP[#]		0 (0%)
PP segment length, mm		0 (0%)
PP segment peak depth, mm		0 (0%)
Malapposition		
Total number stents with malapposition[#] (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



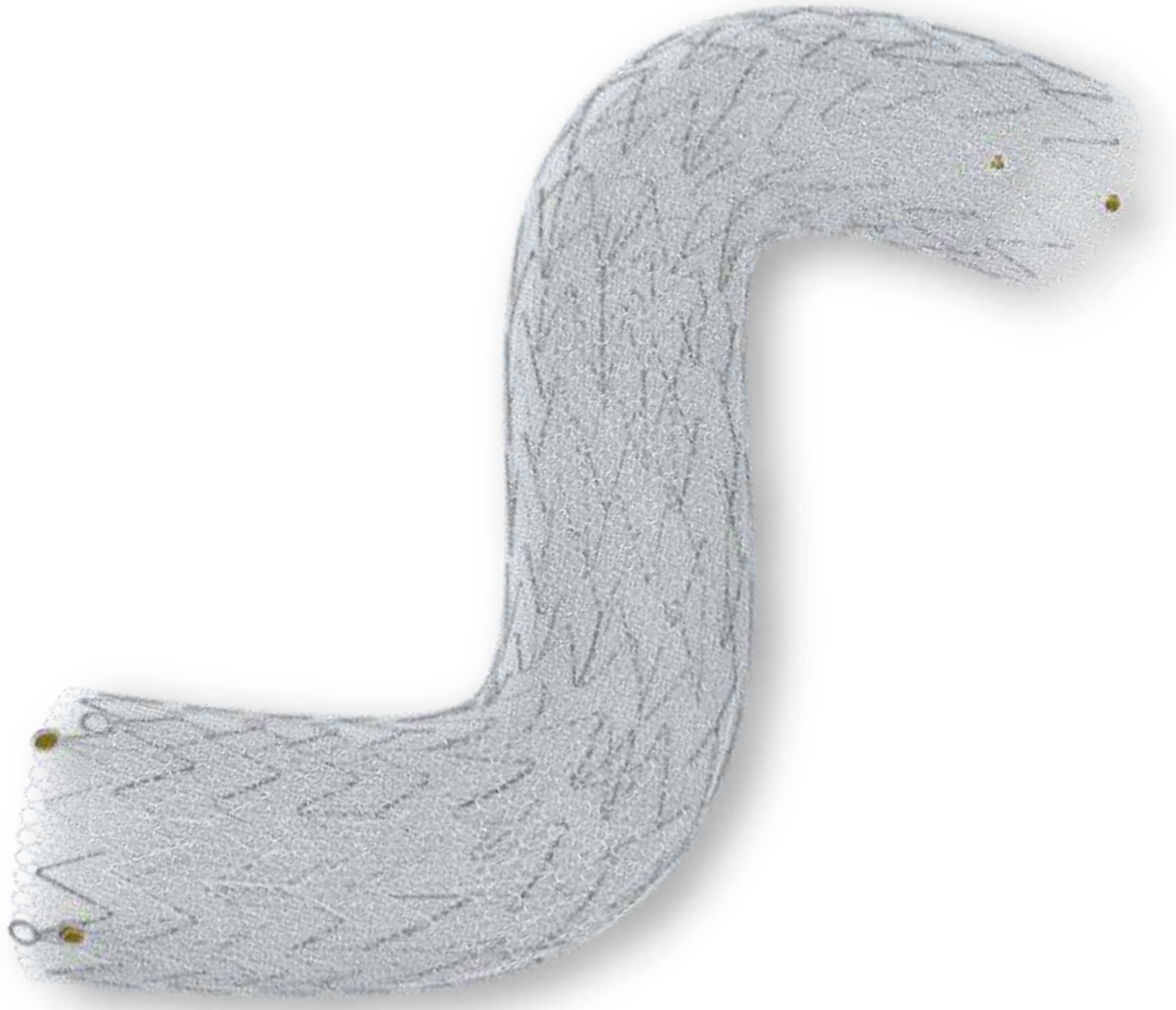
CGuard

