

# Aspects techniques de l'angioplastie des carotides

*the main goal of carotid revascularization is to prevent stroke*



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Saint Laurent du Var  
France

MEET 2008  
session paramédicale

## Ms Roy... 64 years old :

Asymptomatic restenosis of the right internal carotid, 11 years after CEA

### Risk factors :

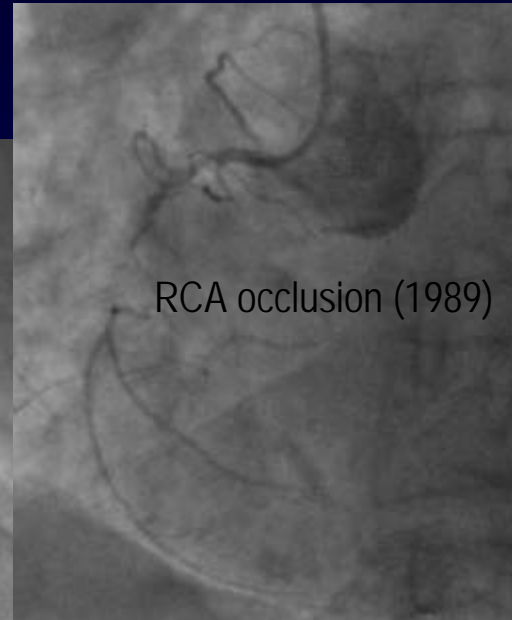
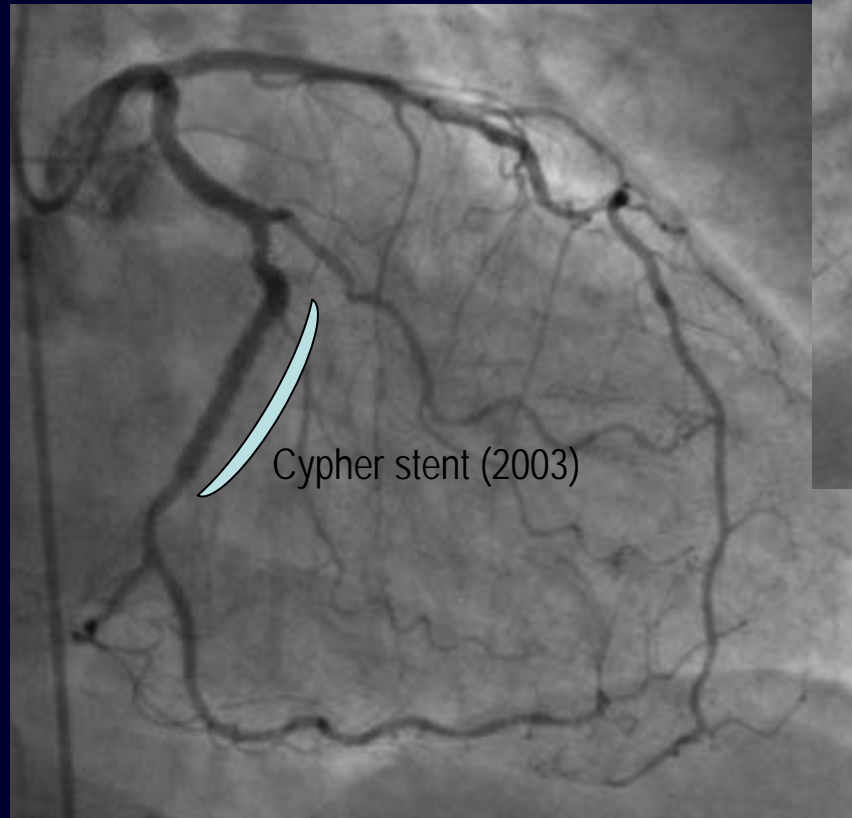
- current smoker
- Severe uncontrolled hypertension
- Dyslipidemia

### • History :

- 1987 : Surgical Bypass (left subclavian to Right carotid artery) for symptomatic brachial cephalic artery disease.
- Endarterectomy of the LCA in 1993 and RCA in 1995
- Reno vascular disease : left renal arteries angioplasties in 2000 and 2003 for restenosis.
- lower limb ischemia class II. Common iliac angioplasty in 2000 without restenosis. Chronic bilateral SFA occlusions.
- Coronary disease :
  - posterior non Q wave infarction in 1989 (RCA thrombosis)
  - 2003 : Stable angina class II. angioplasty of the Cx using Drug eluting cypher stent implantation

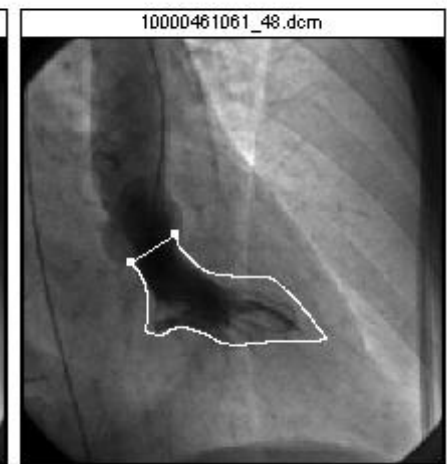
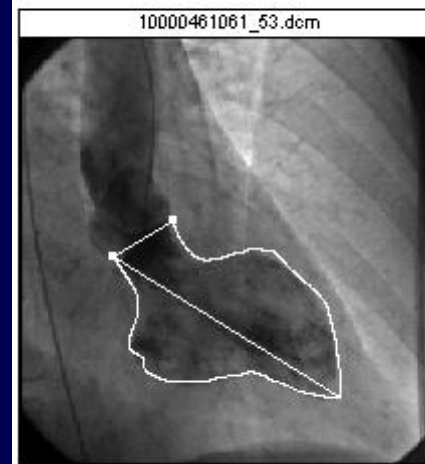
Ms Roy... 64 years old :

