Revascularisation carotidienne
Angioplastie

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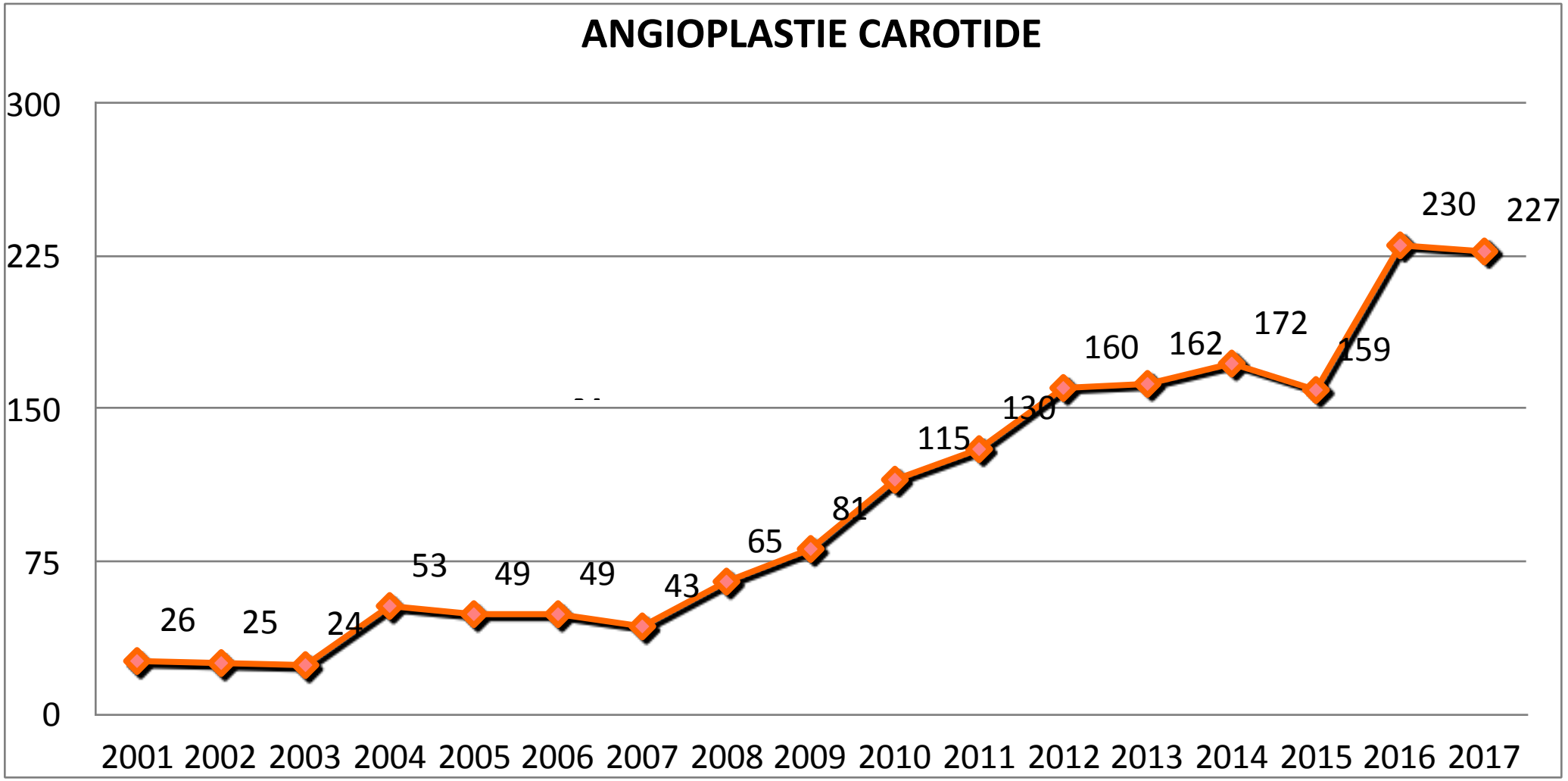
Conflict of Interest Max Amor

- **Nothing to declare.**

Activité Carotide Protégée Louis Pasteur Essey –Les-Nancy



PLAN

- **Quelques cas d'angioplastie carotidienne**
- **Une brève mise au point sur l'angioplastie : les dernières nouveautés.**
- **Les résultats des dernières études randomisées**
- **Indications et contre-indications de l’angioplastie**
- **Qui**

Clinique Louis Pasteur

Institut Lorrain du Coeur et des Vaisseaux

ILCV

63 y Old asymtomatic man
Bilateral lesions
Right tandem de-novo lesions
Left post surgical

Previous left main coronary stenting 3 weeks ago

BEFORE ANGIOPLASTY

Clinique Louis Pasteur

Institut Lorrain du Coeur et des Vaisseaux

ILCV

BEFORE ANGIOPLASTY

AFTER ANGIOPLASTY

6years before : 64 years man

- Double coronary vessel disease and right severe internal carotid stenosis .
- Right internal carotid Patch-Endartériectomy followed 2 months later by a double by-pass graft (Stagged Technic)

Double Lesions RICA restenosis & De-novo LICA

1. Bilateral endarterectomy
2. Right Angioplasty et Left carotid endartectomy
3. Wait and See under Aspirine

J 0

Placement of a Precise Carotid Stent under filter Protection ?

Double Restenosis

- **When ?**immediately ?, Same hospitalisation, Delayed (1, 2, 3)
- **Which Protecting Device ?**Filter,Moma,Silk Road (1,2,3
- **Single stent ?**
- **Several stents ?**
- **Covered ?**

J 1

24 hours later, Two ADAPT stents 21mm, Filter Protection

3 stents : 2 Right 1 Left

J1

- Fermeture du point de ponction
- Bonne tolérance hémodynamique
- Très bon résultat échographique, pas d'emboles au scan
- Sortie après 72 h d’hospitalisation

Case 11

Polyvascular Patient (CAD+CVD) with Total Endovascular Treatment

Y.A 61 y.o male

Cardiovascular risk factors: **HBP, Dyslipidemia**

medical History: CAD : 2015 : **RCA +Lcx PCI**

CVD : 2015 : Right internal carotid artery stenting

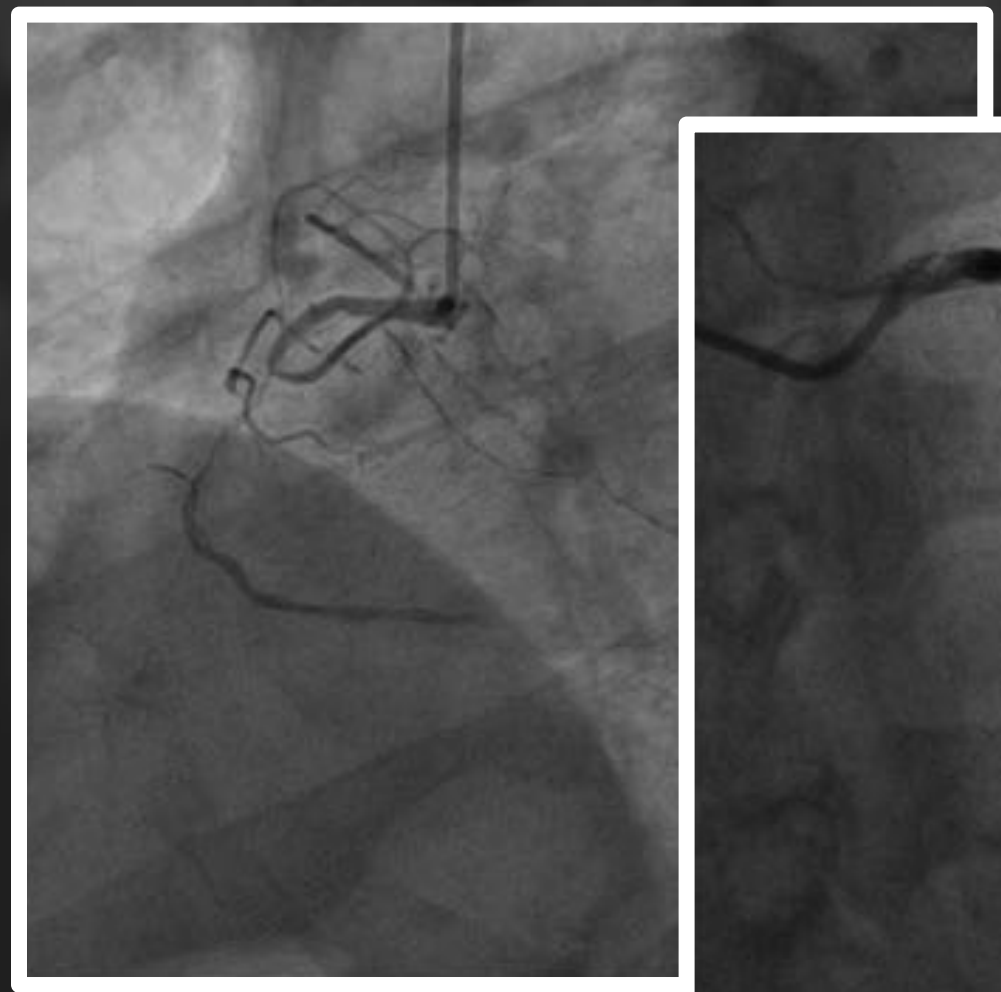
Current diagnosis:

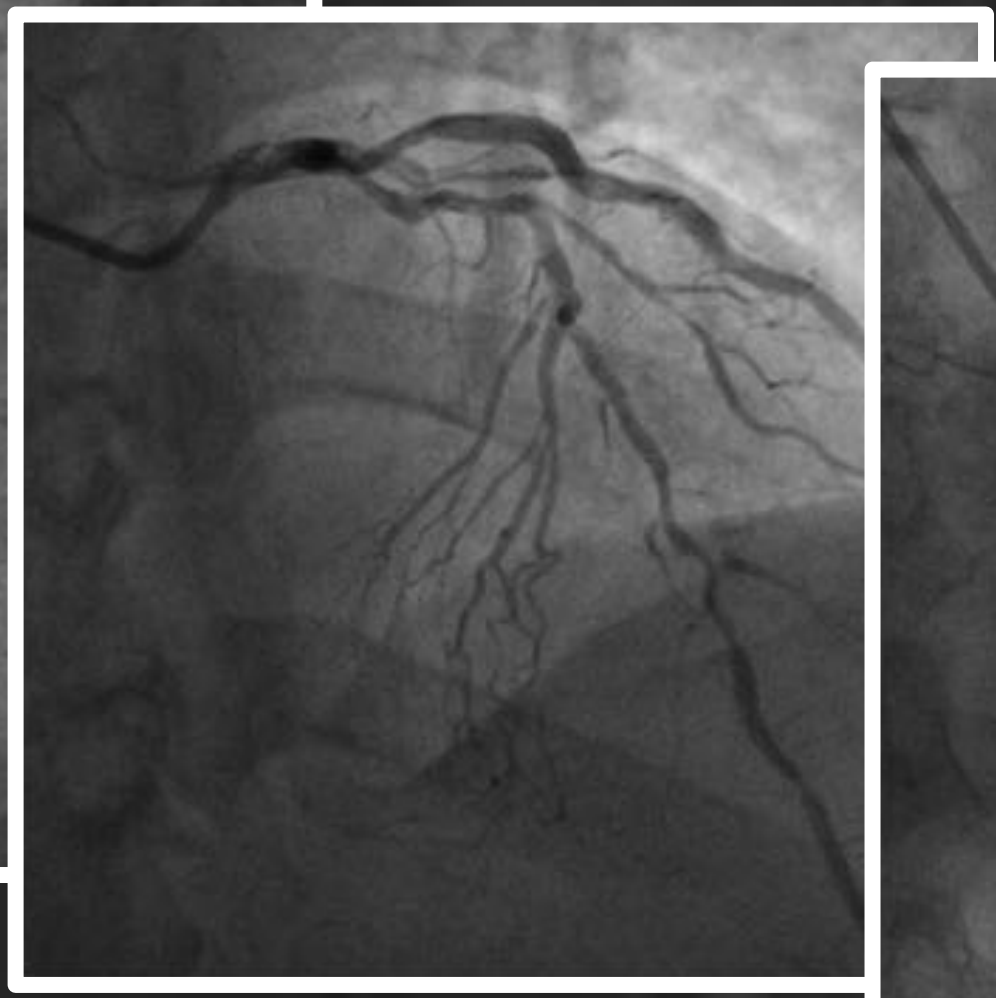
- **Progressive stable angina**
- **Asymptomatic Left ight internal carotid artery stenosis**