OPTIMA

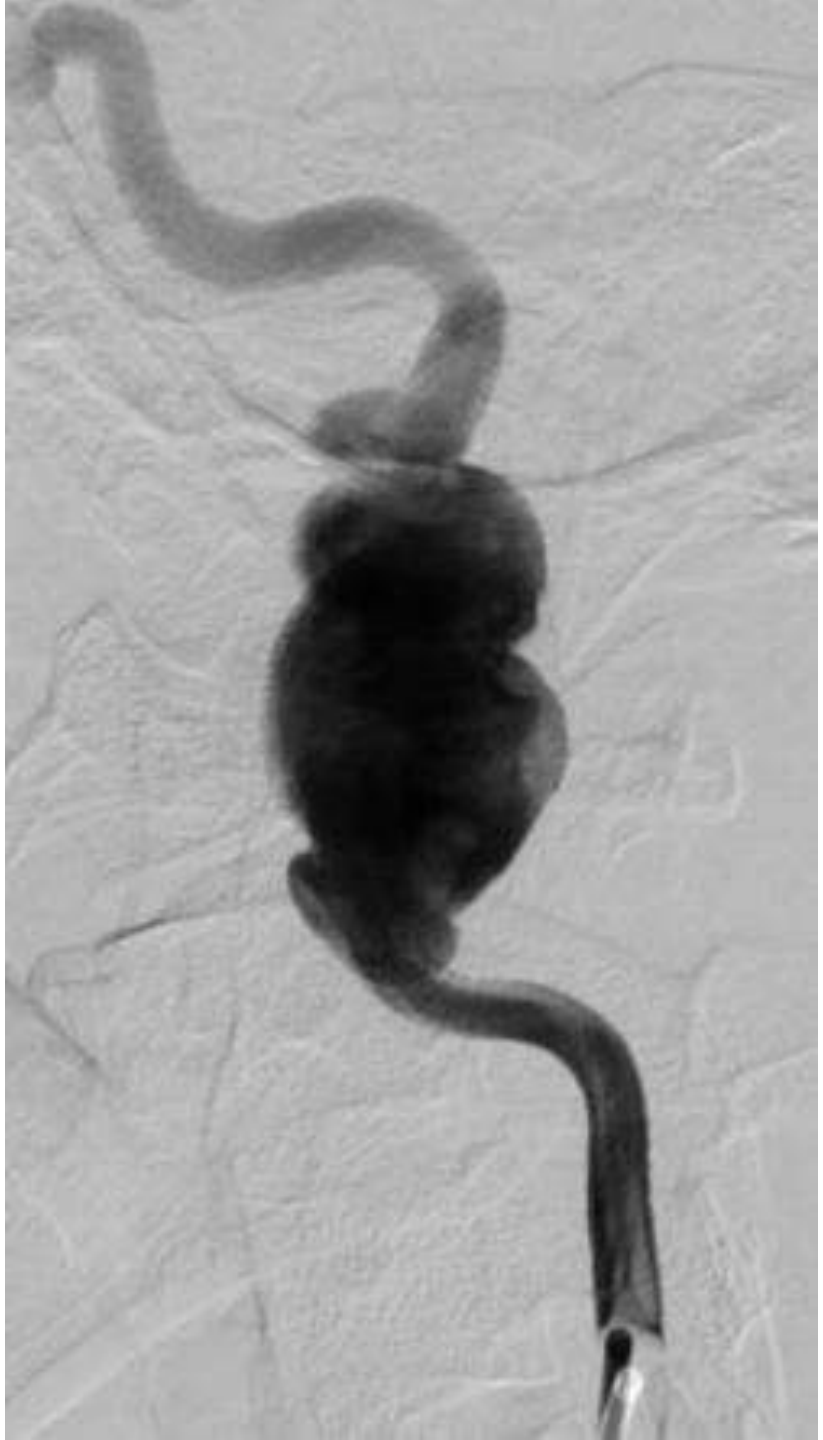
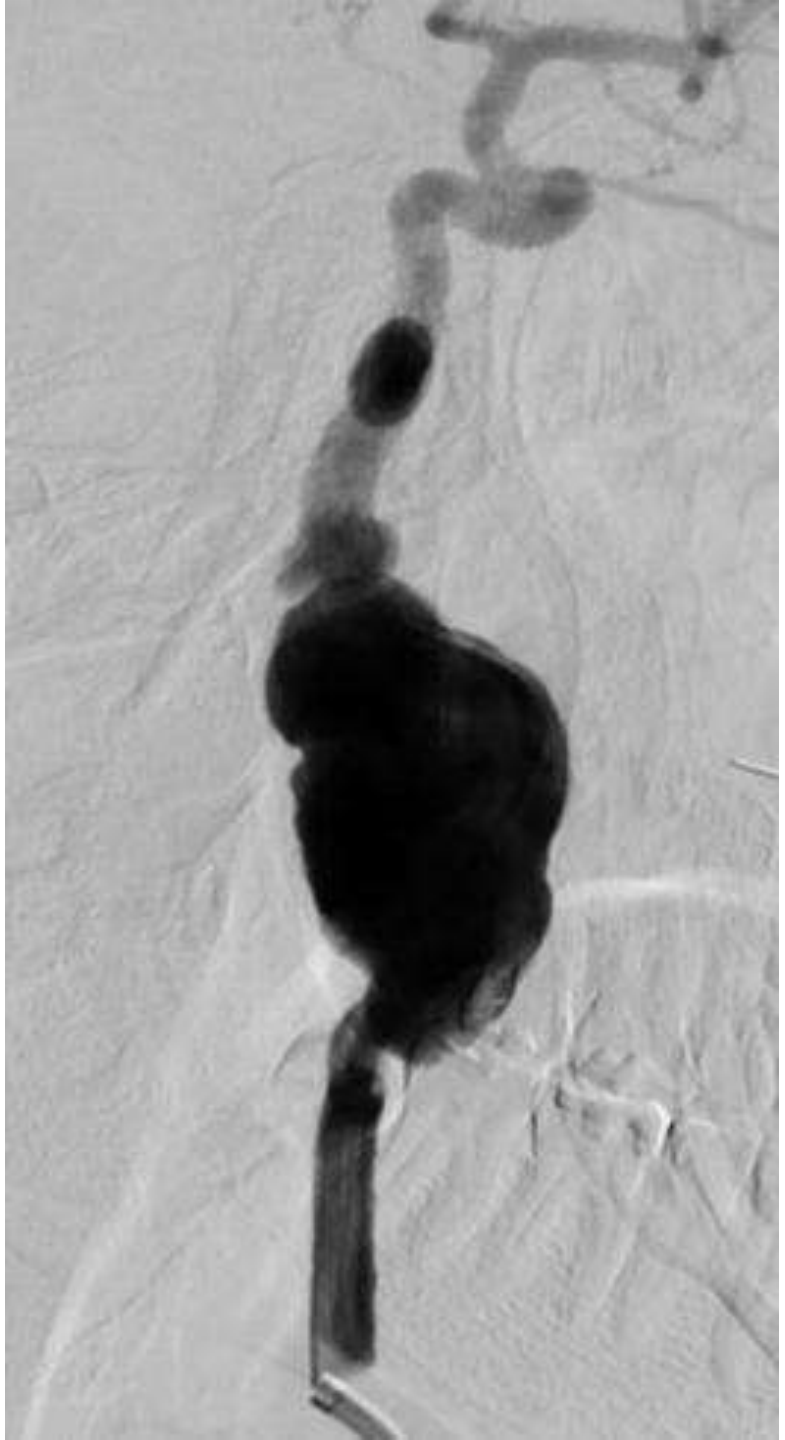
Clinical Outcomes by 30-days