2006 : asymptomatic restenosis of the right internal carotid artery

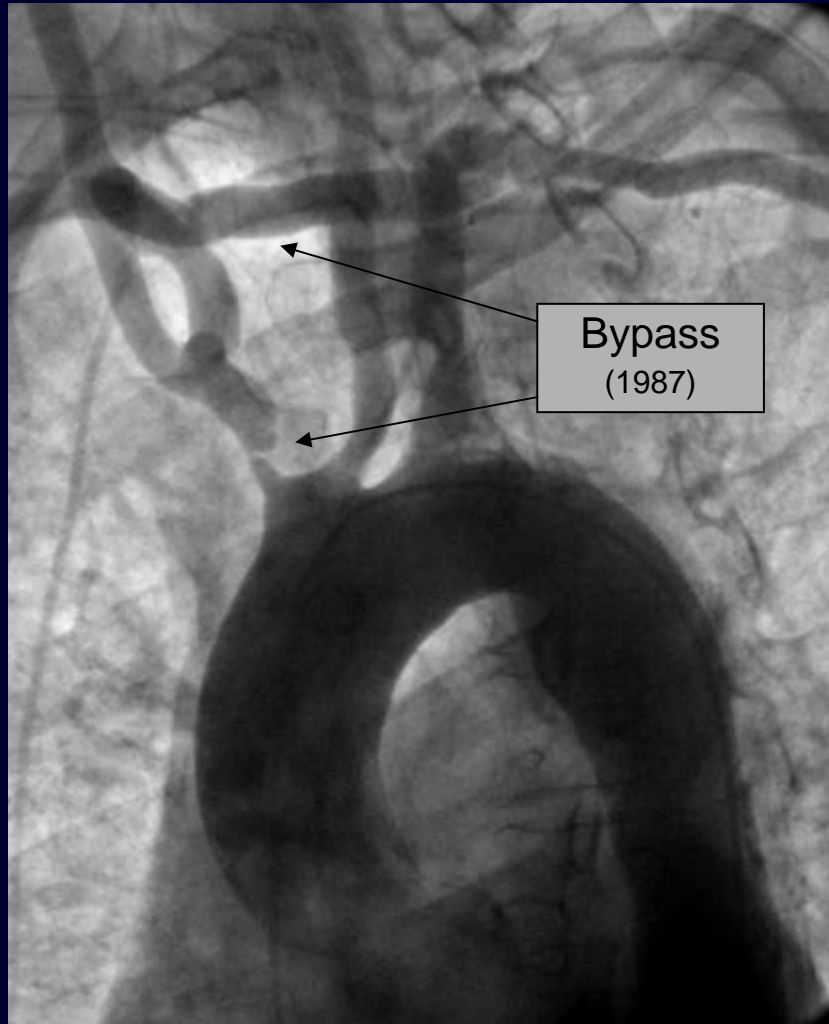


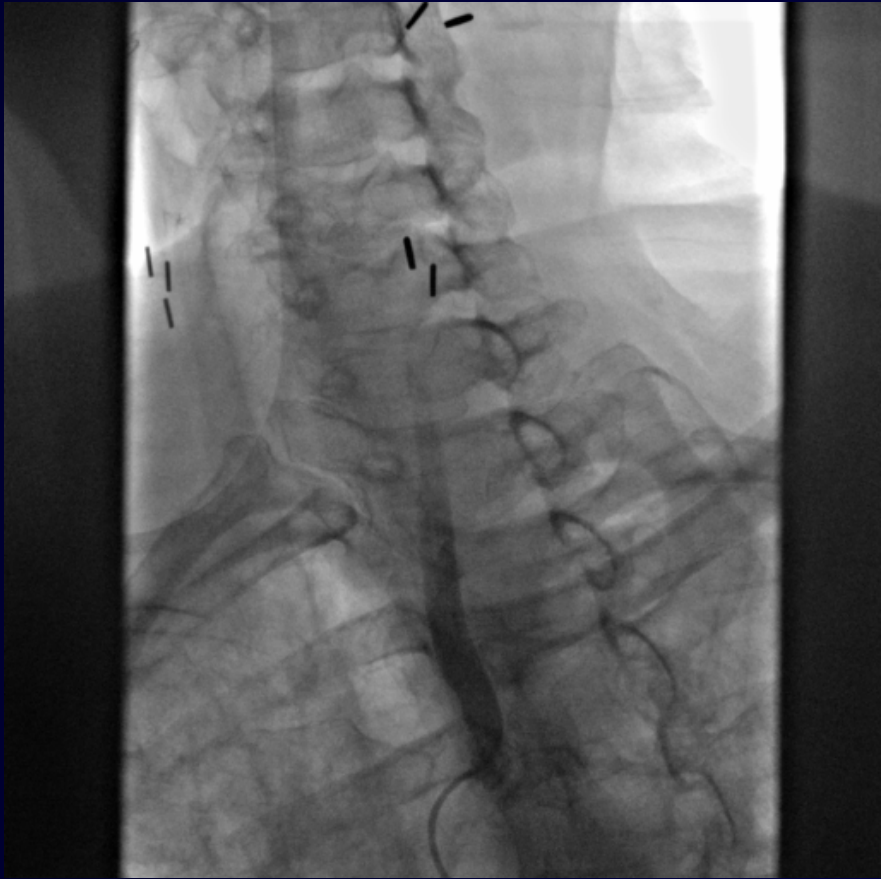
**EF : 78.2 %**

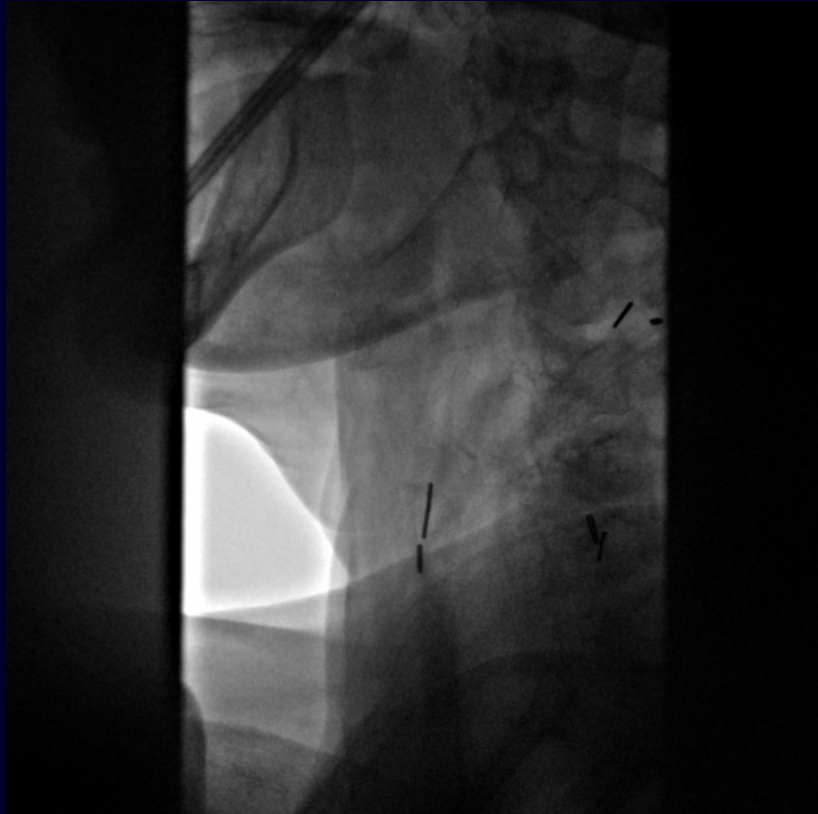
ES image : (S1;F1)  
ES volume : **16.3 ml**  
ESV index :



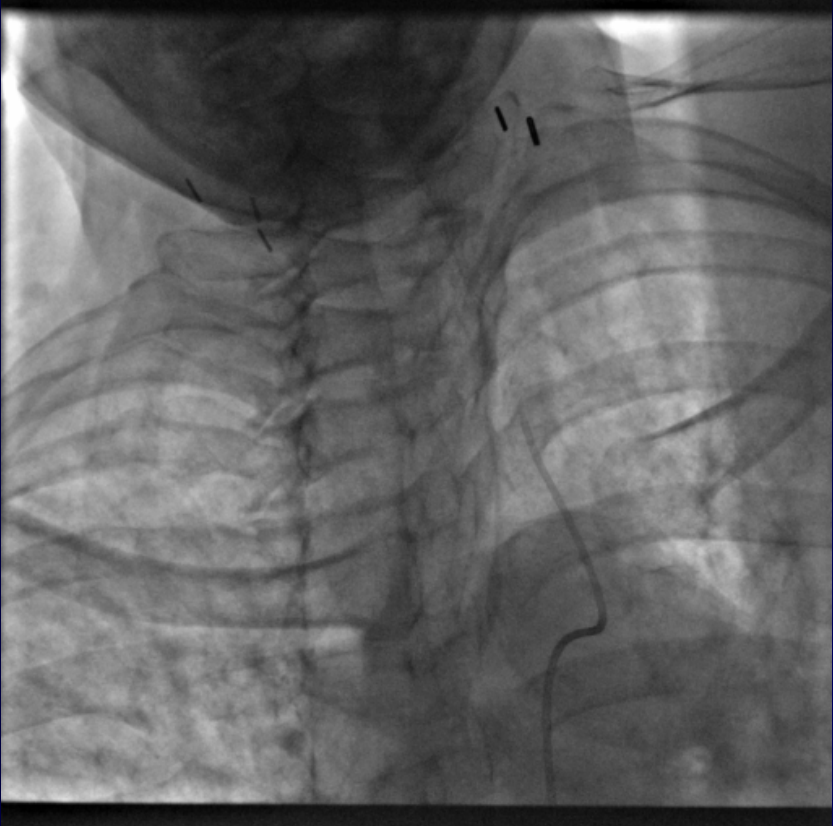
Ms Roy... 64 years old :  
asymptomatic restenosis of the right internal carotid artery









