

Ictus, PFO, fibrillazione atriale e 'dintorni'

Prevenzione dello stroke atero-embolico: Ruolo dell'interventistica carotidea

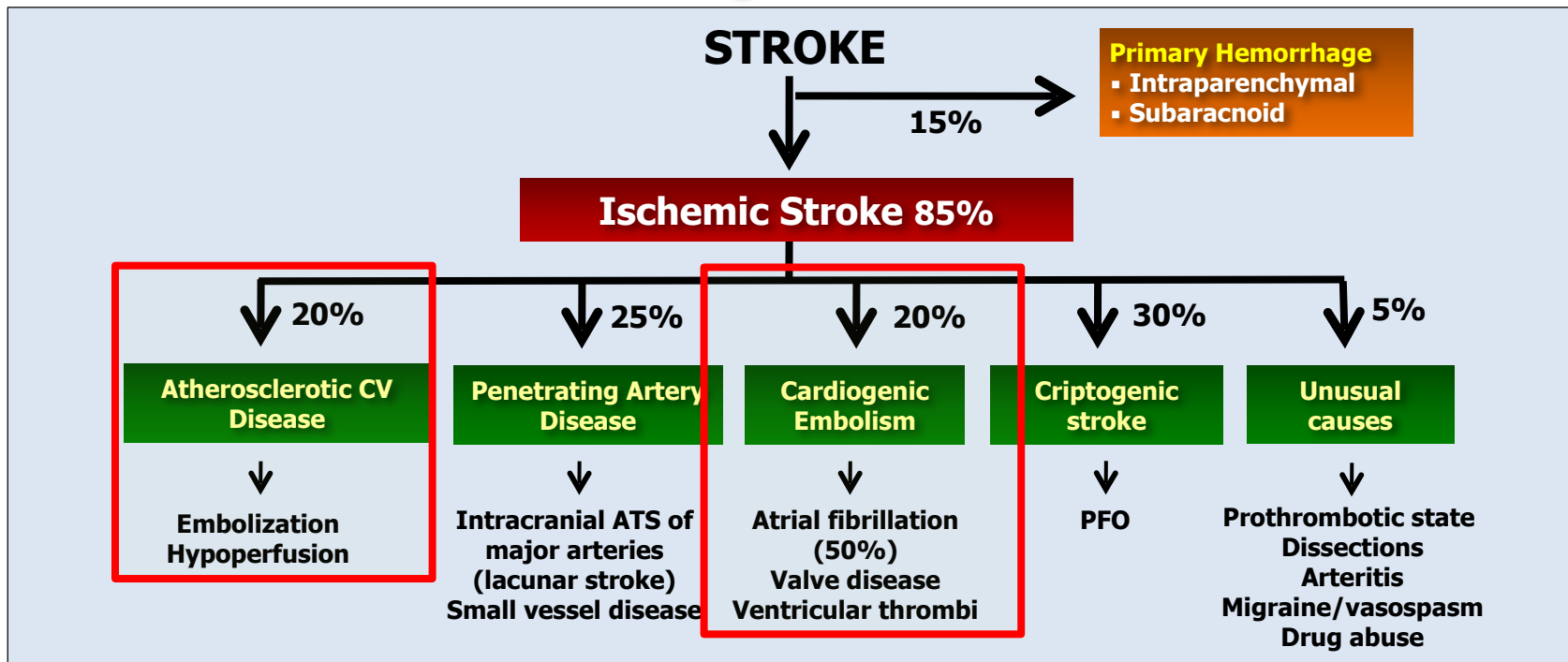
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Carotid Artery Disease

An heterogeneous disease



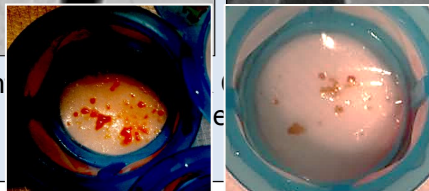
Carotid Artery Disease The case for a distinction

Acute ischemic stroke (large vessel occlusion)