Outcome	n (%) or mean (SD)
Periprocedural clinical outcomes	
Death	0 (0%)
Any stroke	2 (0.57%)
Major	0 (0%)
Minor	2* (0.57%)
Ipisilateral ischemic	2 (0.57%)
Hemorrhagic (any)	0 (0%)
Contralateral (any)	0 (0%)
TIA[§] (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%)
Ipisilateral 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%)
Ipisilateral ischemic	2* (0.57%)
Hemorrhagic (any)	0 (0%)
Contralateral	1 (0.28%)

Aneurysms: Physiological Healing (Flow-Divertion)



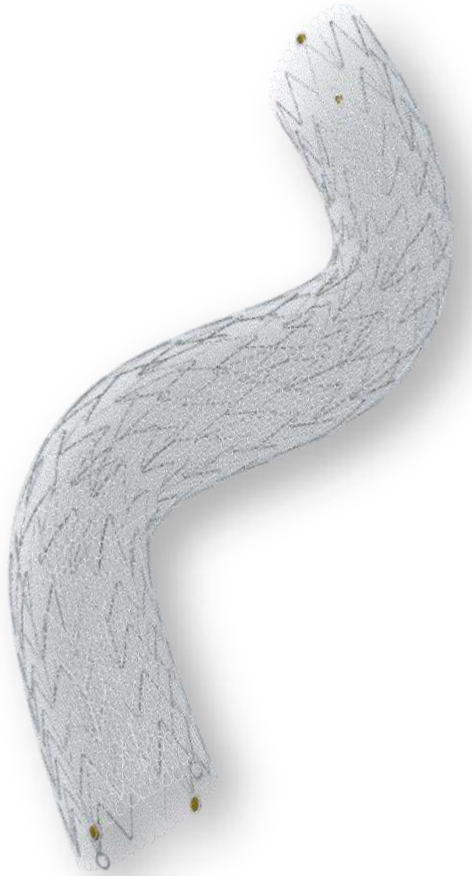
43 yo Man, h. symptomatic

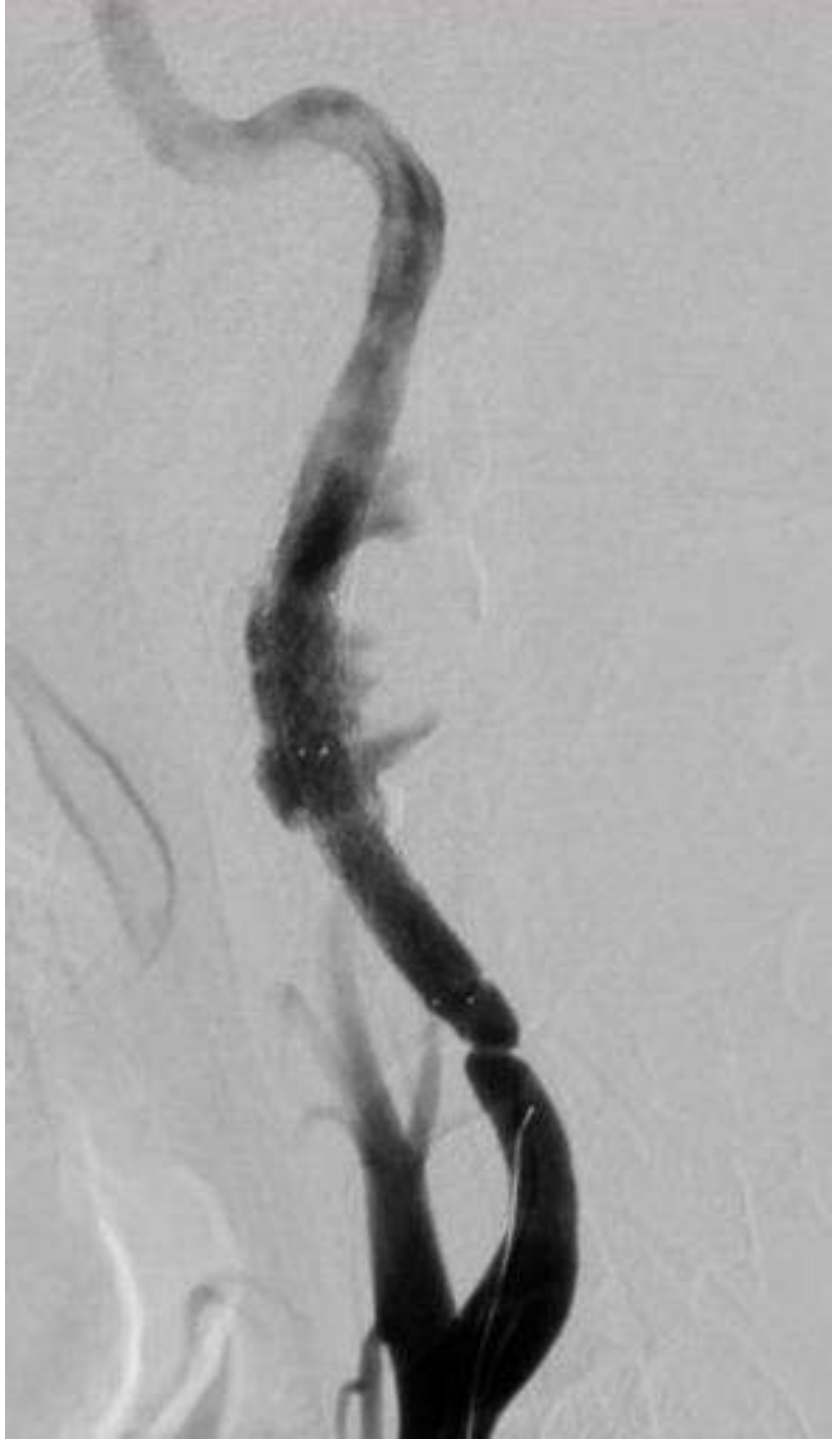