Biological parameters: Hb: 13,5 gr/dl , Cr cl :76ml/min

- **Medication:** **aspirine, simvastatine, perindopril, metoprolol**

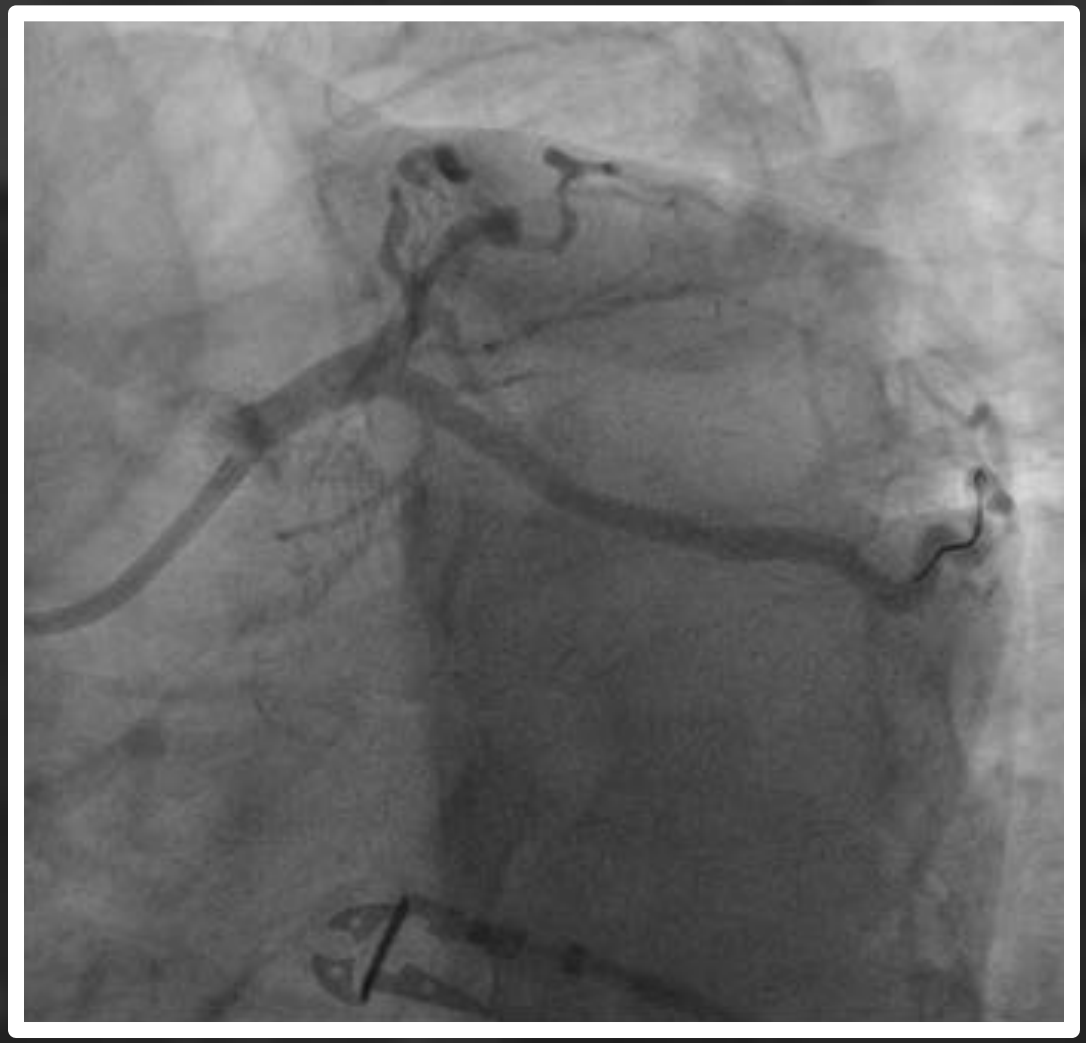
2015 Angiographic Evaluation





2015 Angiographic Evaluation

2015: RCA and Lcx PCI

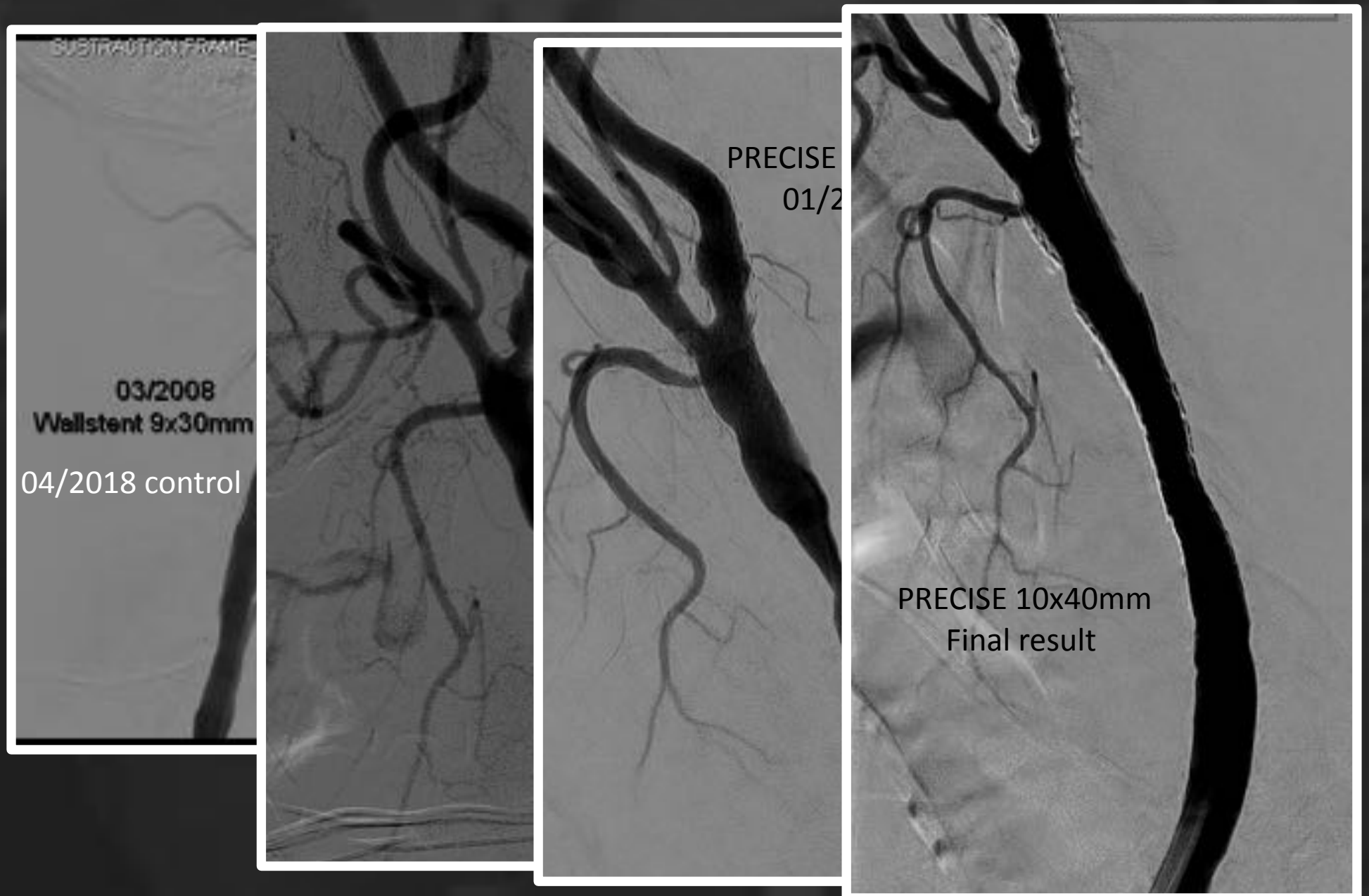


2015: Right internal carotid artery Stenting

2016:LAD Stenting

2016:Left Internal carotid artery through radial access

Case 04: Asymptomatic short LCC artery lesion



PLAN

- **Quelques cas d'angioplastie carotidienne**
- **Une brève mise au point sur l'angioplastie : les dernières nouveautés.**
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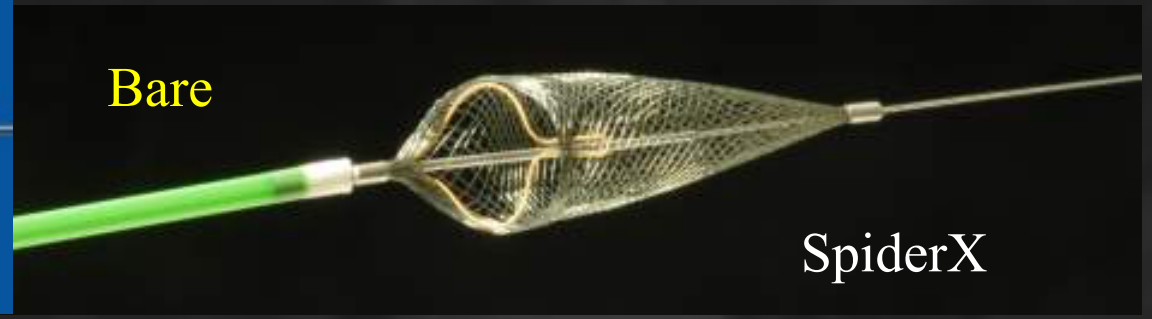
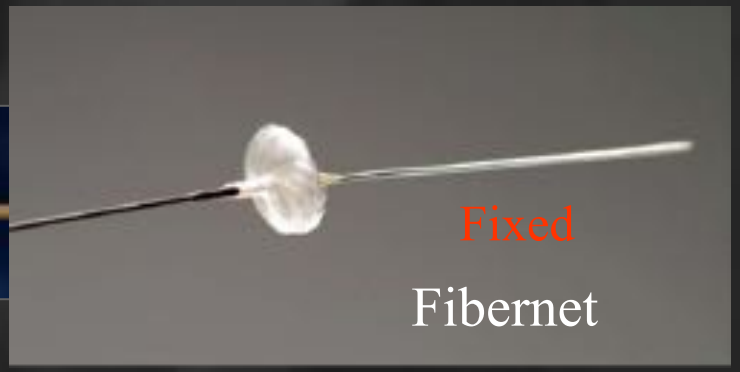
11 Systems of protection

- 7 Filters:
  - Angioguard (J&J)
  - Accunet (Abbott)
  - Easy Filterwire(BSC)
  - Emboshield(Abbott)
  - Interceptor (Medtronic)
  - Spider Rx(EV3)
  - Fibernet(Lumen-Invatec)
- 2 Flow Reversal
  - Moma Device (Invatec)
  - Gore Neuro-protecting system (Gore)
- 2 Occlusive Balloon
  - Percusurge (Medtronic)
  - Mini-invasys Theron double balloon(Mini-Invasys)

Main filters in 2010



Medtronic
Interceptor

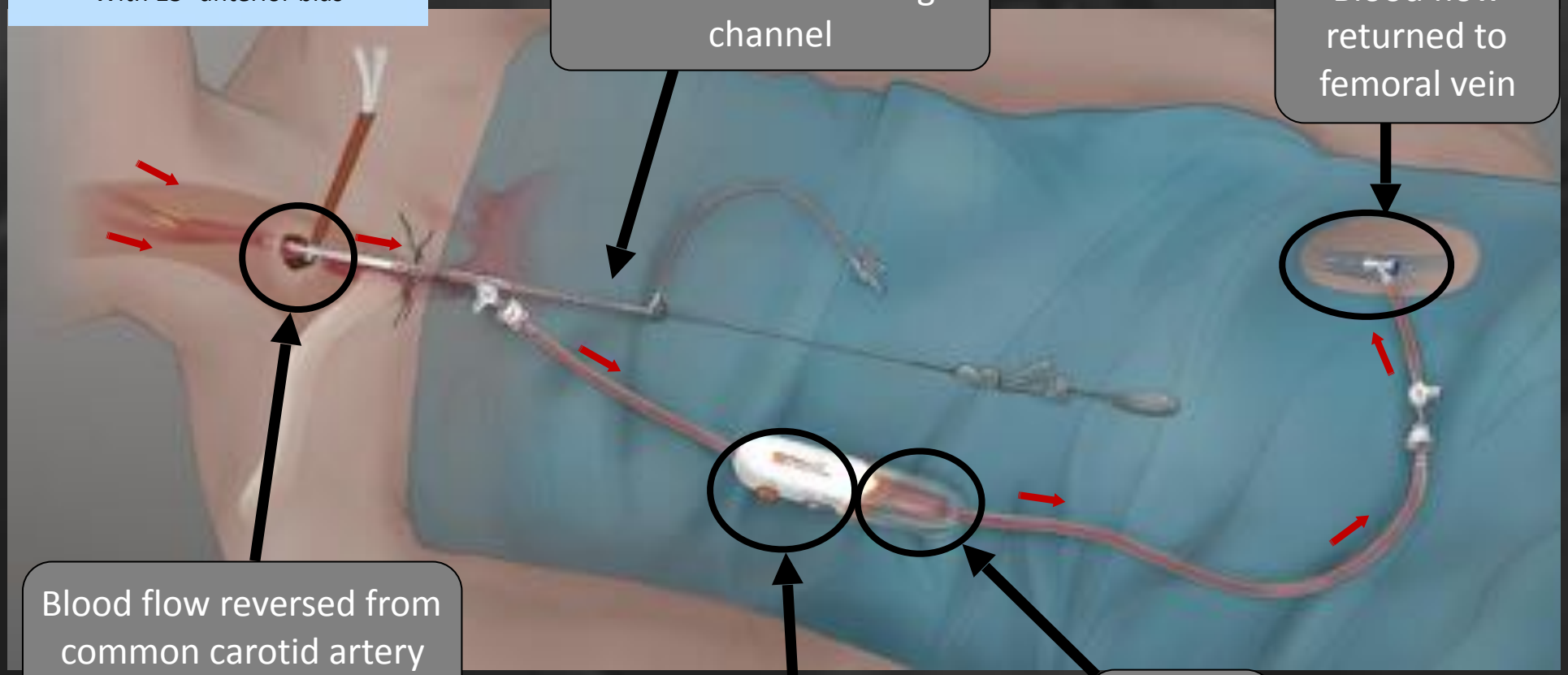


Les systèmes de protection

Protection cérébrale proximale avec inversion du flux cérébral	Protection cérébrale distale	
	Filtre solidaire du guide	**Filtre indépendant du guide**
• **Mo.Ma Ultra Proximal Cerebral Protection Device (Medtronic, Inc.)** • **Neuroprotecting system (WL Gore)**	• FilterWire EZ Embolic Protection System(Boston Scientific Corporation) • RX Accunet filter (Abbott) • Angioguard RX Emboli Capture Guidewire System(Cordis Corporation) • FiberNet Embolic Protection System(Medtronic)	• Emboshield Nav6 (Abbott Vascular) • SpiderFX Embolic Protection Device (Covidien)