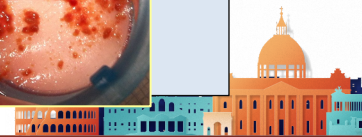
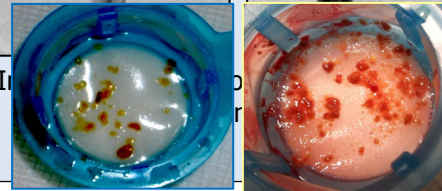


Interventional NR
Mechanical thrombectomy,
Aspiration ± CAS

Symptomatic carotid stenosis (TIA, minor stroke, mRS 1-3)



Asymptomatic carotid stenosis



Carotid Artery Stenting

Focusing the main issue



- The first stroke is an **unheralded event** in approximately **80%** of patients.
- **Half of ipsilateral ischemic strokes** in patients with >60% asymptomatic carotid stenosis **were disabling or fatal**, (ACST study)
- The **rate of of asymptomatic** patients undergoing CAS/CEA is **70-80%** (Stroke 2020)

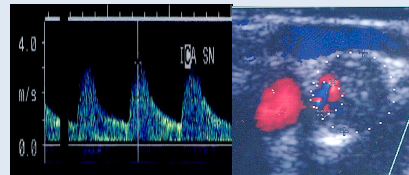


Endovascular treatment of carotid artery disease

Diagnostic-therapeutic pathway

First step

US Color-Doppler & clinical assessment
→ Initial diagnosis and preliminary risk of MACCE



Second step

Imaging techniques: CTA or MRA
(±additional tools as per guidelines)
→ final diagnosis and risk of MACCE



Third step

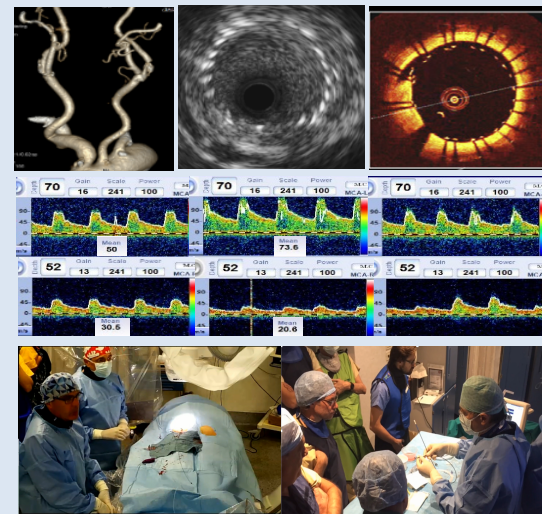
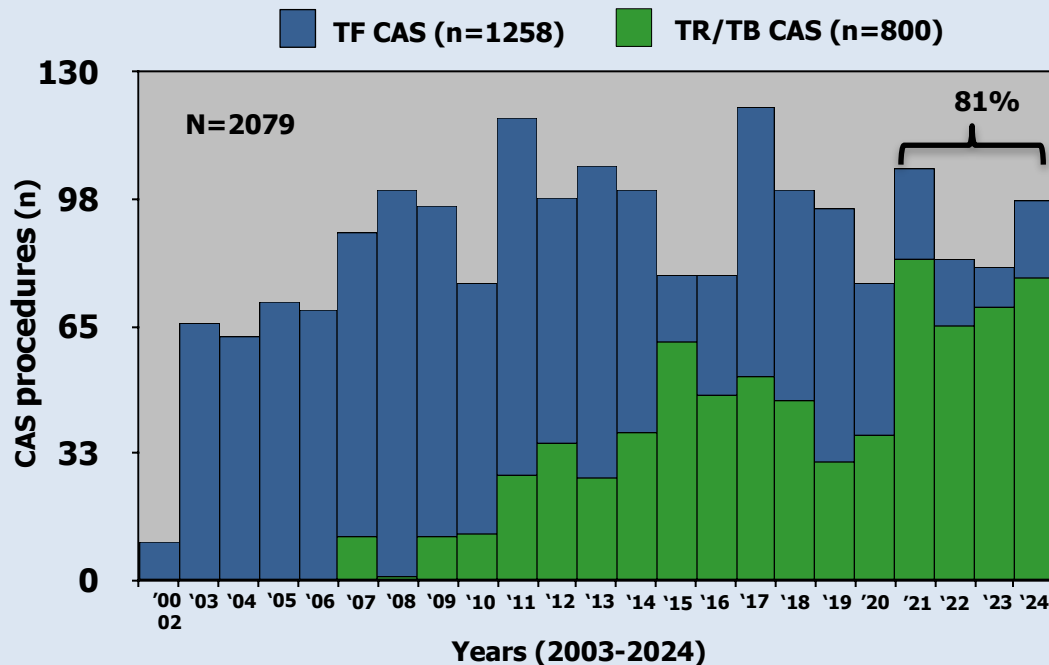
CEA+BMT