C-HEAL

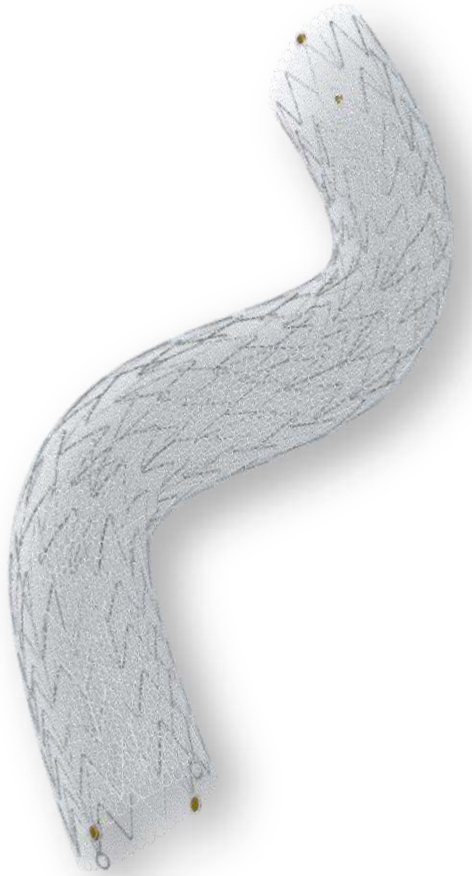
STUDY

NCT04434456





Immediate result



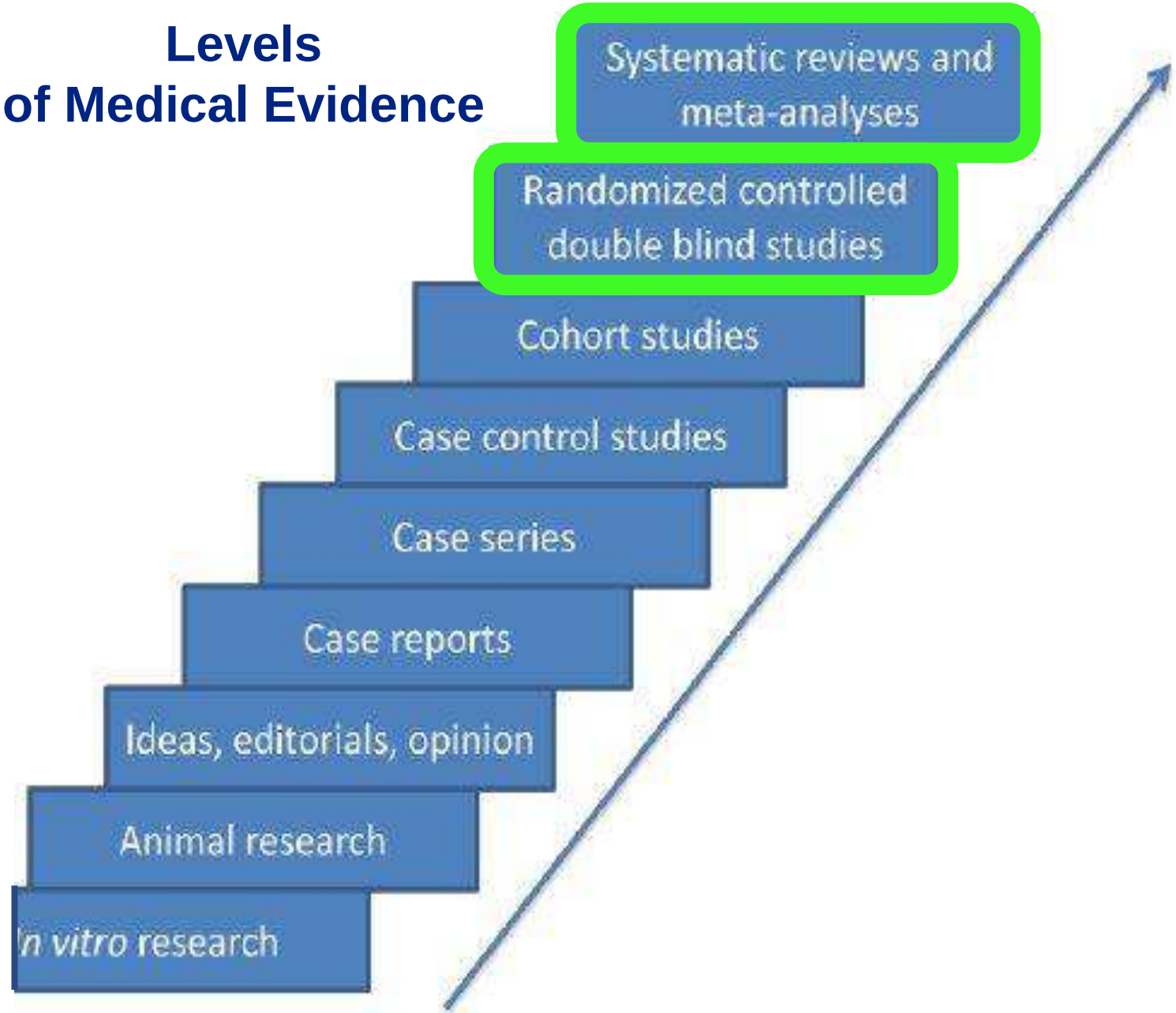
Immediate result

ANEURYSM
Total Exclusion @ 72h

Reconstruction of
NORMAL
ANATOMY

Acute Result Maintained @6mo CT Angio Control