TCAR – Direct carotid access + Flow reversal

Uber-Flex Sheath tip
With 15° anterior bias



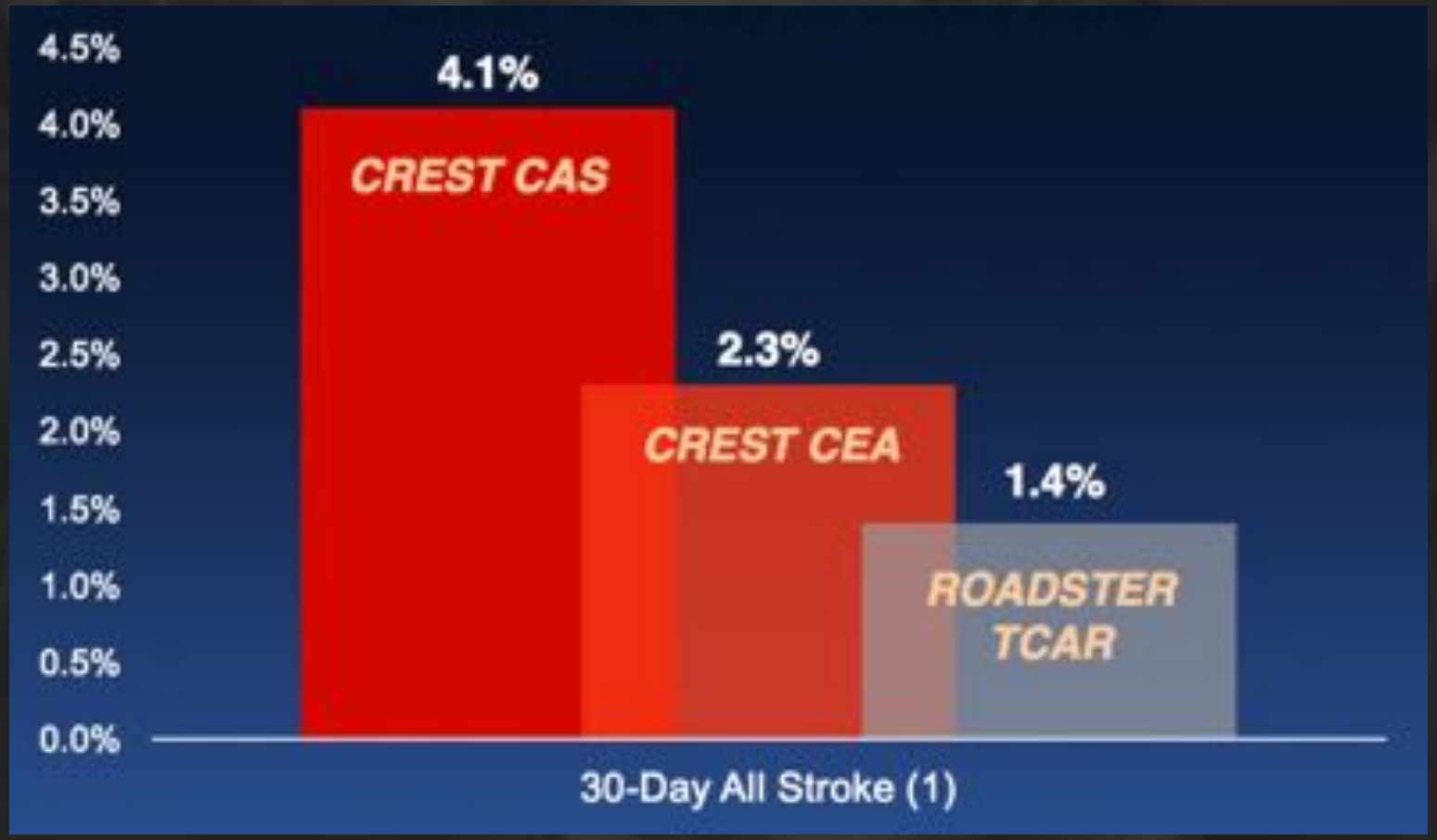
Introducer – working channel

Blood flow returned to femoral vein

Blood flow reversed from common carotid artery

Dynamic Flow Controller
High / Low / Off

Embolic filter (200µ)



Kwolek C et al. JVS 2015; 62: 1227-35
Brott T et al . NEJM 2010; 363 (1): 11-23

Available Carotid stents

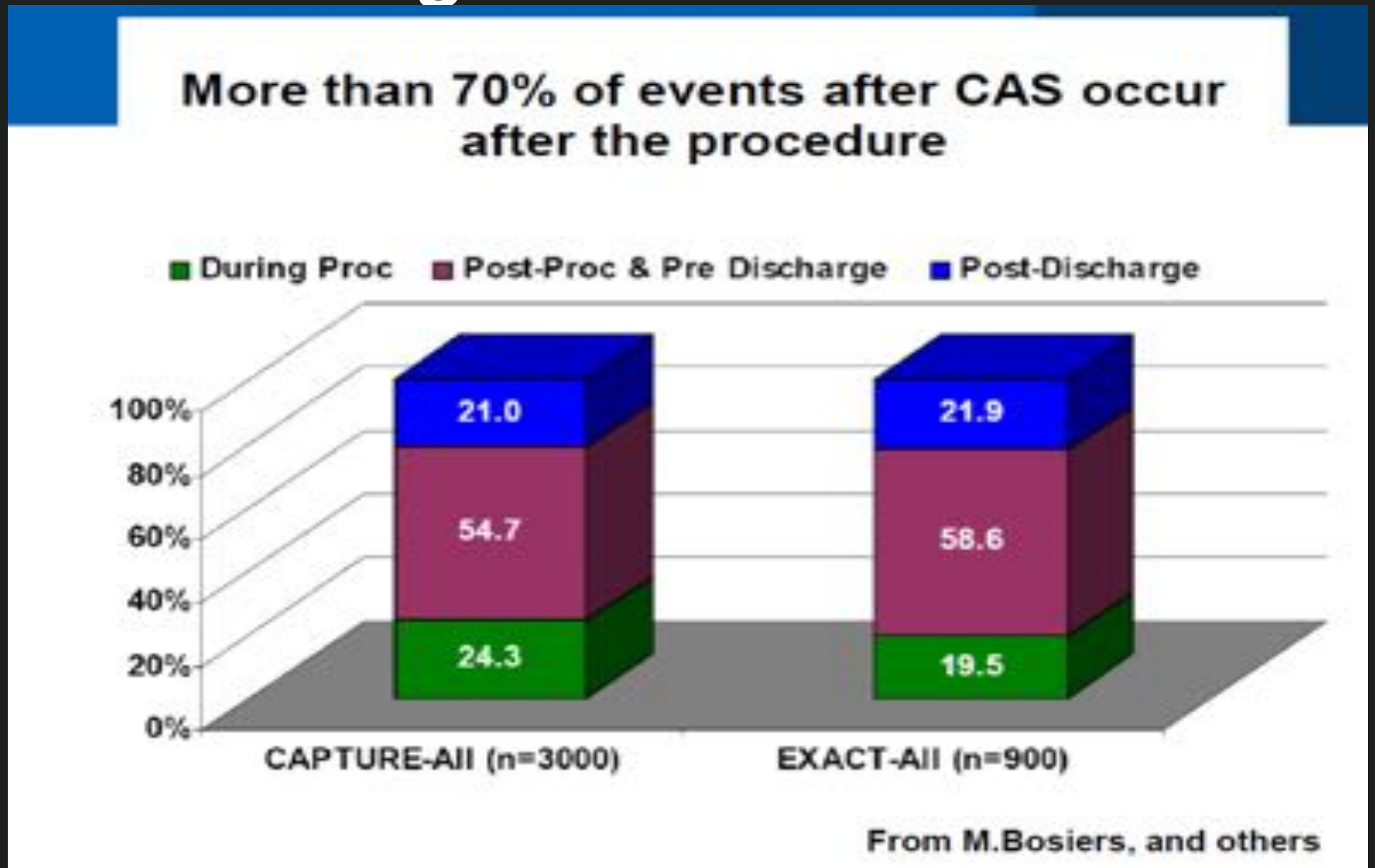
Open versus Closed Cell versus Mesh-Covered Stents

Stent Name	Stent Image	Stent Design	Free Cell Area	Specifics of Design	Stent Diameter (unconstrained)	Stent Length (unconstrained)
Acculink		Open Cell	11.5mm 2	Self-expanding nitinol stent	5 - 10mm (15 - 30Fr)	20 - 40mm
Protégé		Open Cell	10.7mm 2	Self-expanding nitinol stent	6 - 10mm (18 - 30Fr)	20 - 60mm
Precise Pro Rx		Open Cell	6mm2	Self-expanding nitinol stent	5 - 10mm (15 - 30Fr)	20 - 40mm
Adapt		Closed Cell	4.4mm2	Self-expanding nitinol stent	6 - 10mm (18 - 30Fr)	21 - 44mm
X-Act		Closed Cell	2.5mm2	Self-expanding nitinol stent	7 - 10mm (21 - 30Fr)	20 - 40mm
Wallstent		Closed Cell	1.1mm2	Braided construction	7 - 10mm (21 - 30Fr)	22 - 59mm
Cristallo Idesale		Hybrid	3.2mm2	Multisegment nitinol	6 - 11mm (18 - 33Fr)	20 - 40mm
Gore		Mesh Covered	0.5mm2	PTFE mesh (heparin coated) on nitinol stent)	unable to obtain specifics	
Roadsaver		Mesh Covered	0.4mm2	Nitinol double layer micromesh	5 - 10mm (15 - 30Fr)	25 - 43mm
InspireMD Cguard		Mesh Covered	0.18mm 2	PET MicroNet on nitinol stent	6 - 10mm (18 - 30Fr)	20 - 60mm

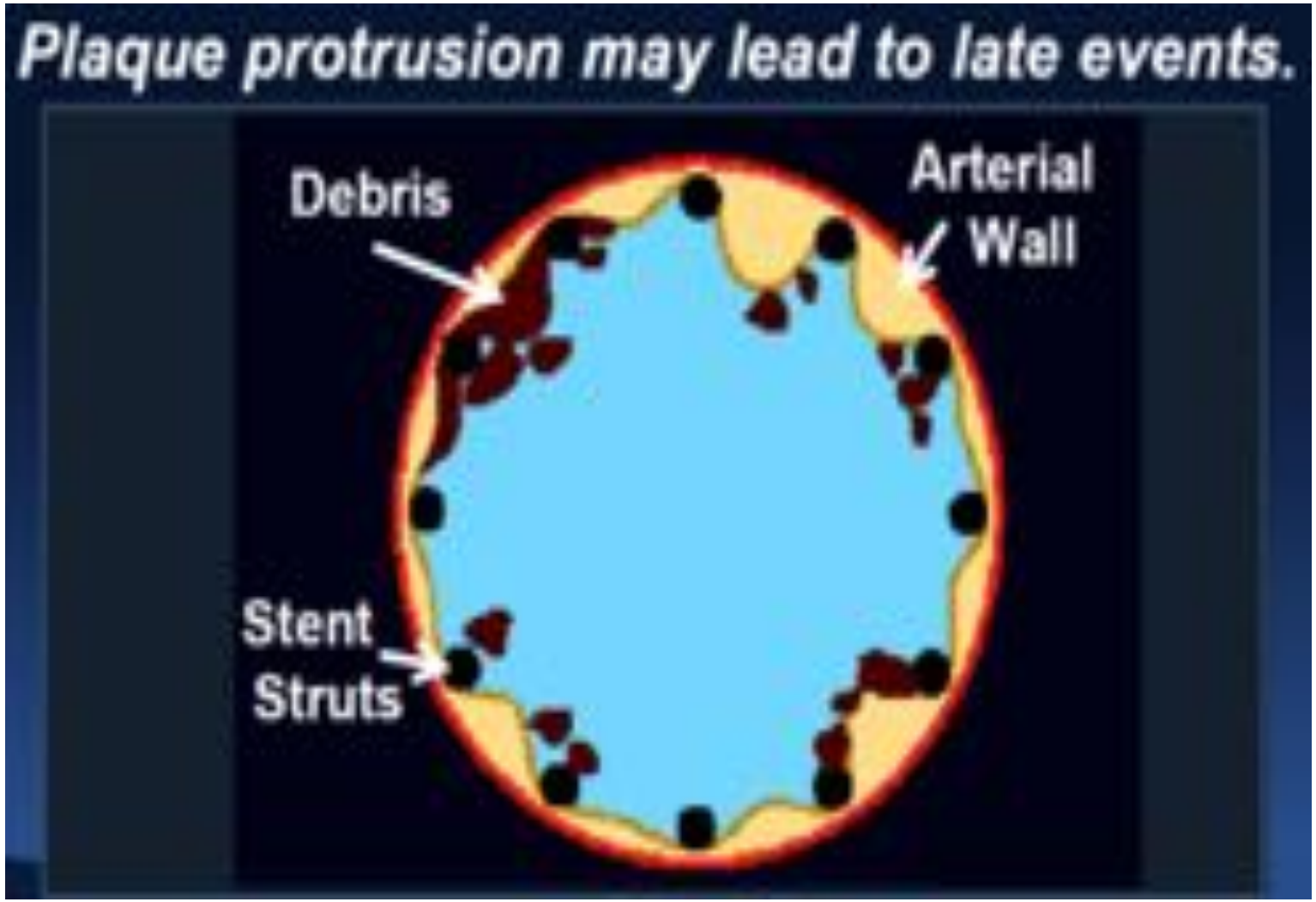
http://dx.doi.org/10.1053/j.semvascsurg.2017.04.007