CAS+BMT



Carotid Artery Stenting

Lesson learnt from >2000 procedures in 20 years



Carotid Artery Stenting

A matter of multiple choices (for a successful CAS)

✓ **Patient selection & assessment**

Extensive work-up

✓ **Cath staff experience**

High operator/hospital volumes

✓ **Cerebral brain protection**

Distal vs. proximal protection

✓ **Carotid stent**

Open cell vs. closed vs. double-layer

✓ **Vascular approach**

Femoral vs. radial

✓ **Vascular imaging**

Angio alone vs. angio + IVUS, OCT

✓ **New technologies & techniques**

Intravascular lithotripsy (IVL), Drug-coated balloon, No.Ma2 technique, trawl-fishing technique

✓ **Polyvascular arterial disease diagnosis and treatment**

All in one shot vs. step by step

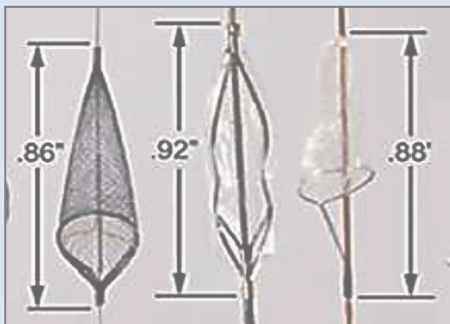
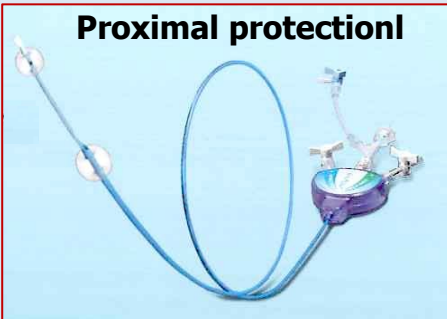
✓ **Educational**