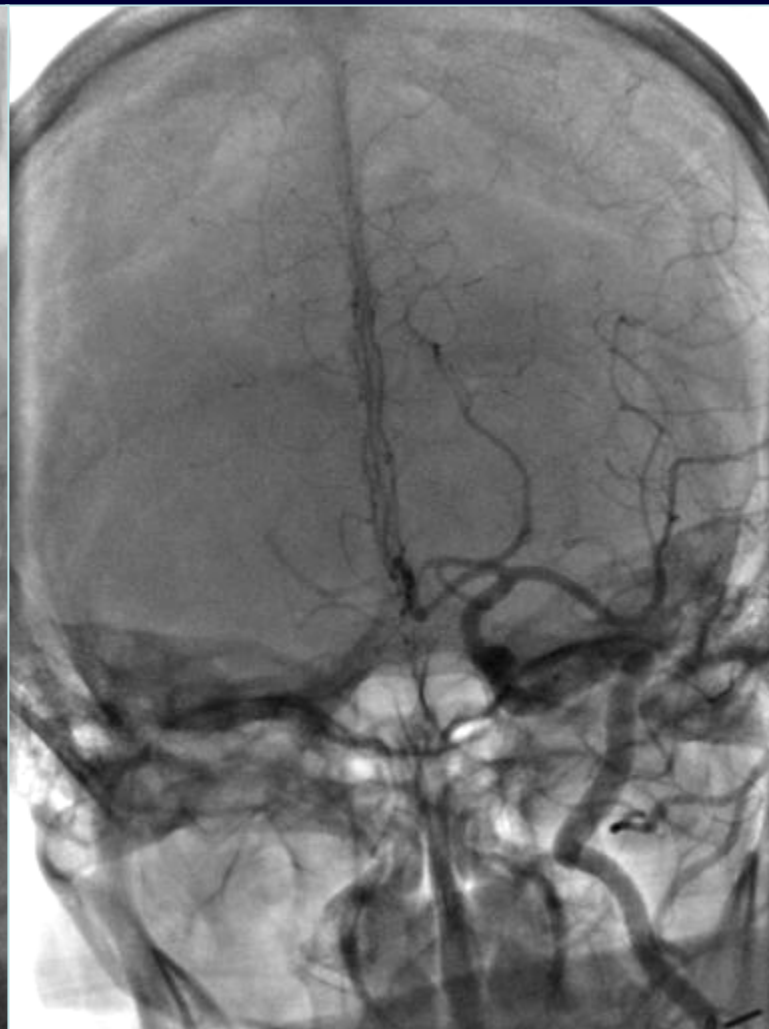
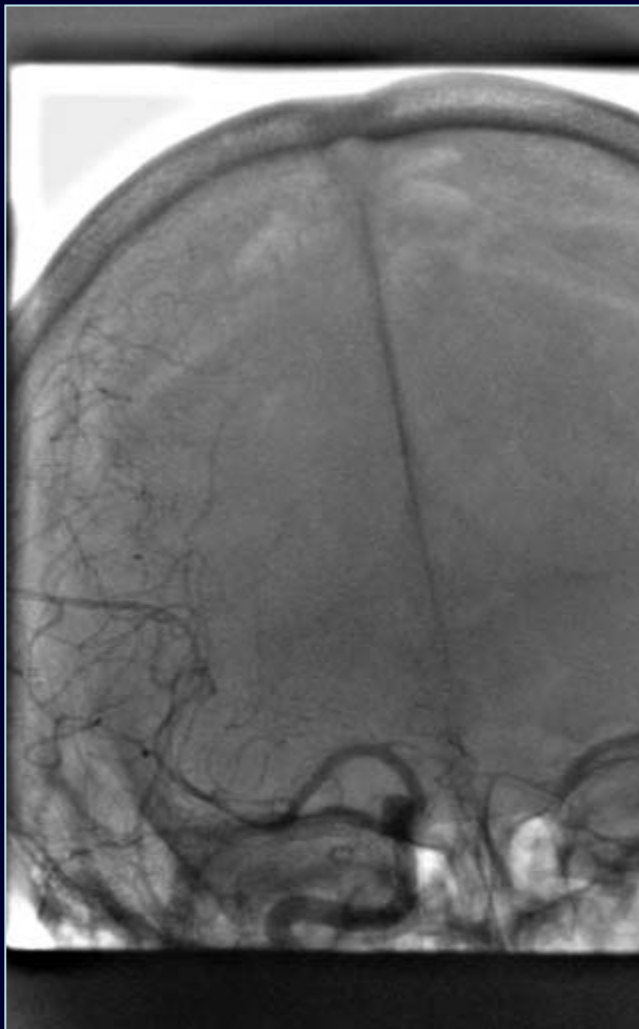


Ms Roy... 64 years old :  
asymptomatic restenosis of the right internal carotid artery





Ms Roy... 64 years old :  
asymptomatic restenosis of the right internal carotid artery