The impact of stent design on outcomes: Procedural Stroke

Timing for Events in CAS:

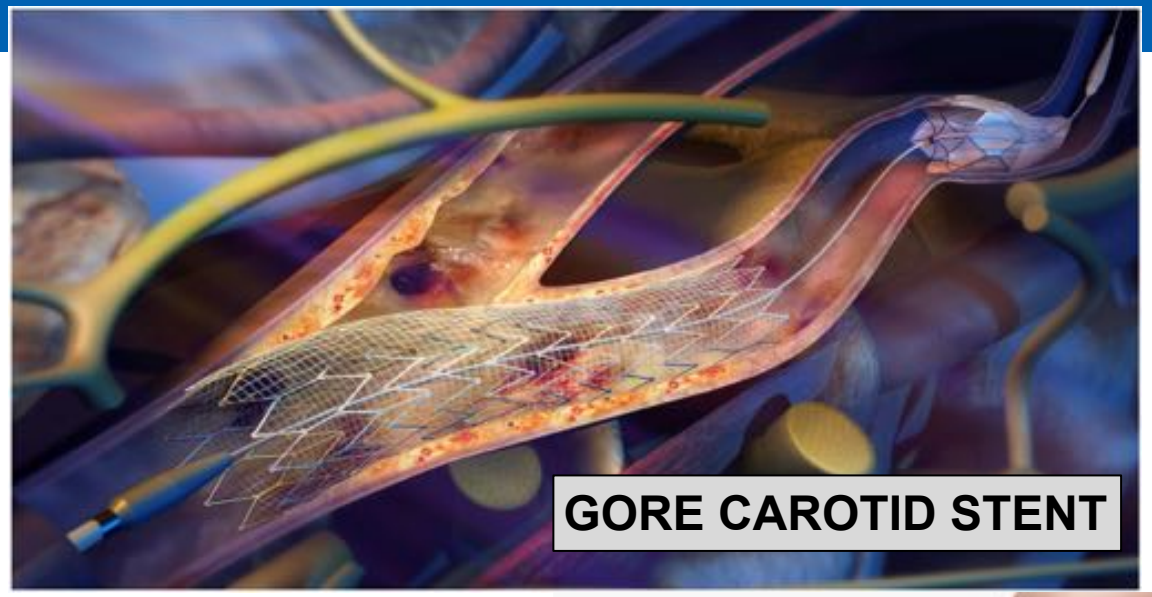


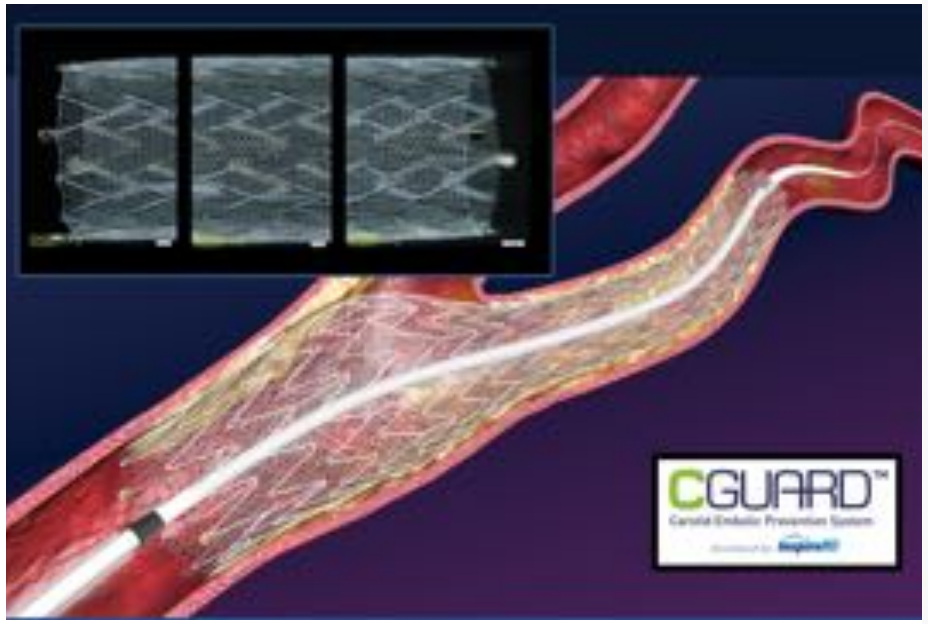
Causes of Late Embolization

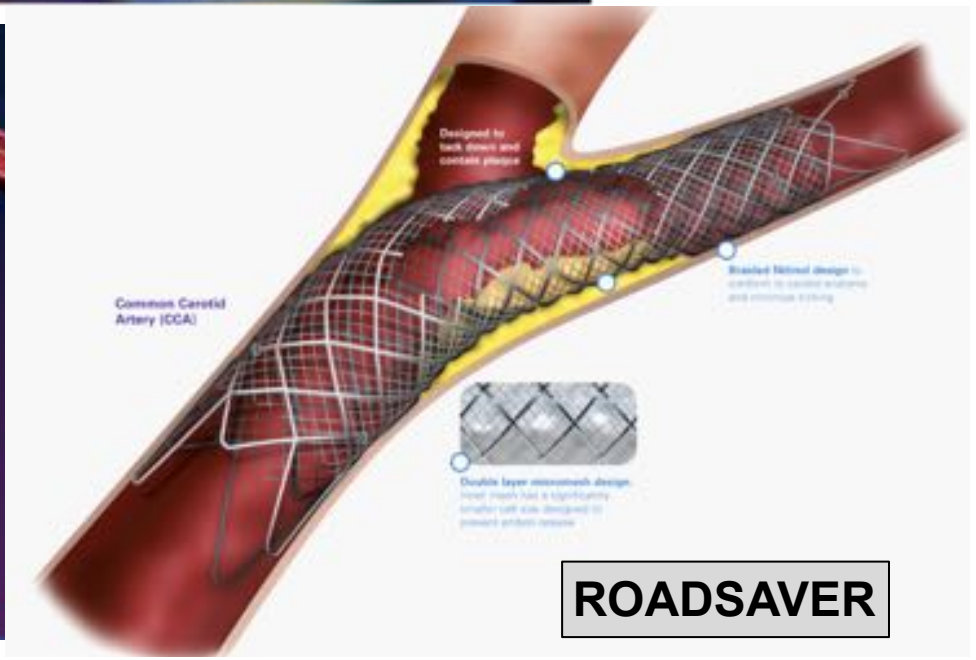


Prof. Dr. Klaus Mathias, TCT 2013

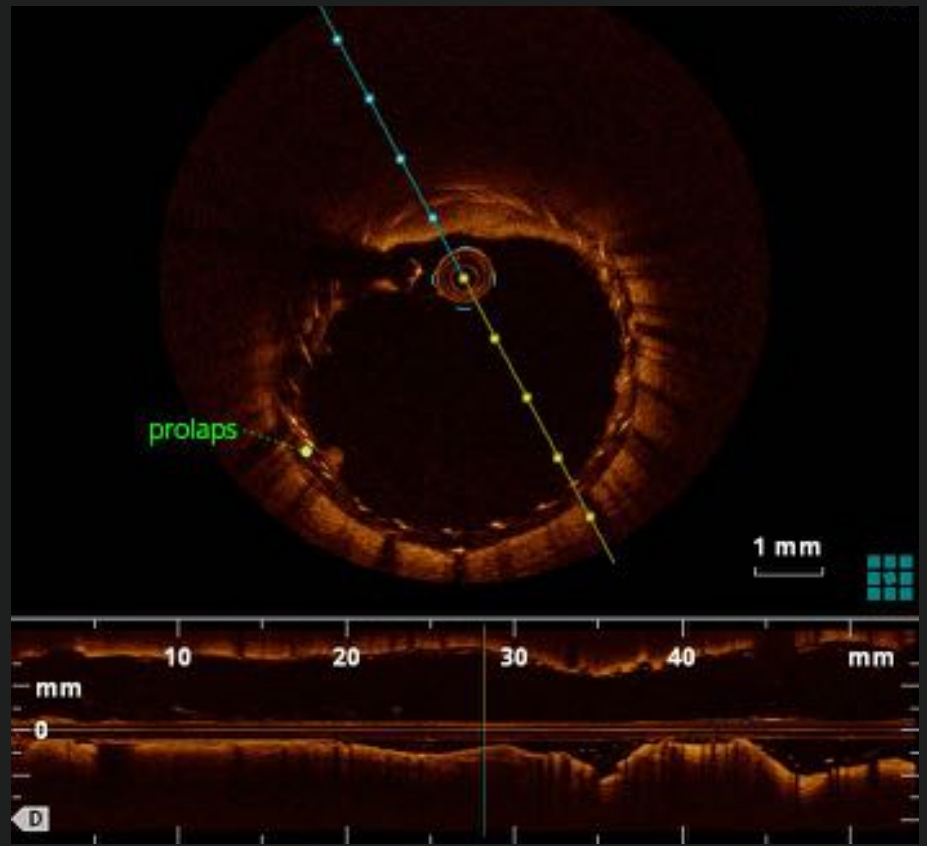
THE THREE MICROMESH CAROTID STENTS



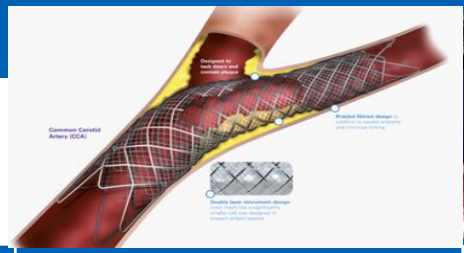


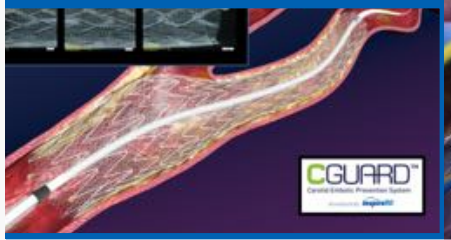


Micromesh may provide sustained embolic protection:



Tentative Summary of the main characteristics of the 3 Micromesh Stents

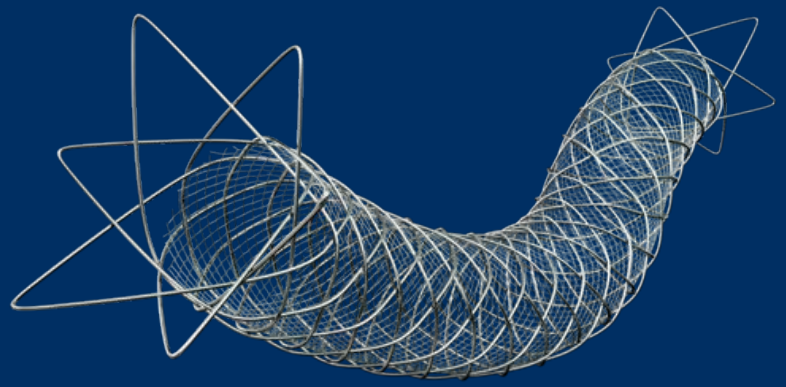


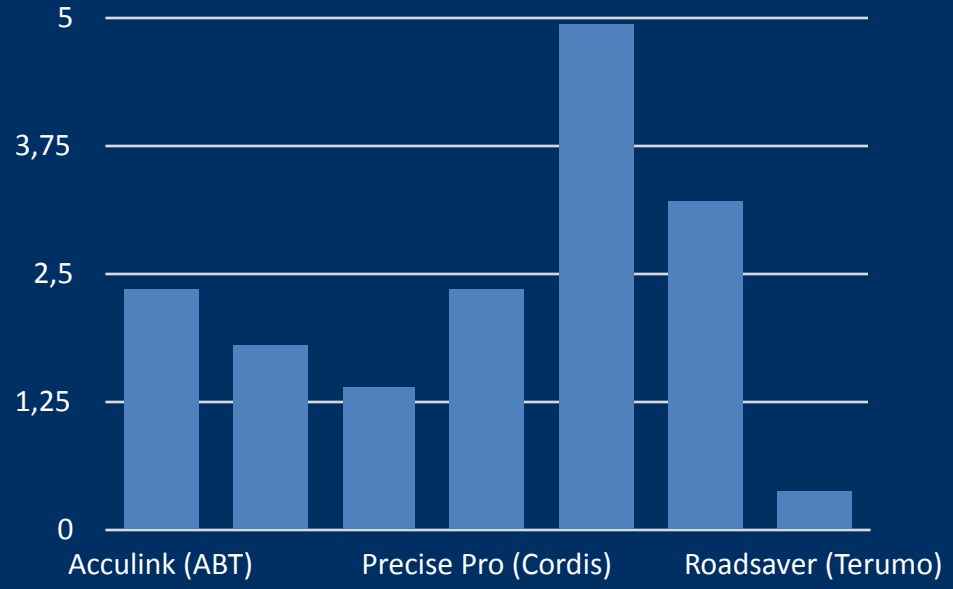


	Roadsaver	CGuard™	Gore Carotid
Company	Microvention /Terumo	Inspire MD	WL Gore
Material (Stent/ Micromesh)	Nitinol /**Nitinol**	Nitinol/**PET**	Nitinol/**PTFE/ CBAS Coating**
Size of delivery	**5F**	6F	6F
Size of Pores *μ*	**375-500**	**150-180**	**500**
Flared tips	**yes**	no	no
Retrievable/ Repositionable	**yes**	no	no
Accuracy	++	+++	++
Conformability	+++	++	++
Crossability	+++	+	++
ECA preservation	yes	?	??
EPD compatibility	All	All	All

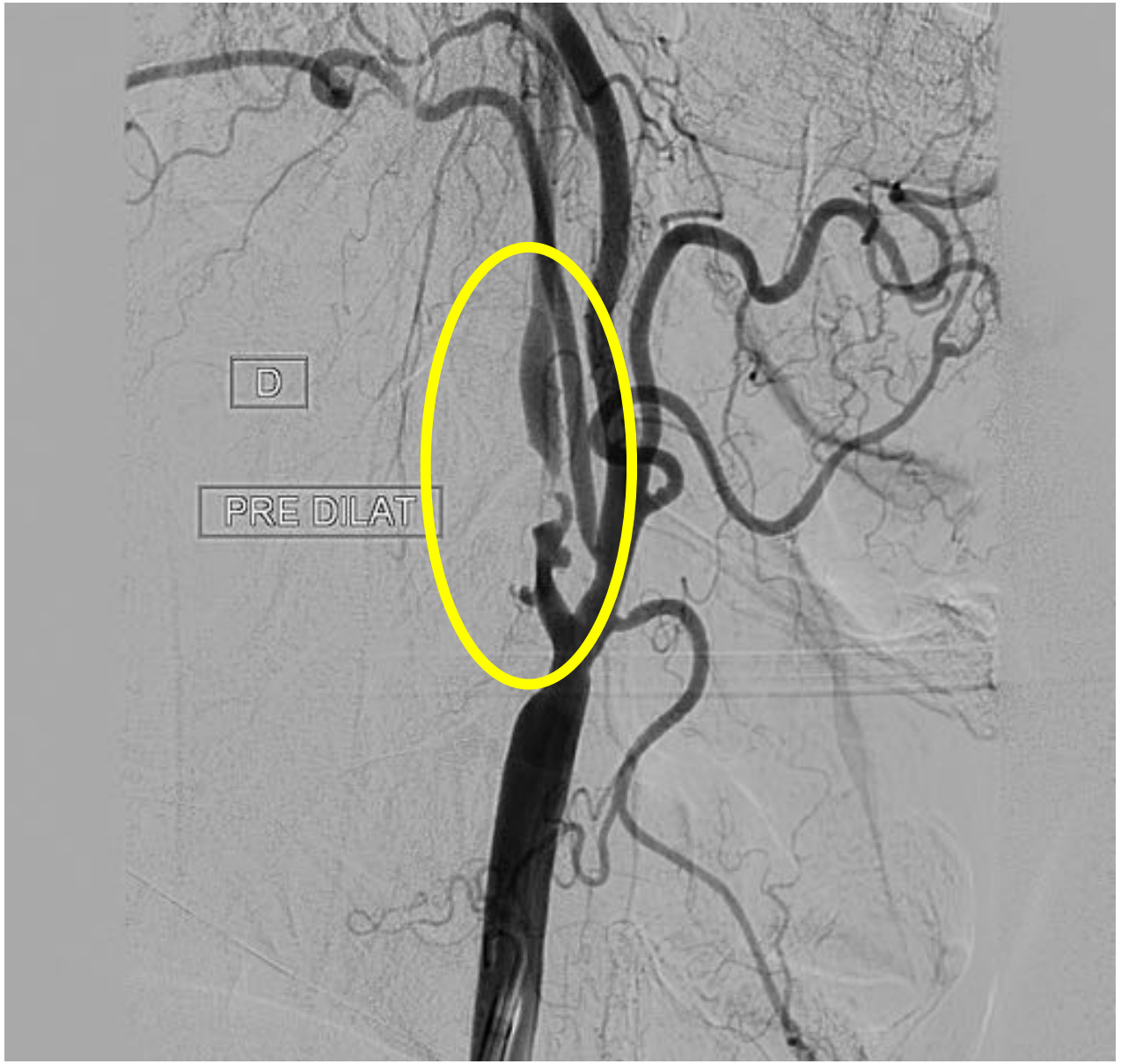
Roadsaver – dual layer micromesh Carotid stent

- Braided Nitinol carotid stent with a built-in Nitinol micromesh for sustained embolic protection

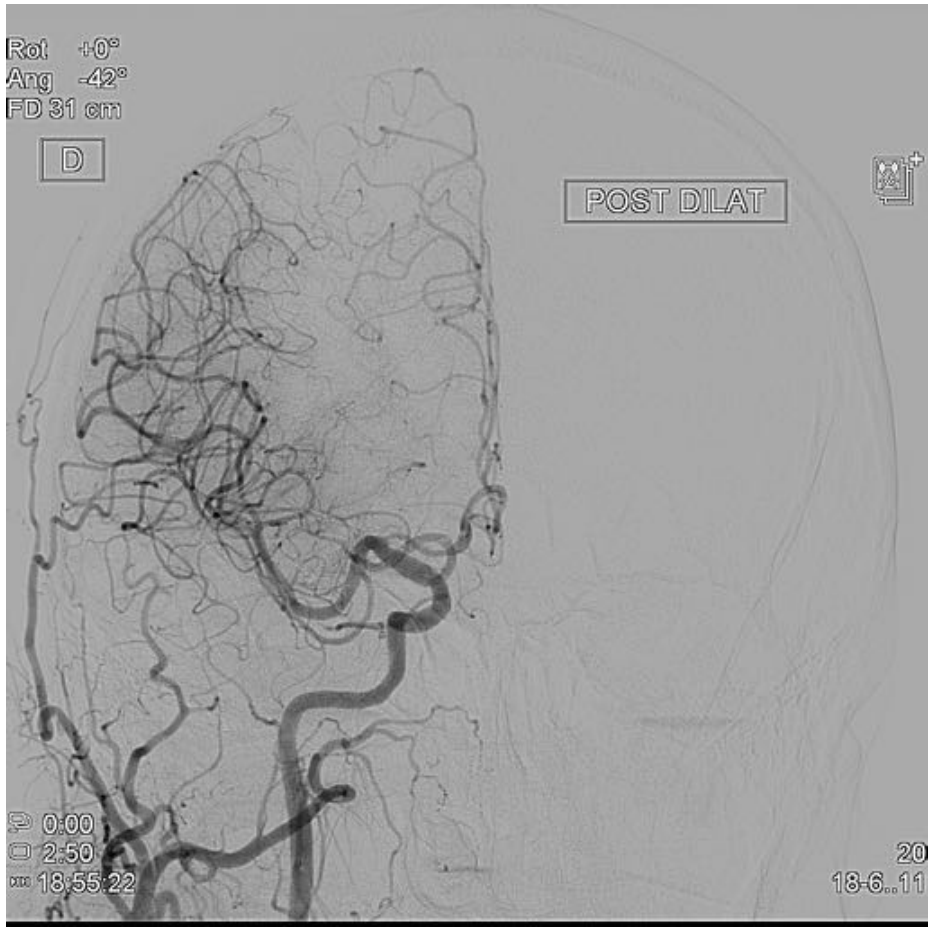




Severe Symptomatic RICA stenosis with multiple ulcerations



After ROADSAVER Stent
10x30mm placed under filter
protection

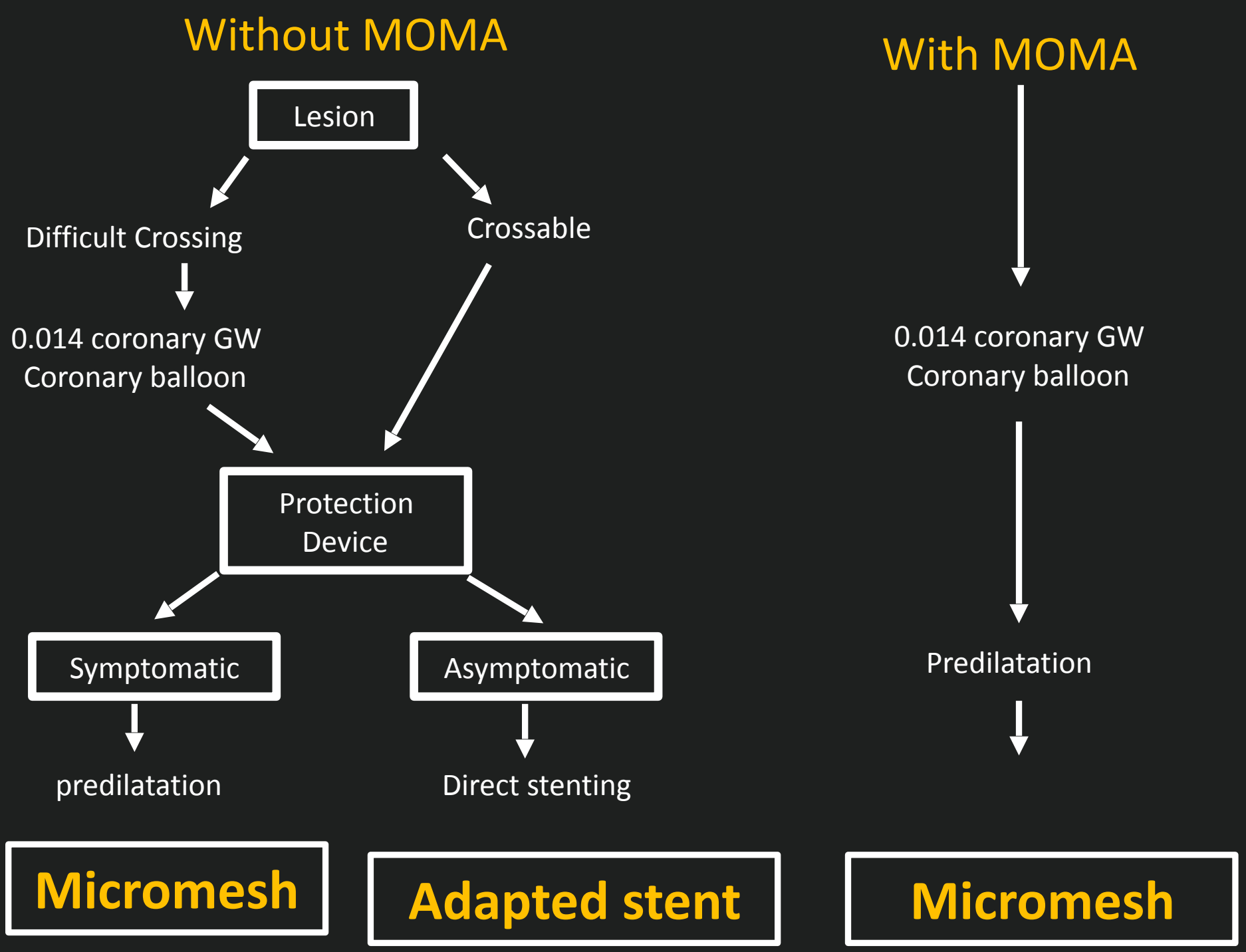

Rot +0°
Ang -42°
FD 31 cm
D
POST DILAT
0:00
2:50
18:55:22
20
18-6..11

Stent Selection including Micromesh

Type	Open Cells Stent		Closed Cells Stent			Micromesh	
Name Comp	Precise Cordis	Proteg EV 3	Wallstent BSC	Adapt BSC	Xact Abbott	Roadsaver Terumo	Cguard Inspire
Sympto	+	±	+++	+++?	++	+++	+++
Asymp.	+++	++	+	++	++	+++	+++
Bifurc.	++	+++	+++	+	±	+++	+
Ulcerate	++	++	+++	++?	+++	+++	+++
Calcifie	++	++	+	++	+++	+	++
Short	+++	+++	-	++	+++	+	+++
Long	++	++	+++	++	+	+++	+
Accurac	+++	++	+	++	+++	+	+++
Irr/Coni	+	+++	+++	++	+++	++	+
Restenosis	+++	+++	+++	+++	+++	+++	+++
Radioth	++	++	+++	-	+++	+++	+