Checking results, teaching CAS, spreading the news

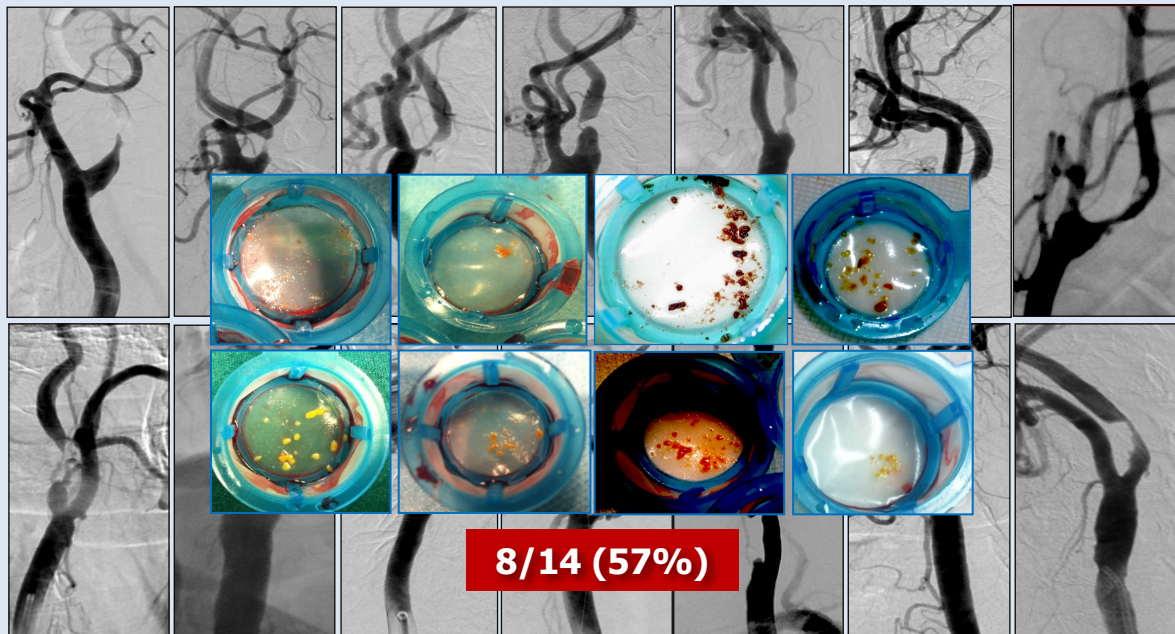


Carotid Artery Stenting Role of cerebral protection

Proximal protection



Distal protection



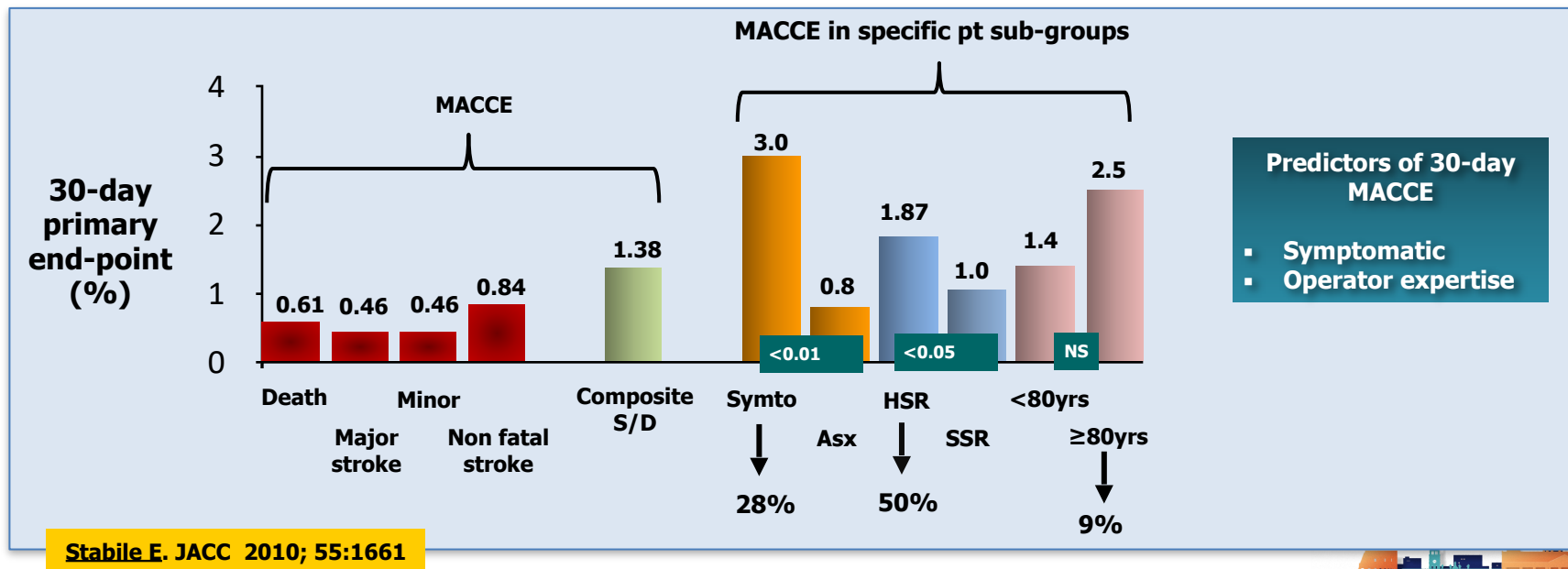
8/14 (57%)

Carotid Artery Stenting

Role of cerebral protection

1.300 unselected pts underwent CAS with PP (Mo.MA Ultra system, 9-10 F) from July 2004 to May 2009.