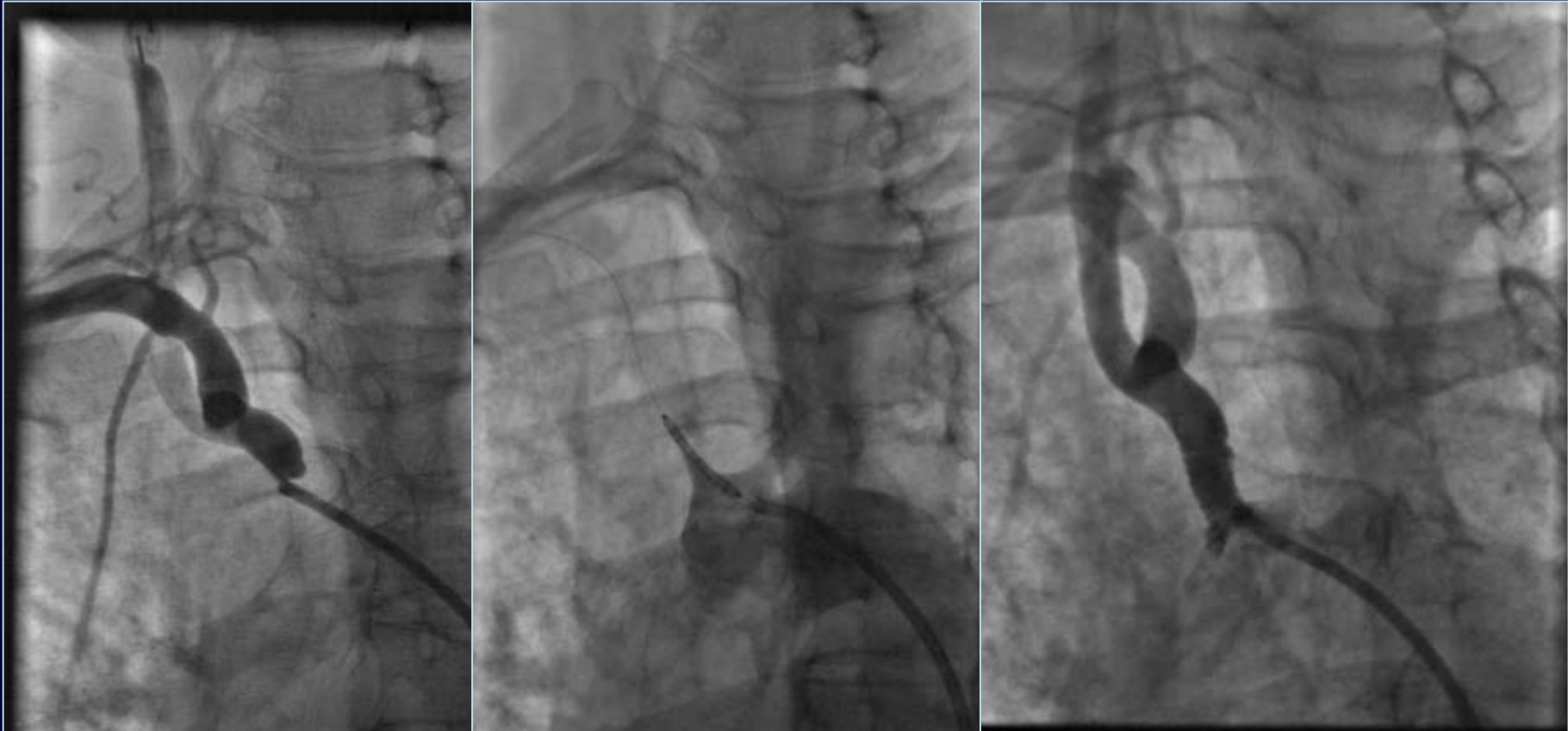


Ms Roy... 64 years old :  
asymptomatic restenosis of the right internal carotid artery



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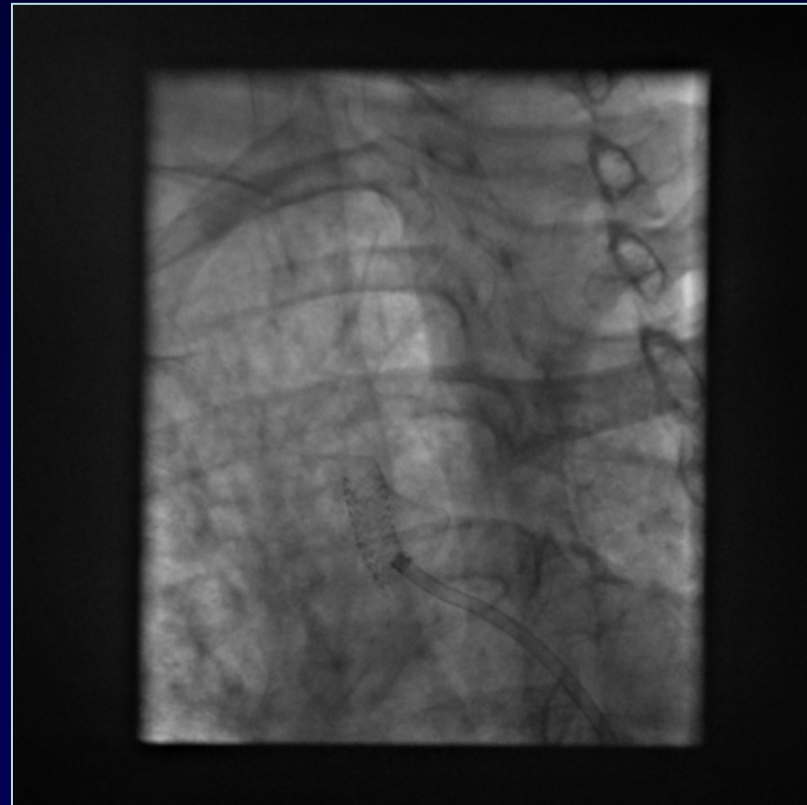


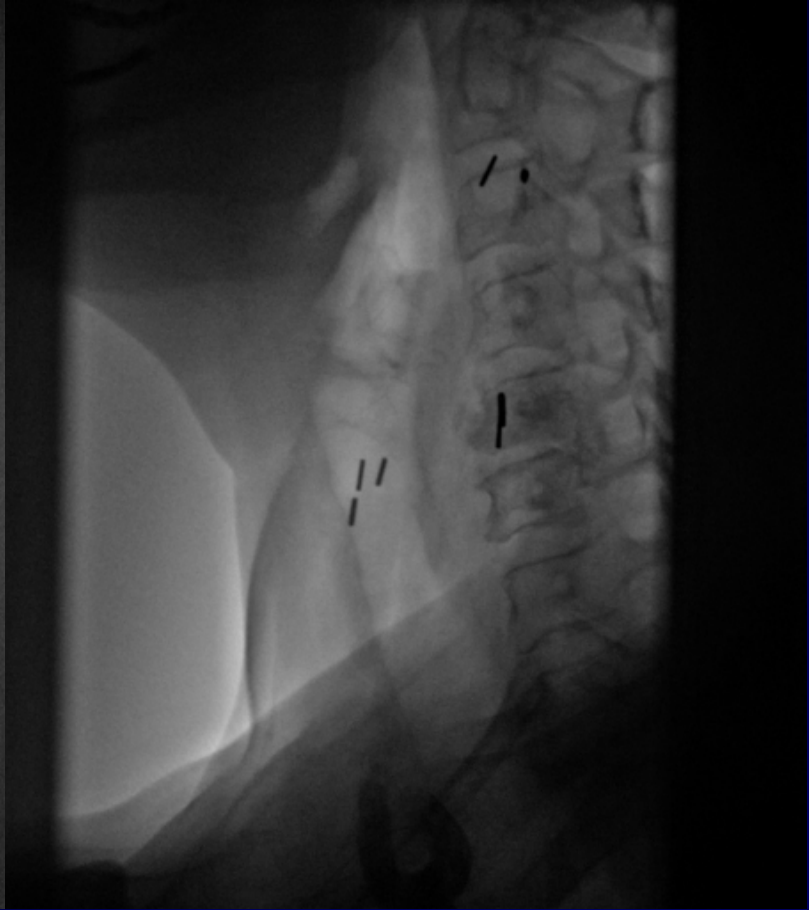
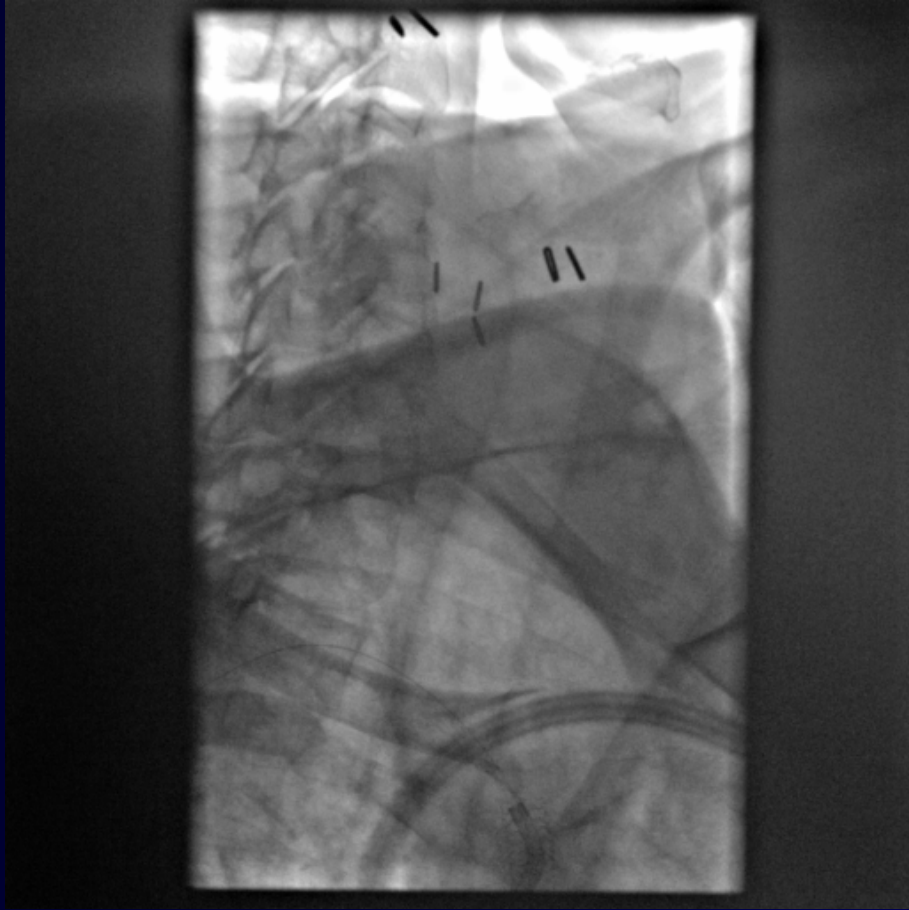
Clopidogrel and aspirine. 30.000 u heparine. IV ISDN and Urapidyl.