APPROACH IN OUR CENTER

Clinique Louis Pasteur
GRAND NANCY


Without MOMA
Lesion
Difficult Crossing
Crossable
0.014 coronary GW
Coronary balloon
Protection
Device
Symptomatic
Asymptomatic
predilatation
Direct stenting
Micromesh
Adapted stent
With MOMA
0.014 coronary GW
Coronary balloon
Predilatation
Micromesh

Case 12

Minimal invasive Carotid Artery Stenting Through Distal Radial Artery (Snuffbox)

Y.A 53 y.o male

Cardiovascular risk factors: HBP, Dyslipidemia

medical History: CAD : RCA +Lcx PCI

PAD : Bilateral iliac stenting , Common femoral artery Surgery

Current diagnosis:

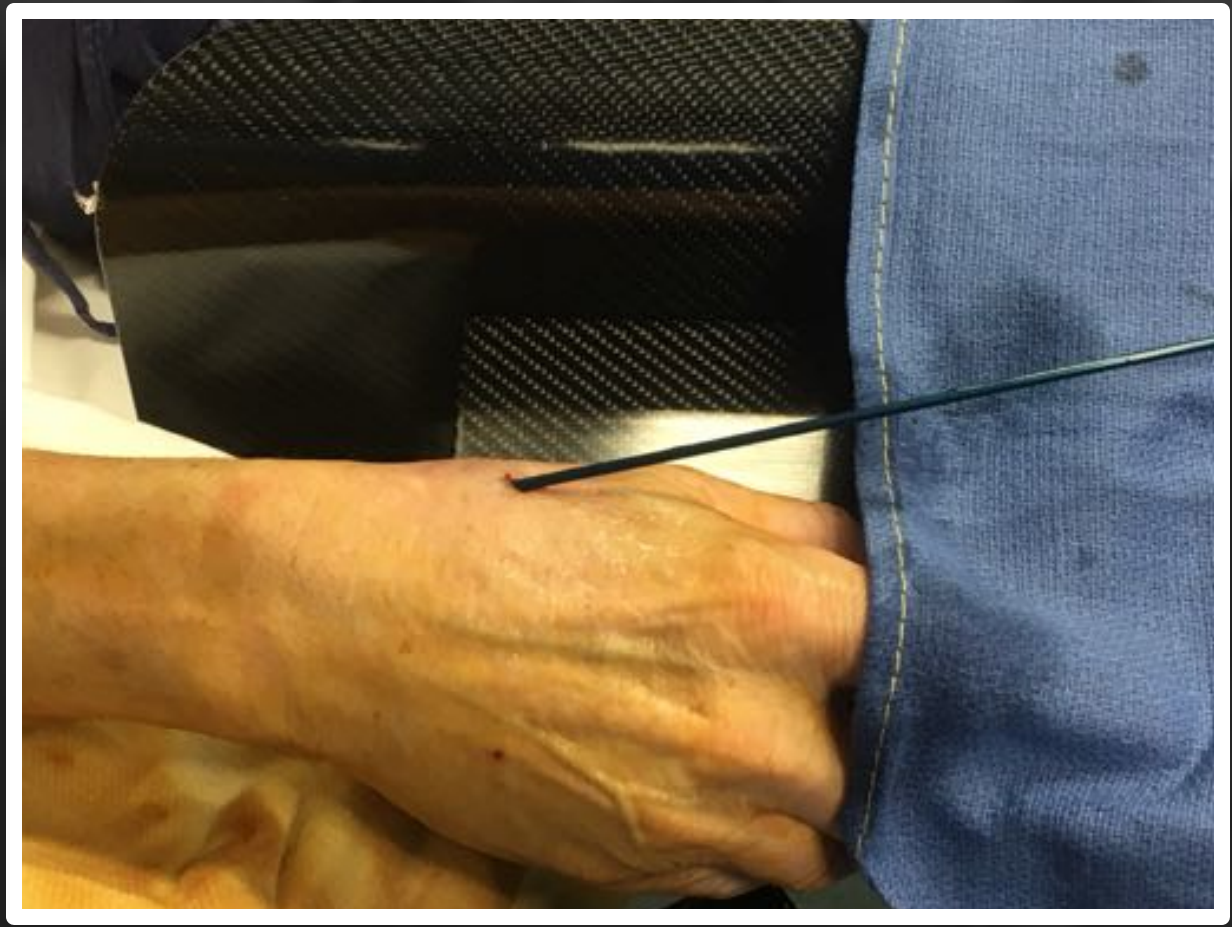
- Progressive asymptomatic Left carotid aretery stenosis

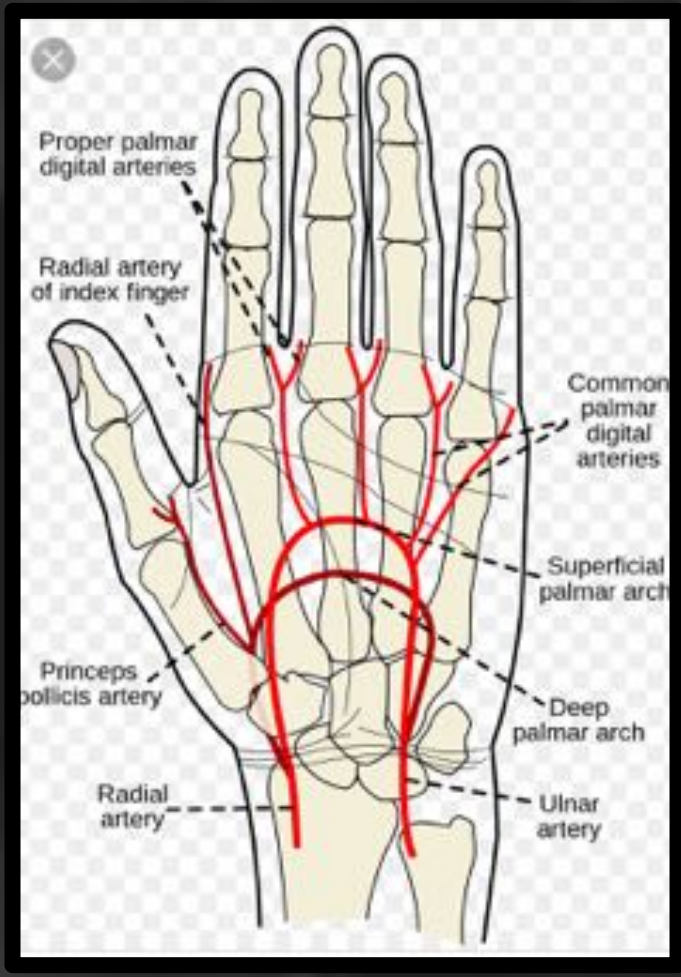
Biological parameters: Hb: 12,5 gr/dl , Cr cl :85ml/min