Exclusion criteria: ECA occlusion, severe ipsilateral CCA lesion. High level of operator expertise.



Carotid Artery Stenting

Role of cerebral protection

Microembolization During Carotid Artery Stenting in Patients With High-Risk, Lipid-Rich Plaque

A Randomized Trial of Proximal Versus Distal Cerebral Protection

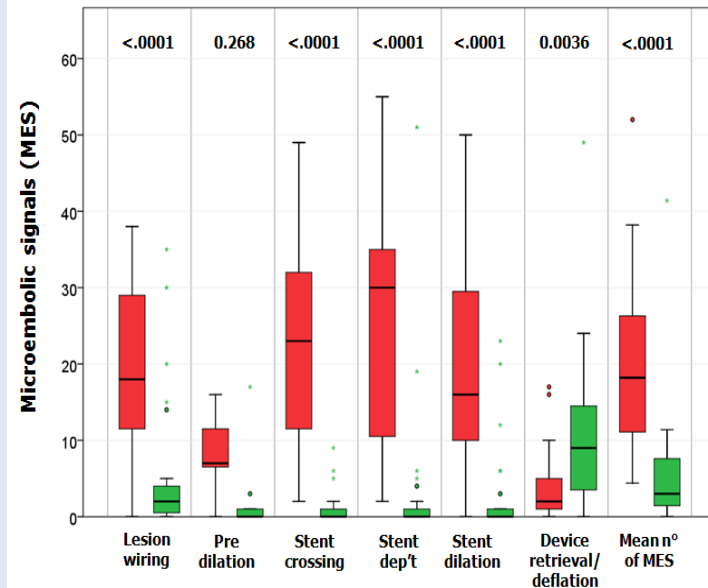
Variable	Estimated Effect (%)	95% CI	p Value
Age (1-yr Increment)	-0.4	-3.4 to 2.8	0.822
HSR versus LSR	-12.2	-52 to 60.9	0.677
Lesion length (>15 vs. ≤15)*	-16.6	-49.6 to 37.9	0.482
Lesion eccentricity (>1.2 vs. ≤1.2)*	52.7	-10.6 to 161	0.128
Stenosis diameter by ECST (1% increment)*	-0.5	-4.6 to 3.8	0.826
Pre-dilation (yes vs. no)	-18.4	-51.4 to 36.9	0.445
Protection device (MO,MA vs. FilterWire EZ)	-81.7	-88.6 to -70.7	<0.0001

Evaluated by using multivariate analysis of covariance. *Lesion length, lesion eccentricity, and percentage diameter stenosis were assessed using computed tomography angiography.

HSR = high surgical risk; LSR = low surgical risk; other abbreviations as in Tables 2 and 3.

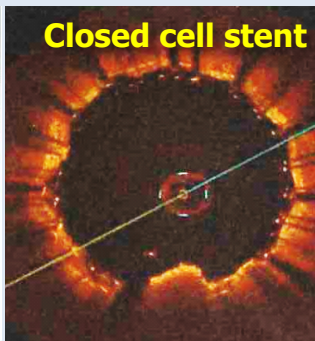
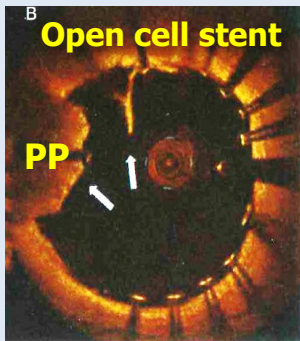
MES by TCD