Right femoral approach (8F sheath) ; Guiding catheter : JR4 Cordis

Stabilizer Cordis 014. Stent Guidant Herculink 7x18 ( 16 atm)

Ms Roy



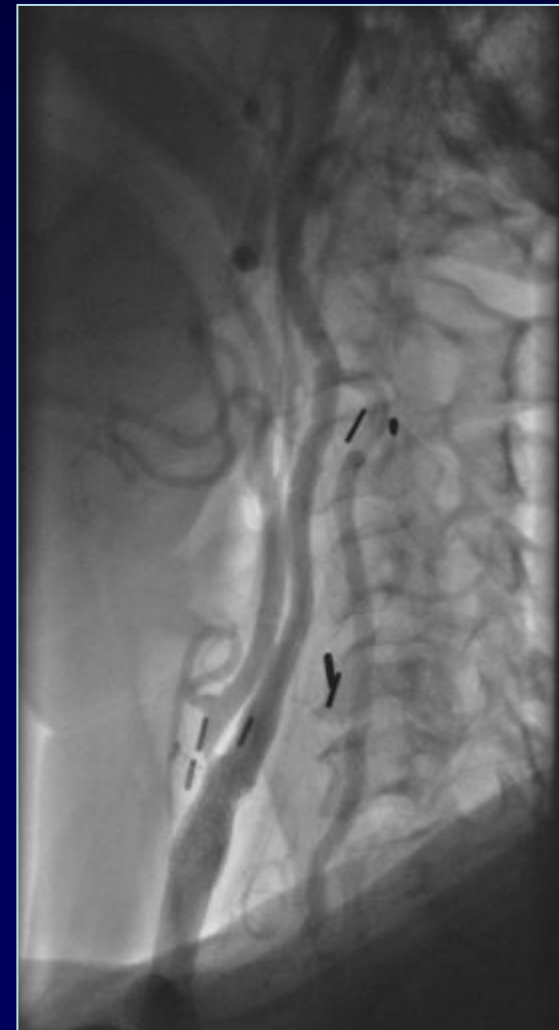




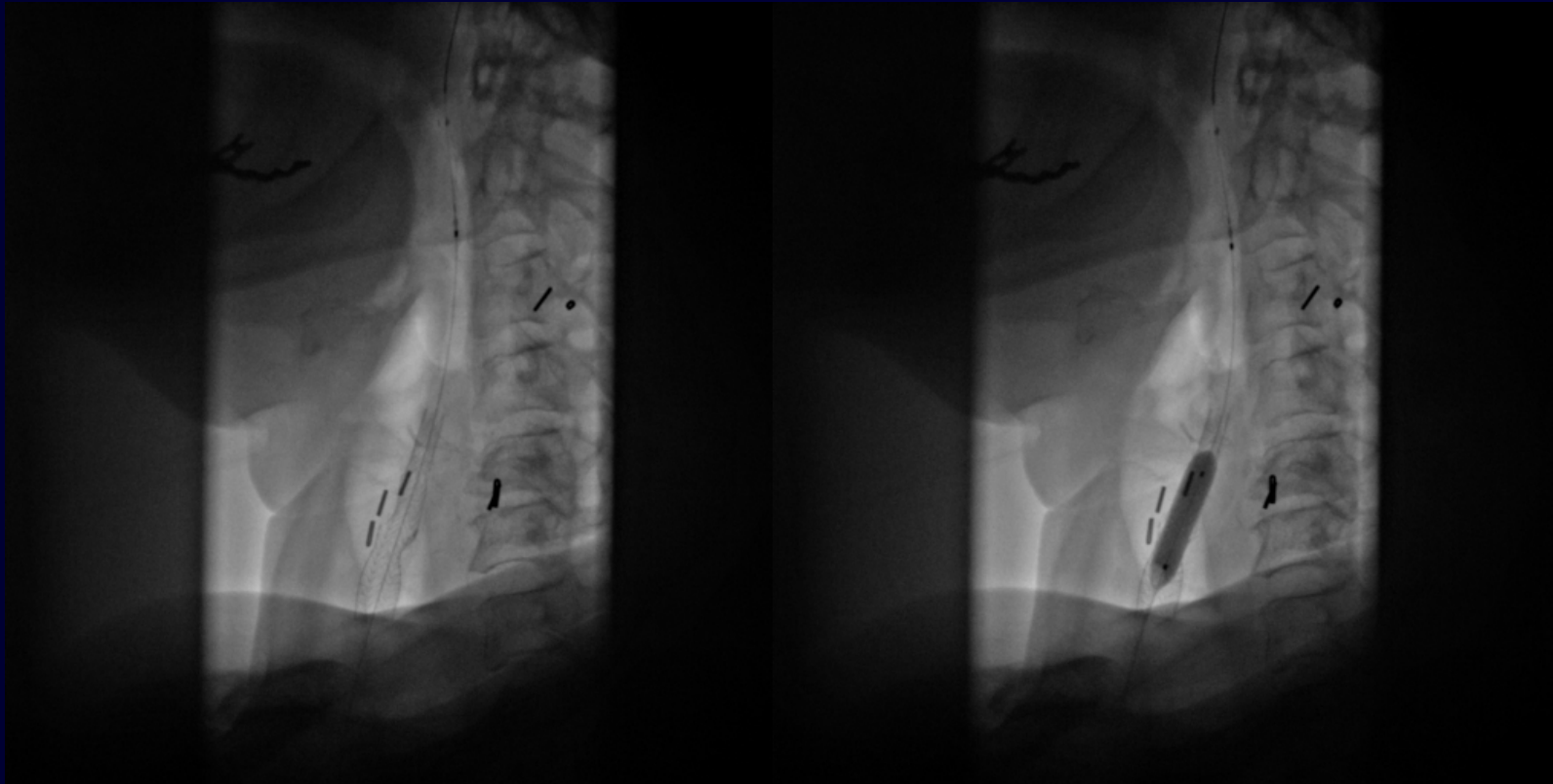
**Ms Roy... 64 years old :**

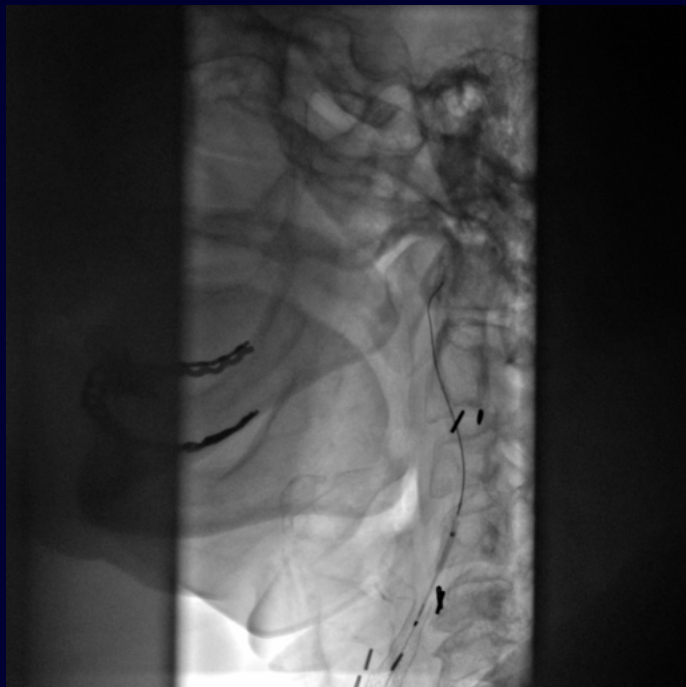