- **Medication:** aspirine, atorvastatine, perindopril, bisoprolol

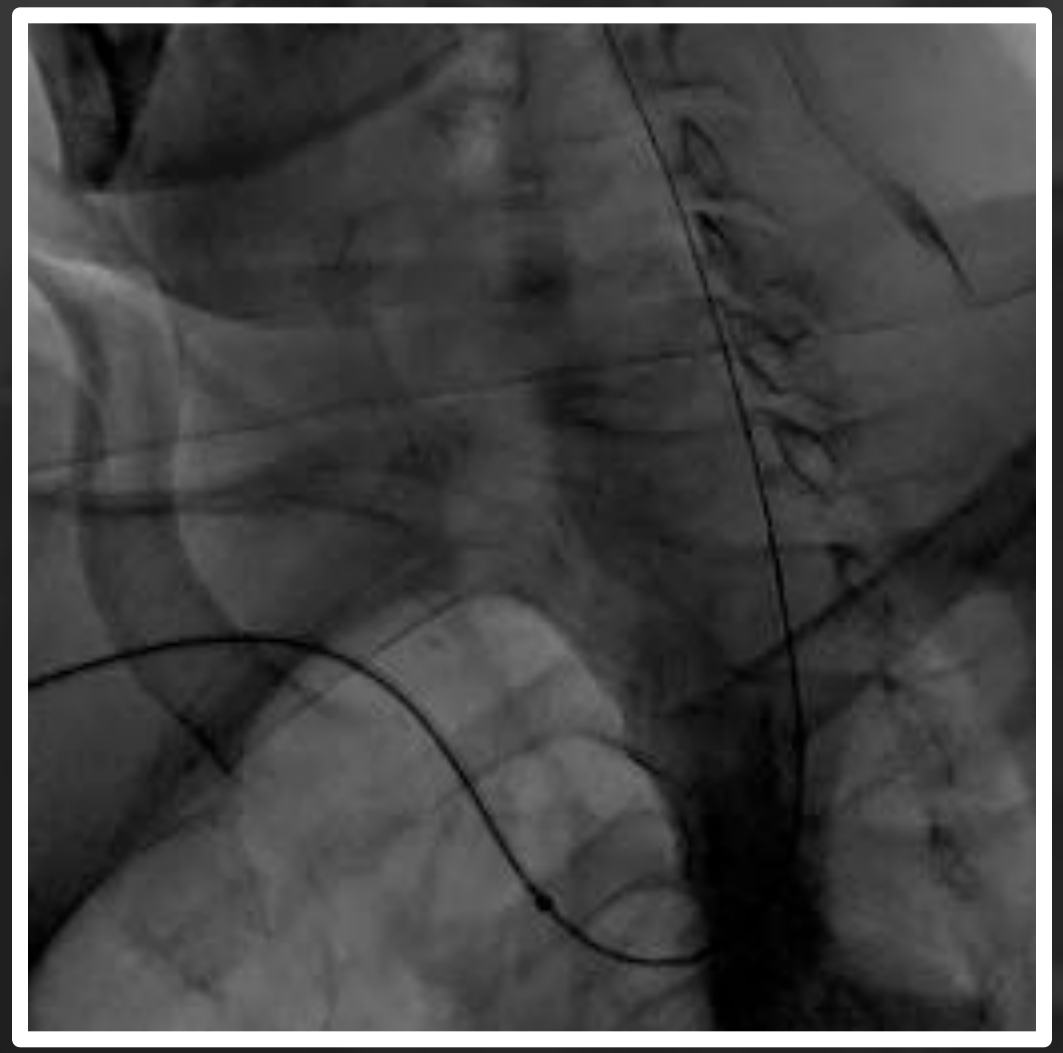
Angiography

Snuffbox Vascular anatomy

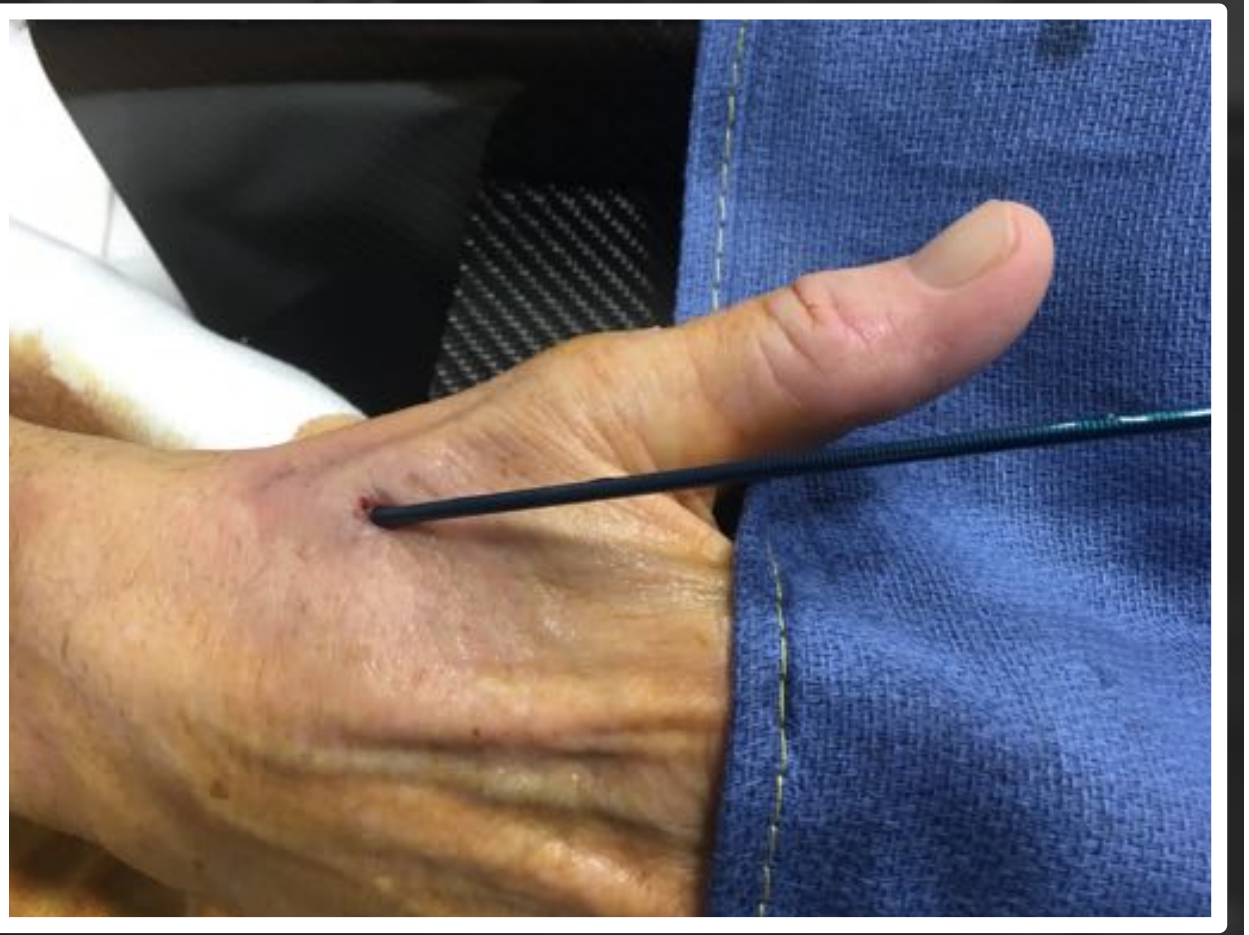




Advencement and position



Closure Device



Final result

PLAN

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- **Une brève mise au point sur l'angioplastie : les dernières nouveautés.**
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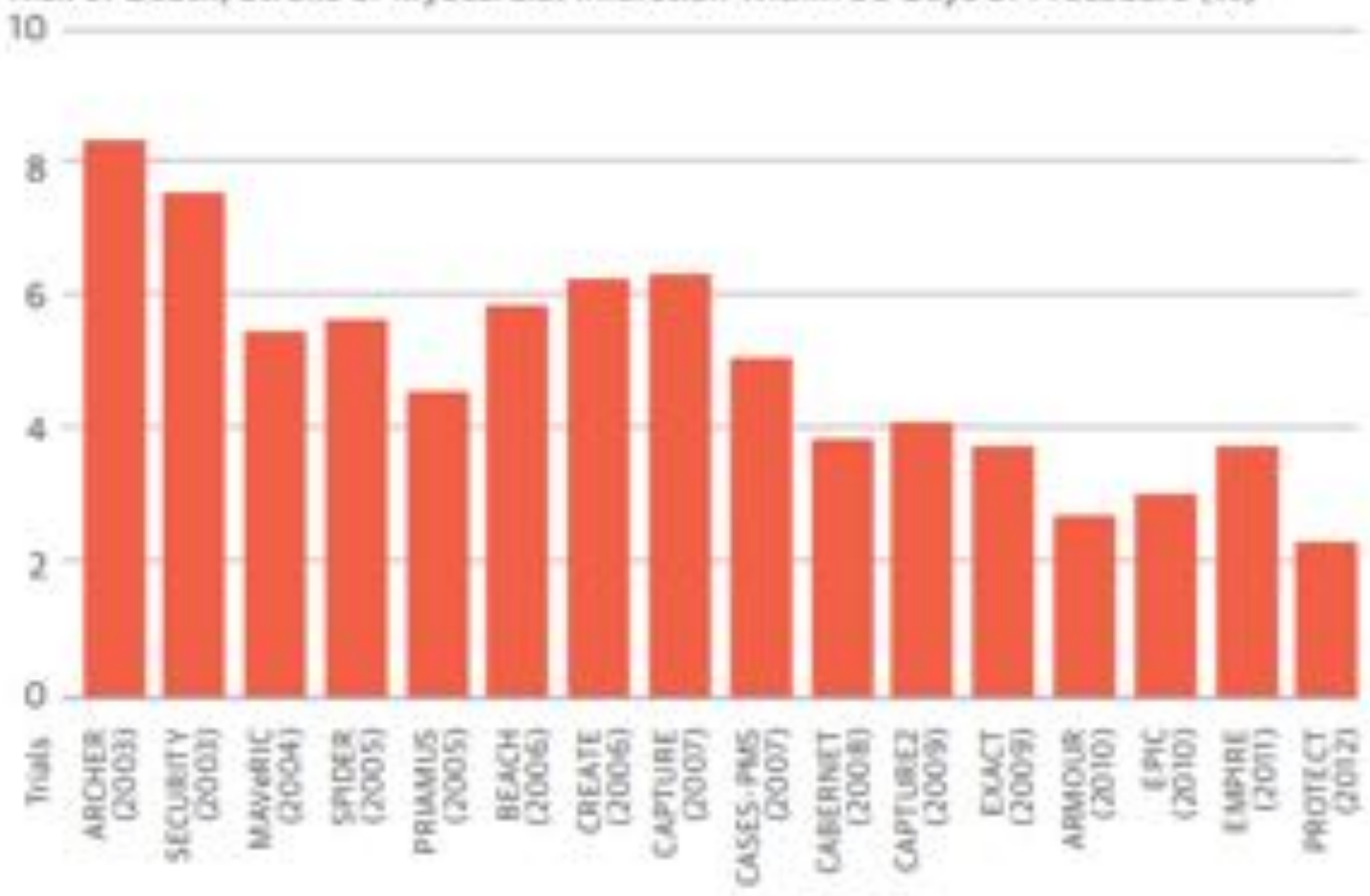
C CAS Results Show an Improving Trend In High Surgical Risk Patients (2003–2012)



Résumé des 5 études randomisées pris en compte

			30th Day								
	N	% Symp	Stroke/†		Major Stroke		Any Stroke		MI		% EPD
			CAS	CEA	CAS	CEA	CAS	CEA	CAS	CEA	
Sapphire 2004	Haut risque, Sponsor J&J						5.8	7.7	3.0	7.5	**95.6**
EVA 3S 2006	Mauvaise formation des interventionnels, IM										
SPACE 2006	Protection dans 30%, formation insuffisante,IM										
ICSS 2009	Mauvaise formation des interventionnels, IM										
CREST 2010	Bonne formation des interventionnels, Protec?										

STENTING SURGERY

RISKS

Embolic Risk
Durability
Antiplatelet Therapy
Bleeding
Local complication
Hypotension

Cardiac Risk
General Anesthesia
Cranial Nerves Injury
Scar&wound compli.
Hypertension

CEA>CAS: Minor Stroke
CEA=CAS: Major Stroke
CEA<CAS: MI
CEA<CAS: Cranial nerve injury
CEA=CAS: Long Term efficacy

Des recommandations qui datent de 2007

HAS

HAUTE AUTORITÉ DE SANTÉ

STRATÉGIE DE PRISE EN CHARGE DES STÉNOSES DE LA BIFURCATION CAROTIDIENNE – INDICATIONS DES TECHNIQUES DE REVASCULARISATION

Mai 2007

Service évaluation des actes professionnels
Service évaluation médico-économique et santé publique

Un seul angioplasticien carotide ….

GROUPE DE TRAVAIL

- Dr Valérie ASSUERUS, neurologue, Aix-en-Provence
- Dr Bernard BEYSSEN, radiologue vasculaire, Paris
- Dr Marc BEDOSSA, cardiologue interventionnel, Rennes
- Dr Christian BOISSIER, médecin vasculaire, Saint-Etienne
- Pr Alain BONAFE, neuroradiologue, Montpellier
- Pr Marcel CHAUVIN, anesthésiste-réanimateur, Boulogne-Billancourt
- Pr Philippe CLUZEL, radiologue vasculaire, Paris
- Pr Reda HASSEN-KHODJA, chirurgien vasculaire, Nice
- Pr Denis KRAUSE, radiologue vasculaire, Dijon
- Pr Claude LAURIAN, chirurgien vasculaire, Paris
- Dr Pierre LENA, anesthésiste-réanimateur, Saint-Laurent-du-Var
- Dr Marie-Reine LOSSER, anesthésiste-réanimateur, Paris
- Dr Jean-Marc MASSONI, doppler vasculaire, Paris
- Dr Fernando PICO, neurologue, Versailles
- Dr Christine ROULLIERE-LELIDEC, médecin économiste de la santé, Paris
- Dr Jean-Michel SERISE, chirurgien vasculaire, Bordeaux
- Dr Katayoun VAHEDI, neurologue, Paris
- Pr Mathieu ZUBER, neurologue, Paris

Management of asymptomatic carotid artery disease

ESC
European Society of Cardiology

Recommendations	Class	Level
In **"average surgical risk"** patients with an asymptomatic **60-99%** stenosis, **CEA** should be considered in the presence of clinical and/or more imaging characteristics that may be associated with an increased risk of late ipsilateral stroke, provided documented perioperative stroke/death rates are <3% and the patient's life expectancy is >5 years.	**IIa**	**B**
In asymptomatic patients who have been deemed **"high-risk for CEA"** and who have an asymptomatic **60-99%** stenosis in the presence of clinical and/or imaging characteristics that may be associated with an increased risk of late ipsilateral stroke, **CAS** should be considered, provided documented perioperative stroke/death rates are <3% and the patient's life expectancy is >5 years.	**IIa**	**B**

www.escardio.org/guidelines 2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with ESVS (European Heart Journal 2017; doi:10.1093/eurheartj/ehx095)

Management of asymptomatic carotid artery disease *(continued)*

ESC European Society of Cardiology

Recommendations	Class	Level
In **"average surgical risk"** patients with an asymptomatic **60-99%** stenosis in the presence of clinical and/or imaging characteristics[d] that may be associated with an increased risk of late ipsilateral stroke, **CAS may be an alternative to CEA** provided documented perioperative stroke/death rates are <3% and the patient's life expectancy is >5 years.	IIb	B

2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with ESVS (European Heart Journal 2017; doi:10.1093/eurheartj/ehx095)

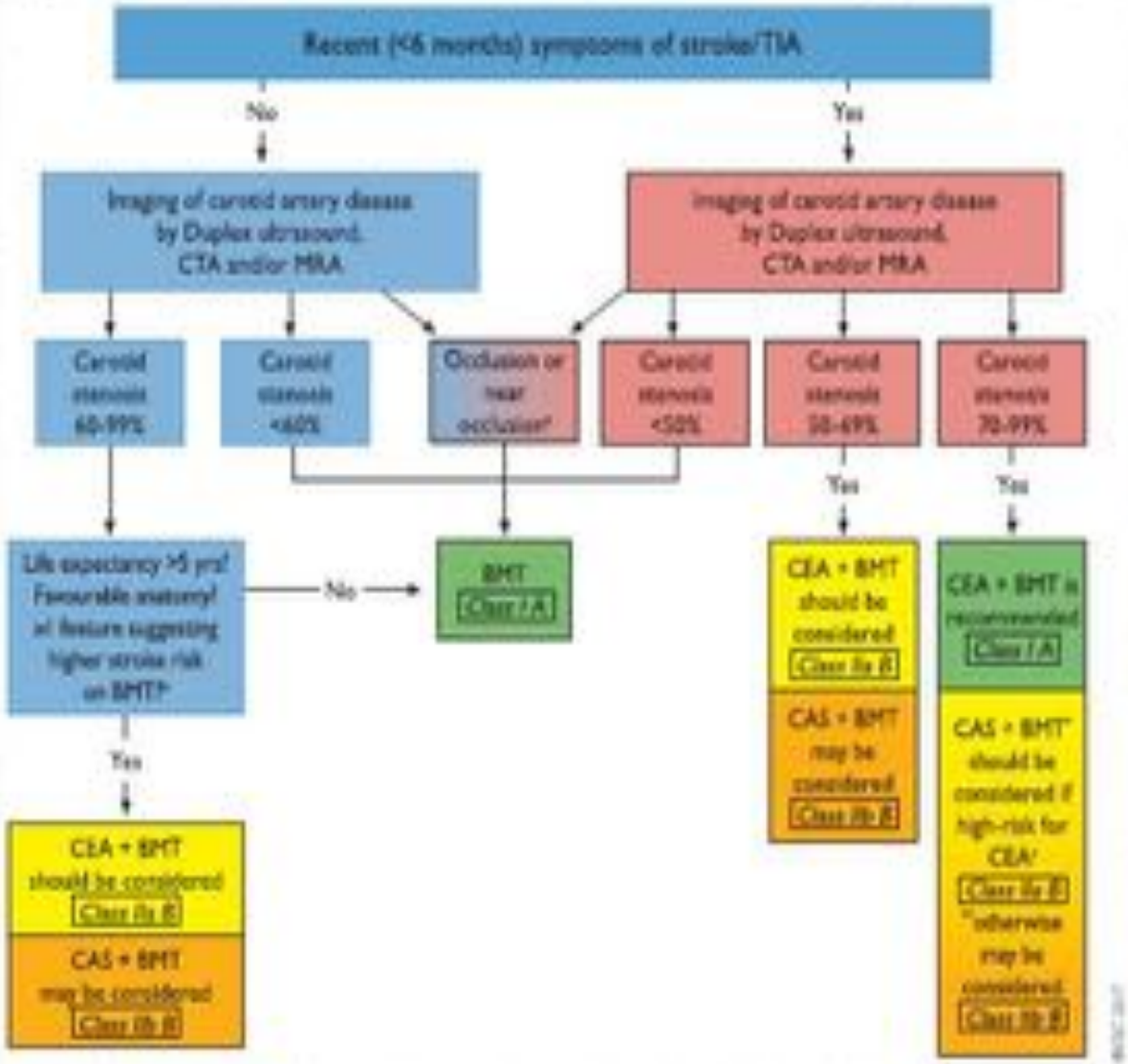
Features associated with increased risk of stroke in patients with asymptomatic carotid stenosis treated medically