■ Distal filter ■ Mo,MA



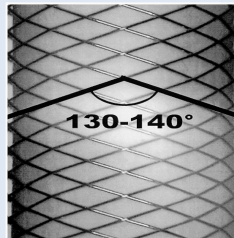
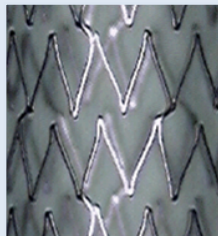
Carotid Artery Stenting

Role of carotid stent: First vs. second generation stents

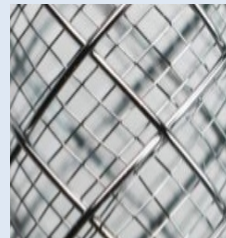


- The use of imaging technique (IVUS/OCT) during CAS confirmed the role of plaque prolapse (PP) through the stent struts as an **source of late debris embolization (40%)**.
- PP occurred more frequently with open-cell vs. closed-cell stent designs
- PP increased risk for ischemic complications within 24 h of the end of CAS and was associated with unstable carotid plaques (soft plaque).

**Open cell
(Precise)
1900 μ**



**Closed Cell
(Carotid Wallstent)
1090 (1mm²)**



**Dual-layer
(Roadsaver)
360 μ (0.381mm²)**



**Dual-layer
(C-Guard)
150-180 μ**

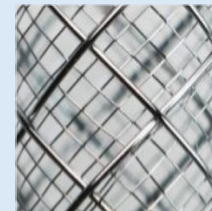


Carotid Artery Stenting

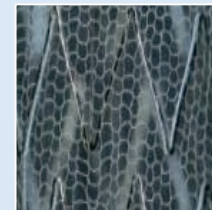
Role of carotid stent: First vs. second generation stents

Systematic review and meta-analysis of 68.442 pts (68% male, 45% symptomatic) from 112 eligible studies submitted to CAS with FGS or SGS. Endpoints: 30-day MACCEs + 12-month ipsilateral stroke.

		FGS		SGS		Casper/ Roadsaver		CGuard	
Procedural phase	30-day Stroke (%) (95% CI)	3.01 (2.63–3.38)	<0.001	0.60 (0.28–0.92)		0.50 (0–1.15)	NS	0.54 (0.17–0.92)	
	30-day Death/Stroke/MI (%) (95% CI)	4.11 (3.65–4.56)	<0.001	1.30 (0.64–1.96)		1.33 (0–2.66)	NS	1.08 (0.55–1.60)	
Follow-up	12-mo Ipsilateral Stroke (%) (95% CI)	3.51 (2.52–4.50)	0.001	0.7 (0–1.47)		0.26 (0–1.27)	NS	0.38 (0–0.9)	
	12-mo Restenosis (%) (95% CI)	3.97 (0.28–5.14)	0.569	3.38 (1.39–5.37)		7.16 (5.45–9.86)	0.04	0.34 (0–0.82)	



Roadsaver



C-Guard

Mazurek A. J Clin Med 2022

FGS/SGS=first/second generation stent

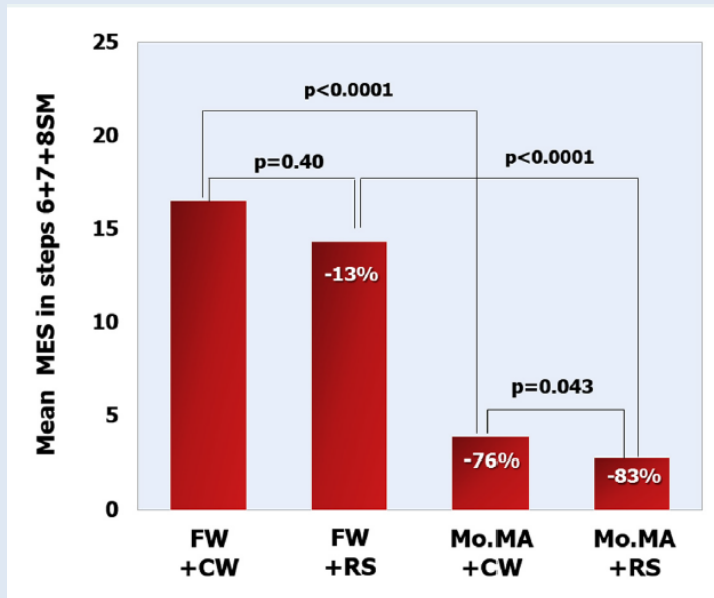


Carotid Artery Stenting

Role of carotid stent + brain protection

Carotid Wallstent Versus Roadsaver Stent and Distal Versus Proximal Protection on Cerebral Microembolization During Carotid Artery Stenting