Levels of Medical Evidence



Sackett DL

MicroNet-Covered Stent System

Decision-making
in Carotid Stenosis

PHARMACOTHERAPY
+ INTERVENTION

ISOLATED
PHARMACOTHERAPY

RISK OF
PROCEDURE

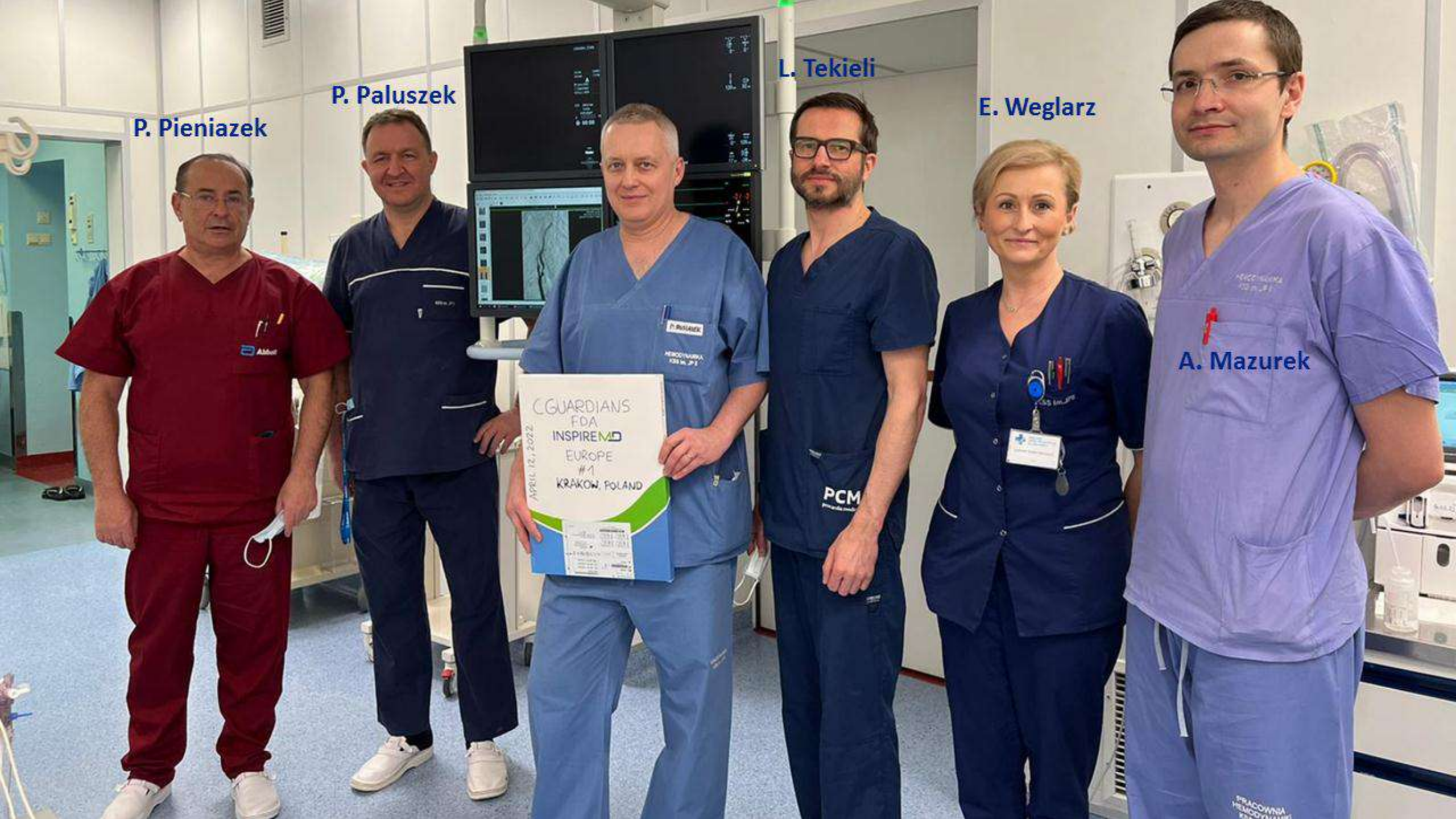
Podlasek , Grunwald, Musiałek 2021
Musialek, de Donato 2023