asymptomatic restenosis of the right internal carotid artery

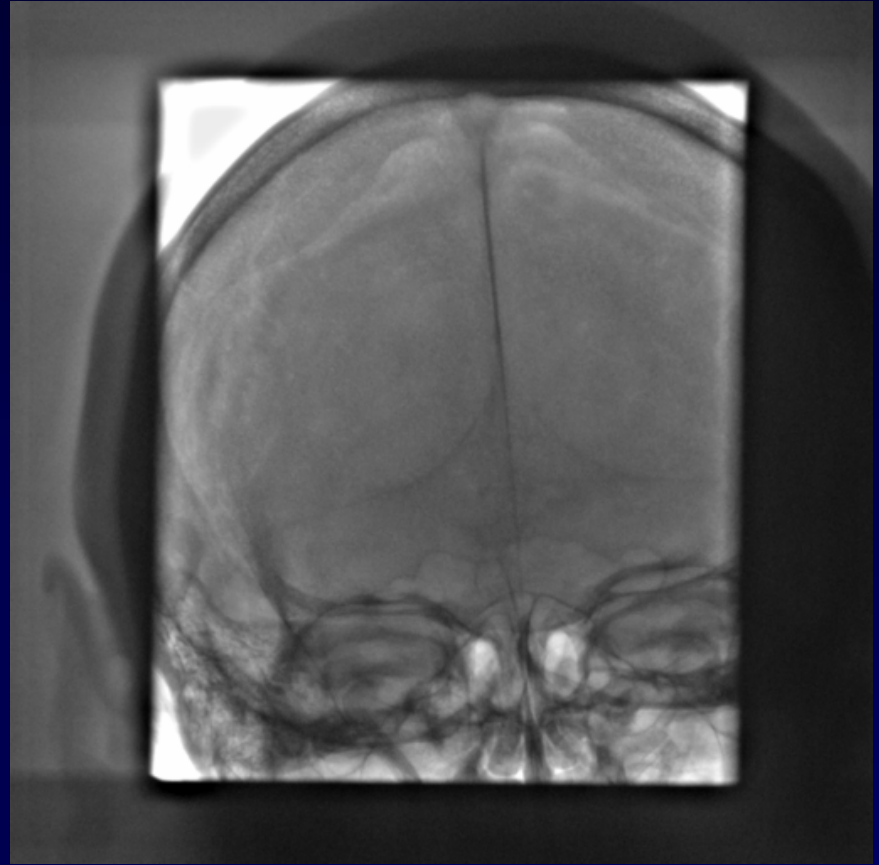
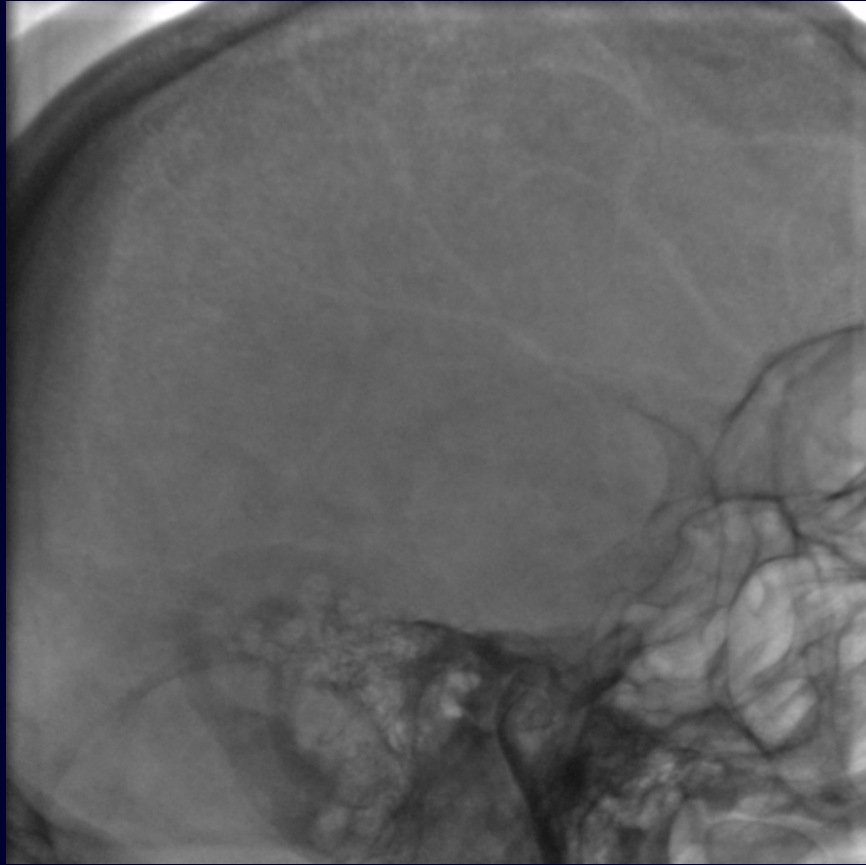
- Distal protection : AccUNET Guidant 7.5
- Self expanding conical Stent Guidant Acculink 7/10 x 40 mm
- Balloon 5x20 & 6x20 ( 14 atm)