- 104/214 consecutive pts with high-risk, lipid-rich carotid stenosis
- Randomized to Carotid Wallstent vs. Roadsaver and Distal (FilterWire EZ) vs. Proximal protection (Mo.MA Ultra)
- Transcranial Doppler assessment of procedural microembolic signals (MES)
- **Primary endpoint:** Number of MES during CAS (by TCD)



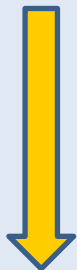
Montorsi P. JACC CV Interv 2020



Carotid Artery Stenting

Role of vascular access: femoral vs. radial

Learning curve
(1st part)
100 pts



Learning curve
(2nd part)
724 pts



Bovine
aortic arch
+LICA



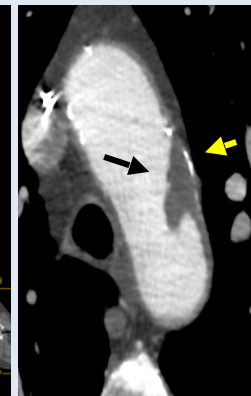
Type II
aortic arch
+RICA



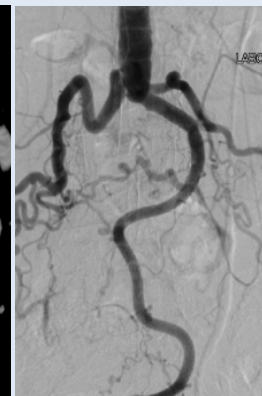
Type III
aortic arch
+RICA



'Plongant'
innominate artery
+RICA



Aortic arch
disease
+RICA/LICA



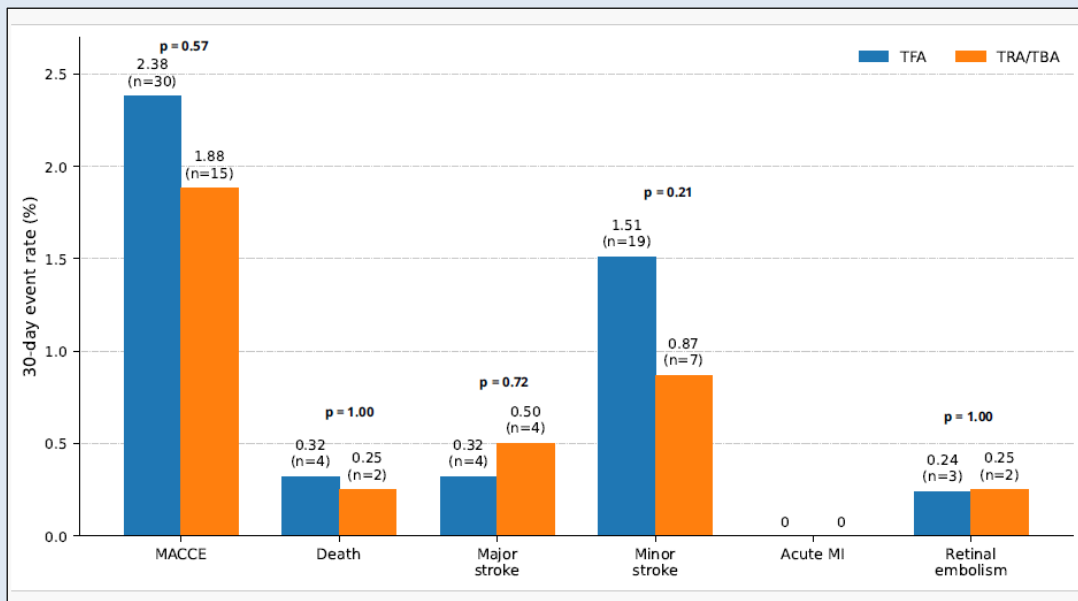
Peripheral arterial
disease
+RICA/LICA

' ALL COMERS'
824 pts up to 6/2026



Carotid Artery Stenting

Role of vascular access: femoral vs. radial



Carotid Artery Stenting

Role of vascular approach

Asymptomatic
Carotid stenosis
60-99%

All comers

Average-SR
+
Life expectancy ≥ 5 years

Carotid Artery Stenting With Proximal Embolic Protection via a Transradial or Transbrachial Approach: Pushing the Boundaries of the Technique While Maintaining Safety and Efficacy

Piero Montorsi, MD^{1,2}, Stefano Galli, MD^{1,2}, Paolo M. Ravagnani, MD^{1,2}