ESC
European Society of Cardiology

Clinical	• Contralateral TIA/stroke
Cerebral imaging	• Ipsilateral silent infarction
Ultrasound imaging	• Stenosis progression (> 20%) • Spontaneous embolization on transcranial Doppler (HITS) • Impaired cerebral vascular reserve • Large plaques • Echolucent plaques • Increased juxta-luminal black (hypoechogenic) area
MRA	• Intraplaque haemorrhage • Lipid-rich necrotic core

2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with ESVS (European Heart Journal 2017; doi:10.1093/eurheartj/ehx095)

Management of extracranial carotid artery disease



ESC European Society of Cardiology

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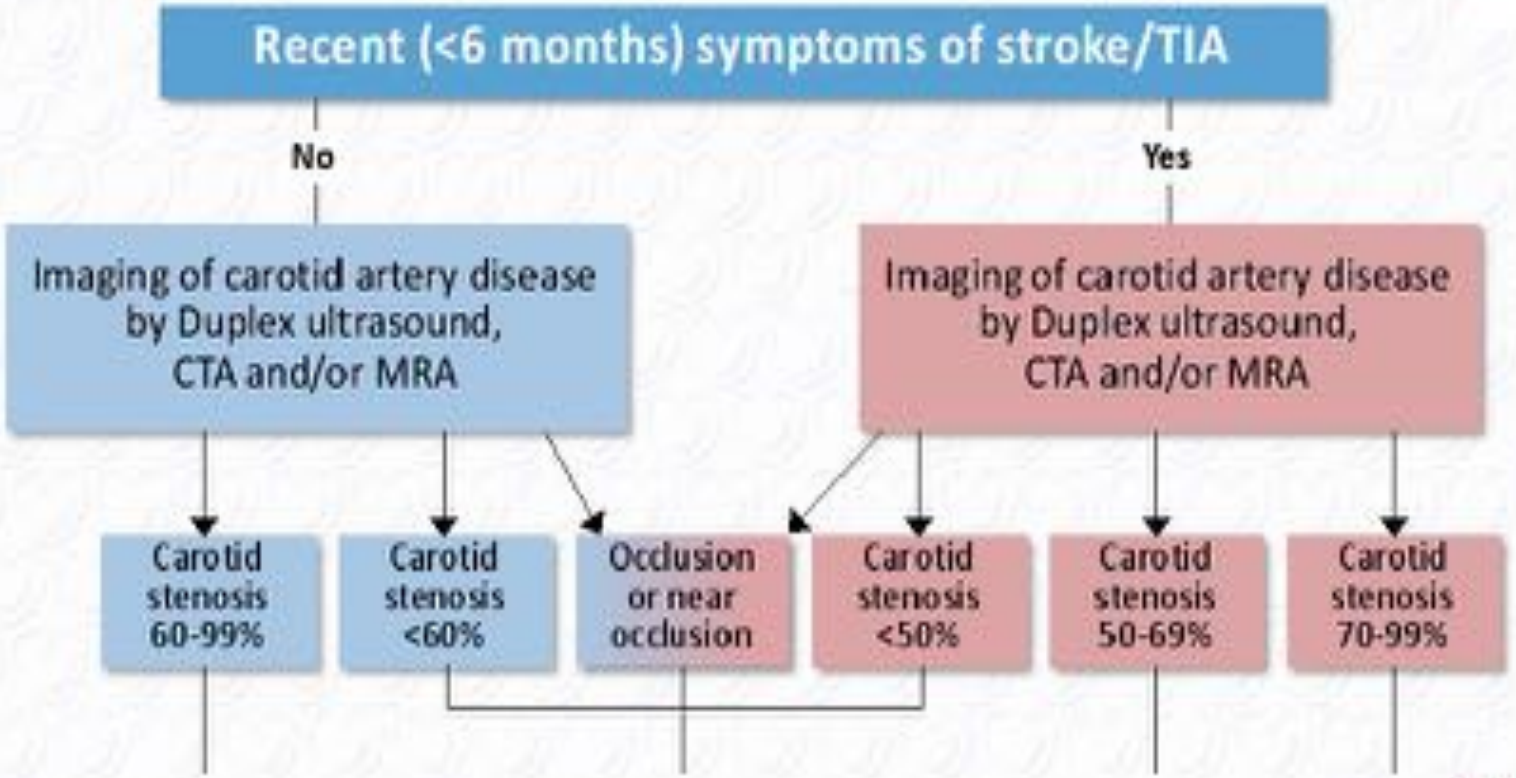
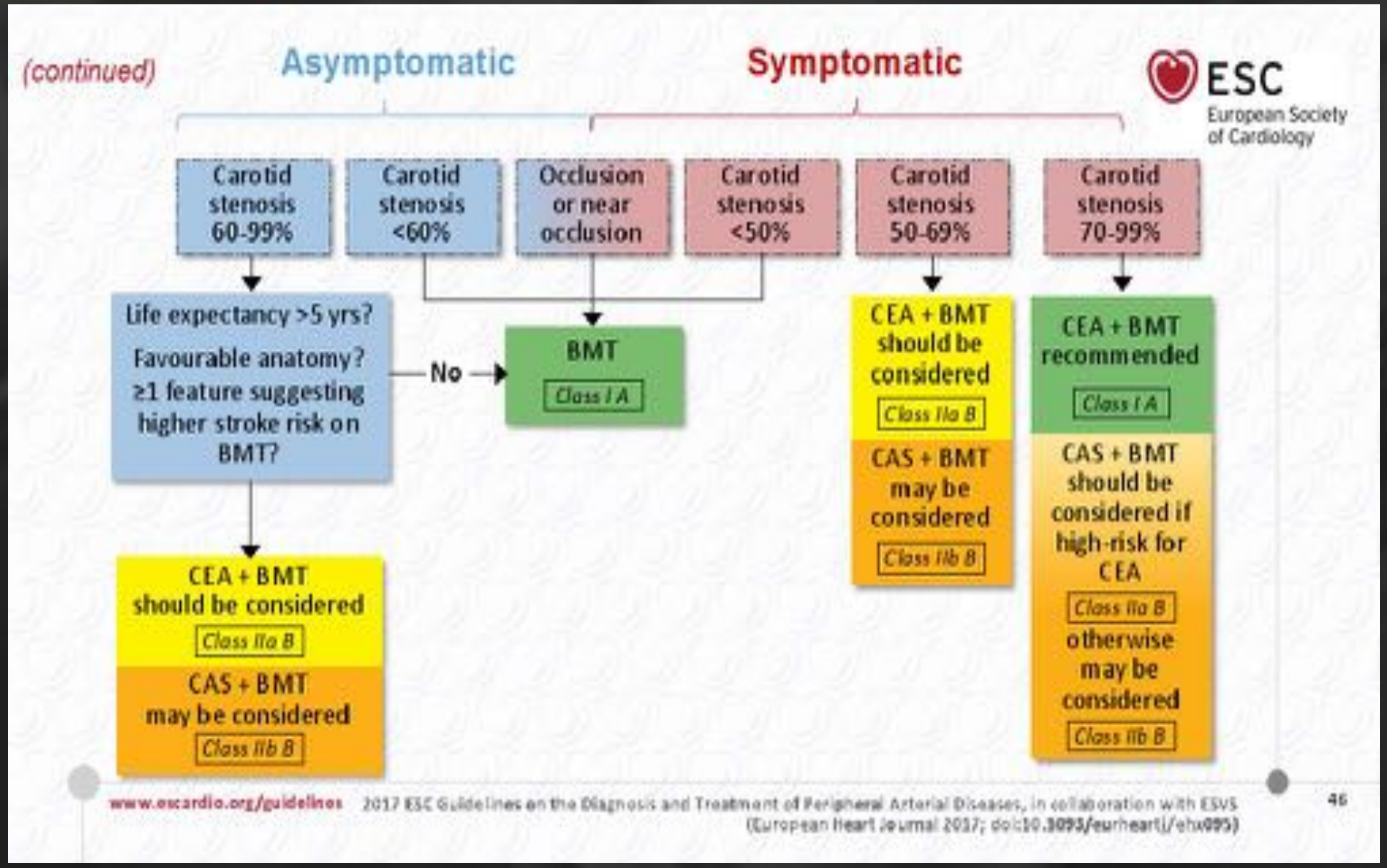
Management of extracranial carotid artery disease

ESC
European Society of Cardiology



(continued)

(continued)


Asymptomatic
Symptomatic
ESC
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Carotid stenosis 60-99%
Carotid stenosis <60%
Occlusion or near occlusion
Carotid stenosis <50%
Carotid stenosis 50-69%
Carotid stenosis 70-99%
Life expectancy >5 yrs?
Favourable anatomy?
≥1 feature suggesting higher stroke risk on BMT?
No
BMT
Class I A
CEA + BMT should be considered
Class IIa B
CAS + BMT may be considered
Class IIb B
CEA + BMT should be considered
Class IIa B
CAS + BMT may be considered
Class IIb B
CEA + BMT recommended
Class I A
CAS + BMT should be considered if high-risk for CEA
Class IIa B
otherwise may be considered
Class IIb B

Revascularization in patients with symptomatic carotid disease

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Recommendations	Class	Level
CEA is recommended in symptomatic patients with **70-99%** carotid stenoses, provided the documented procedural death/stroke rate is <6%.	I	A
CEA should be considered in symptomatic patients with **50-69%** carotid stenoses, provided the documented procedural death/stroke rate is <6%.	IIa	A
In recently symptomatic patients with a **50–99%** stenosis who present with adverse anatomical features or medical comorbidities that are considered to make them "high-risk for CEA", **CAS** should be considered, provided the documented procedural death/stroke rate is <6%.	IIa	B

2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with ESVS (European Heart Journal 2017; doi:10.1093/eurheartj/ehx095)

Revascularization in patients with symptomatic carotid disease *(continued)*

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Recommendations	Class	Level
When revascularization is indicated in "average surgical risk" patients with symptomatic carotid disease, CAS may be considered as an alternative to surgery, provided the documented procedural death/ stroke rate is <6%.	IIb	B
When decided, it is recommended to perform revascularization of symptomatic 50–99% carotid stenoses as soon as possible, preferably within 14 days of symptom onset.	I	A
Revascularization is not recommended in patients with a <50% carotid stenosis.	III	A

2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with ESVS (European Heart Journal 2017; doi:10.1093/eurheartj/ehx095)

Use of embolic protection device during carotid stenting

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Recommendations	Class	Level
The use of embolic protection devices should be considered in patients undergoing carotid artery stenting.	IIa	C

2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with ESVS (European Heart Journal 2017; doi:10.1093/eurheartj/ehx095)

Nature de la lésion	Angioplastie	Chirurgie
Courte	équivalence	
Longue	+++	+
Ulcérée	++	+++
Hypo échogène	++	+++
Calcification excentrée	++	+++
Calcification concentrique	0	+++
Bifurcation CE indemne	équivalence	
Bifurcation CE sténosée	+	+++
Lésions en tandem	+++	+
Lésions bilatérales	+++	+
Sténose haut située	+++	+
De novo	++	+++
Resténose	+++	+
Post-Rx	+++	-

4 chapters to consider for each individual.

Age

General conditions

Patient Preference

Asymptomatic

Symptomatic

Time & Delay .

Time for personalized Therapy

Bifurcat

Calcification

Irregular,Ulceration

Length …

Protection

Stenting

Anatomy of Lesion and Carotid Access

PLAN

- **Quelques cas d'angioplastie carotidienne**
- **Une brève mise au point sur l'angioplastie : les dernières nouveautés.**
- **Les résultats des dernières études randomisées**
- **Indications et contre-indications de l’angioplastie**
- **Qui**

- La situation l'angioplastie carotidienne progresse en France : 2015 :1293, 2016 :1563 ,2018 :1738
- Les futures études (ACST 2 , CREST2,SPACE2)permettront de mieux déterminer la place du traitement médical chez les patients asymptomatiques et préciser l'apport des nouvelles techniques
- Il est nécessaire de créer des centres régionaux de revascularisation carotidienne experts dans les deux techniques avec des taux de morbi-mortalité inférieure à 6 % pour les malades symptomatiques et 3 % pour les malades asymptomatiques .


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Selamat
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