Ms Roy... 64 years old :

asymptomatic restenosis of the right internal carotid artery

Closure device : 8F Angioseal

Hospital stay : 3 days

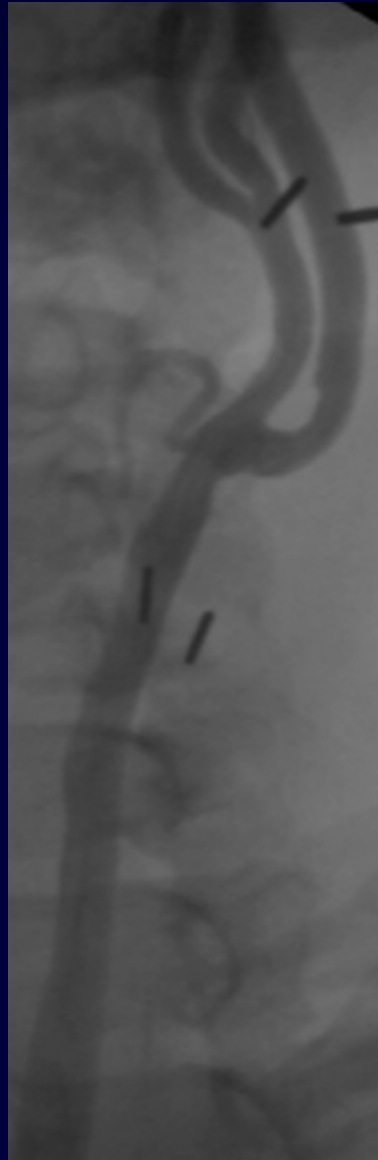
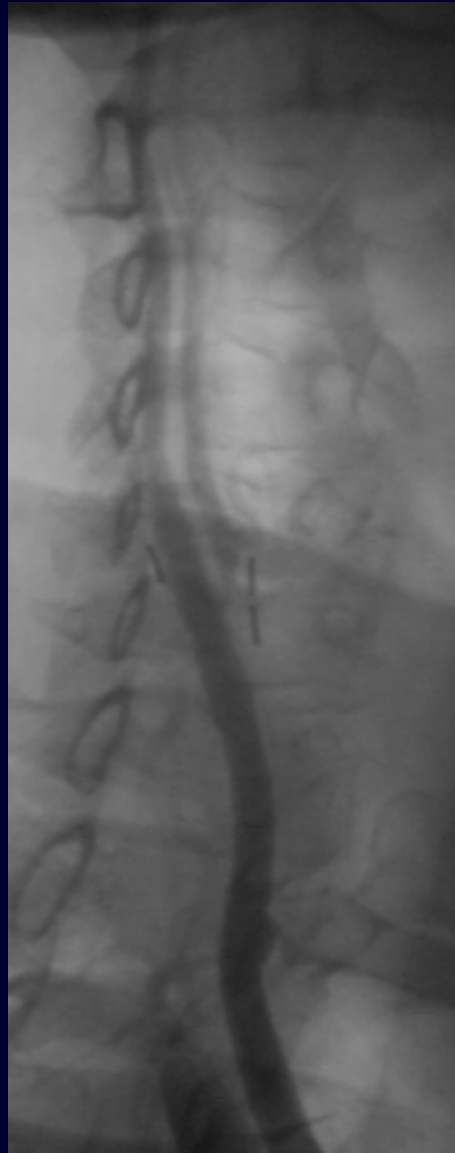
No complication

6 months follow-up :

- asymptomatic
- echo-Doppler : good patency of the two stents

28 months later : coronary angiography for angina class II

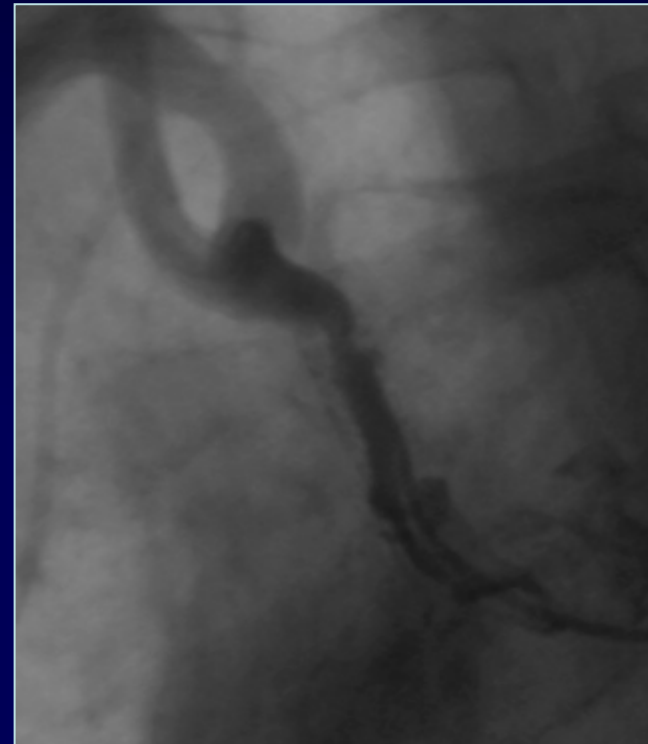
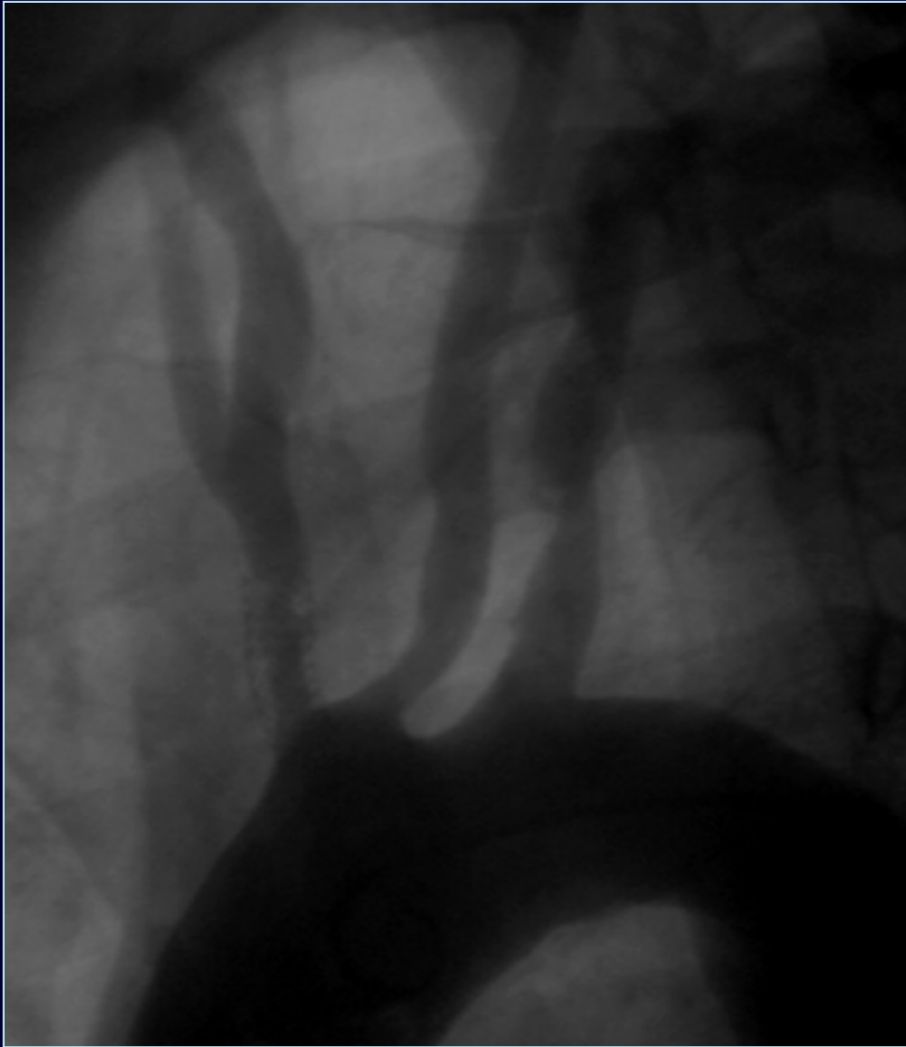
- RCA thrombosis
- No LCA significant lesion