Naylor AR. EJVS 2023

Unchanged*

CEA+BMT
should be
considered

Class

IIa

Level

B

Unchanged*

Class

IIb

Level

B

Class

IIa

Level

B

References

ToE

35,64,148,

41-483

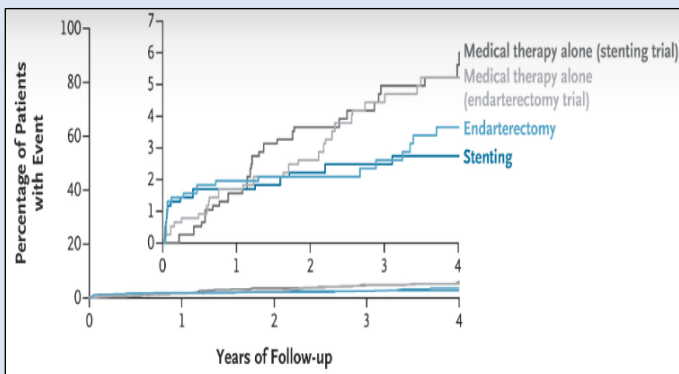
should be
considered

Asymptomatic carotid stenosis

The 'last-minute' CRTs: The CREST-2 study

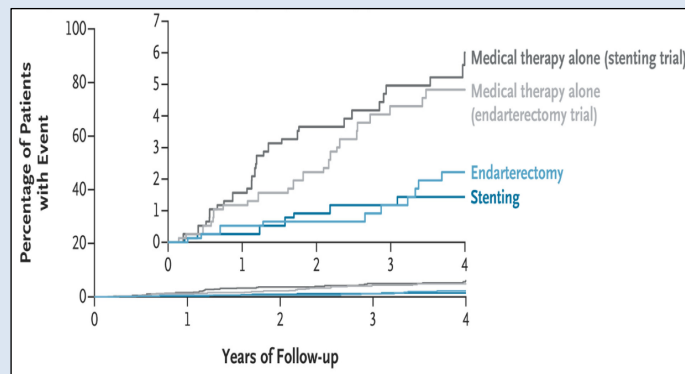
Pts with $\geq 70\%$ asymptomatic carotid stenosis (155 centers in 5 countries)
comparing CAS or CEA + IMM vs. IMM alone.

Primary outcome: composite of any stroke or death or ipsilateral ischemic stroke, up to 4 yrs.



CEA trial

5.3% in the medical-therapy vs. 3.7% in CEA group
P=0.24 for the absolute difference



CAS trial

6.0% in the medical-therapy vs. 2.83% in CEA group
P=0.02 for the absolute difference

Br J IC. NEJM 2026;394:219



Carotid Artery Stenting Take-home Messages

- **Carotid artery stenting is a challenging procedure requiring motivated operators with specific knowledges, passion and a bit of humility.**
- **Several clinical and procedural variables play a role in the procedure safety and efficacy (not a 'one variable show').**
- **The choice of the 'right' brain protection, stent, approach, imaging and new technique/technology may be the right way to go.**
- **Real life experience is running faster than guidelines.**