CGuard MicroNet-Covered Stent

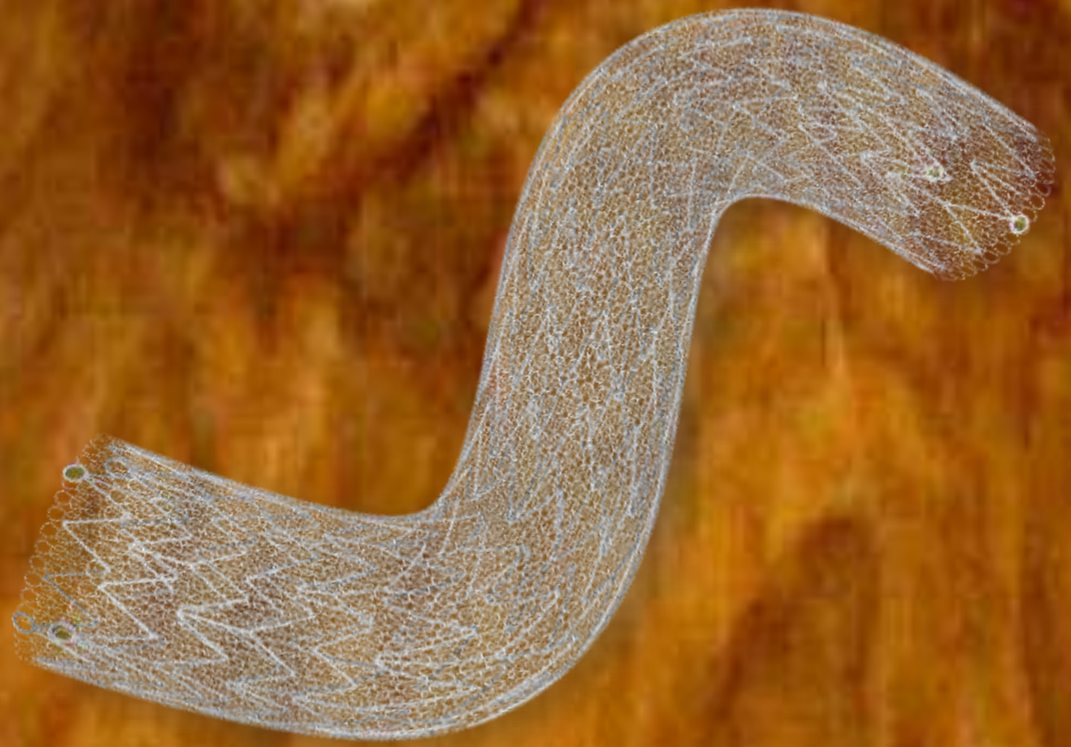
Expanding Clinical Evidence: 2023

CGUARDIANS	**FDA-IDE**	NCT04900844
OPTIMA	**Intravascular Evaluation of Sympt. plaque exclusion**	NCT04234854
PARADIGM 500/533…	**High-Risk All-comers with indication, No exclusions**	NCT04271033
SIMGUARD	**Greatest-Risk Patients: SIMULTANEOUS Urgent Cardiac Surgery+CGuard**	NCT04973579
FLOWGUARD	**MicroNET stent in high-risk lesions beyond carotid bif.**	NCT04461717
C-HEAL	**Flow-Diverter: Aneursym exclusion-and-healing**	NCT04434456
SAFEGUARD-STROKE	**CGuard in Carotid-Related Acute Stroke**	NCT05195658
TOPGUARD	**CGuard in Transcervical Flow Reversal CAS**	NCT04547387

P Musialek @ CVS 2023


P. Pieniazek
P. Paluszek
L. Tekieli
E. Weglarz
A. Mazurek
CGUARDIANS
FDA
INSPIREMD
EUROPE
#1
KRAKOW, POLAND
APRIL 12, 2022

CGuard MicroNET-Covered Stent



A NEW STANDARD OF CARE