Next step : repeat angioplasty of inominate artery



# Quels sont les patients qui doivent être orientés vers l'angioplastie ?

## High-Risk Criteria for CEA

Anatomical Criteria	Medical Comorbidities
Lesion at C-2 or higher	Age $\geq$ 80 yrs
Lesion below clavicle	Class III/IV congestive heart failure
Prior radical neck surgery or radiation	Class III/IV angina pectoris

“Carotid artery stenting is a reasonable alternative to CEA, particularly in patients at high risk for CEA. At the present time, there is insufficient evidence to support CAS in high-risk patients with asymptomatic stenosis less than 80% or in any patient without high-risk features.”

*ACCF/SCAI/SVMB/SIR/ASITN Clinical Expert Consensus Document (JACC 2007)*

Severe chronic lung disease

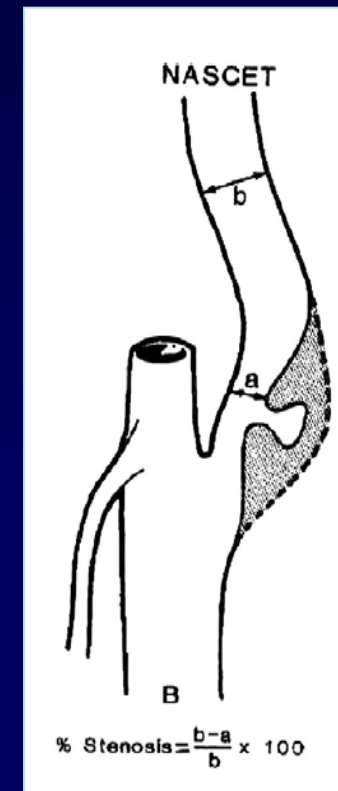
Severe renal disease

CEA = carotid endarterectomy; LV = left ventricular.

*ACCF/SCAI/SVMB/SIR/ASITN Clinical Expert Consensus Document (JACC 2007)*

## Le patient doit être bien cadré avant l'angioplastie

- Interrogatoire et examen cardio-vasculaire et neurologique soigneux +++
- Écho-doppler des carotides +++ (sévérité de la sténose ; morphologie)
- Complément d'imagerie, selon orientation après bilan clinique et écho :
  - Angio IRM de l'aorte et des carotides ainsi que du cerveau+++
  - Angioscanner
  - Angiographie aortique et carotidienne,
  - Coronarographie couplée si nécessaire
- Évaluation de l'ischémie myocardique
- Scanner / IRM cérébrale
- Bilan biologique
  - Ionogramme sanguin
  - NF/plaquettes
  - VS – CRP
  - EAL
  - Glycémie +/- Hb Glyquée
  - Créatininémie / Clairance de la créatinine



## Contraindications to Carotid Artery Stenting

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### Neurological

- Major functional impairment
- Significant cognitive impairment
- Major stroke within 4 weeks

### Anatomical

- Inability to achieve safe vascular access
- Severe tortuosity of aortic arch
- Severe tortuosity of CCA or ICA
- Intracranial aneurysm or AVM requiring treatment
- Heavy lesion calcification
- Visible thrombus in lesion
- Total occlusion
- Long subtotal occlusion (string sign)

### Clinical

- Life expectancy <5 yrs
  - Contraindication to aspirin or thienopyridines
  - Renal dysfunction precluding safe contrast medium administration
- 

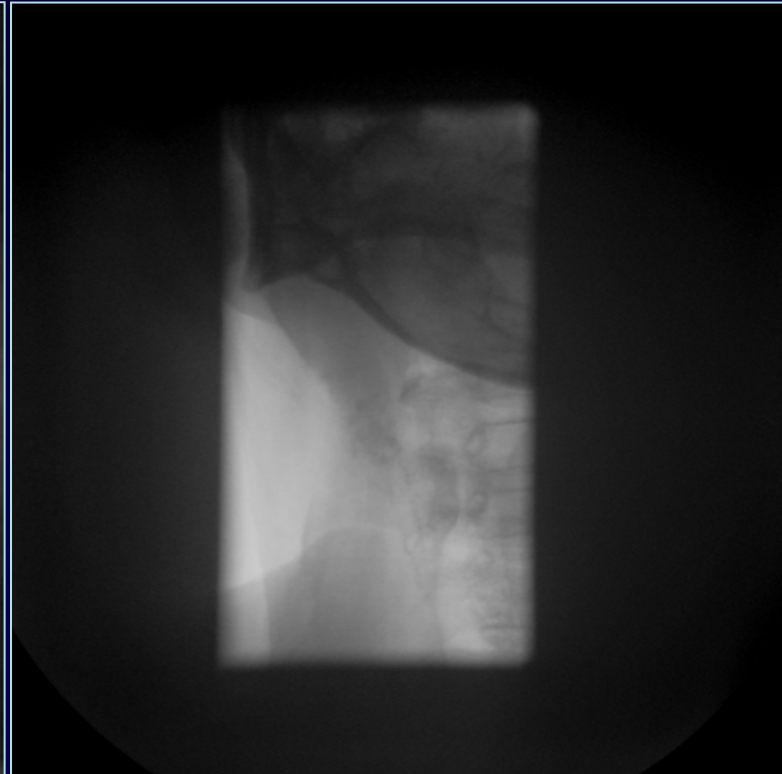
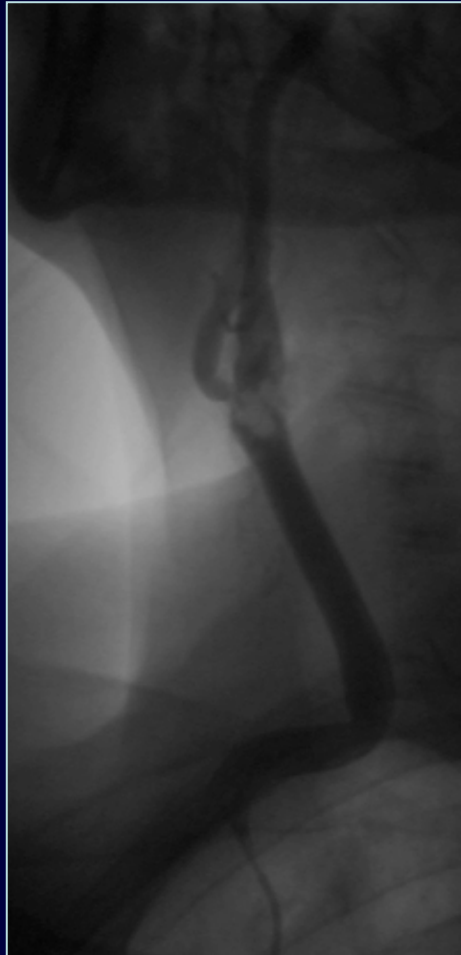
AVM = arterioventricular valve malfunction



Les lésions contenant du caillot, les bourgeons massivement calcifiés ne sont pas de bonnes indications

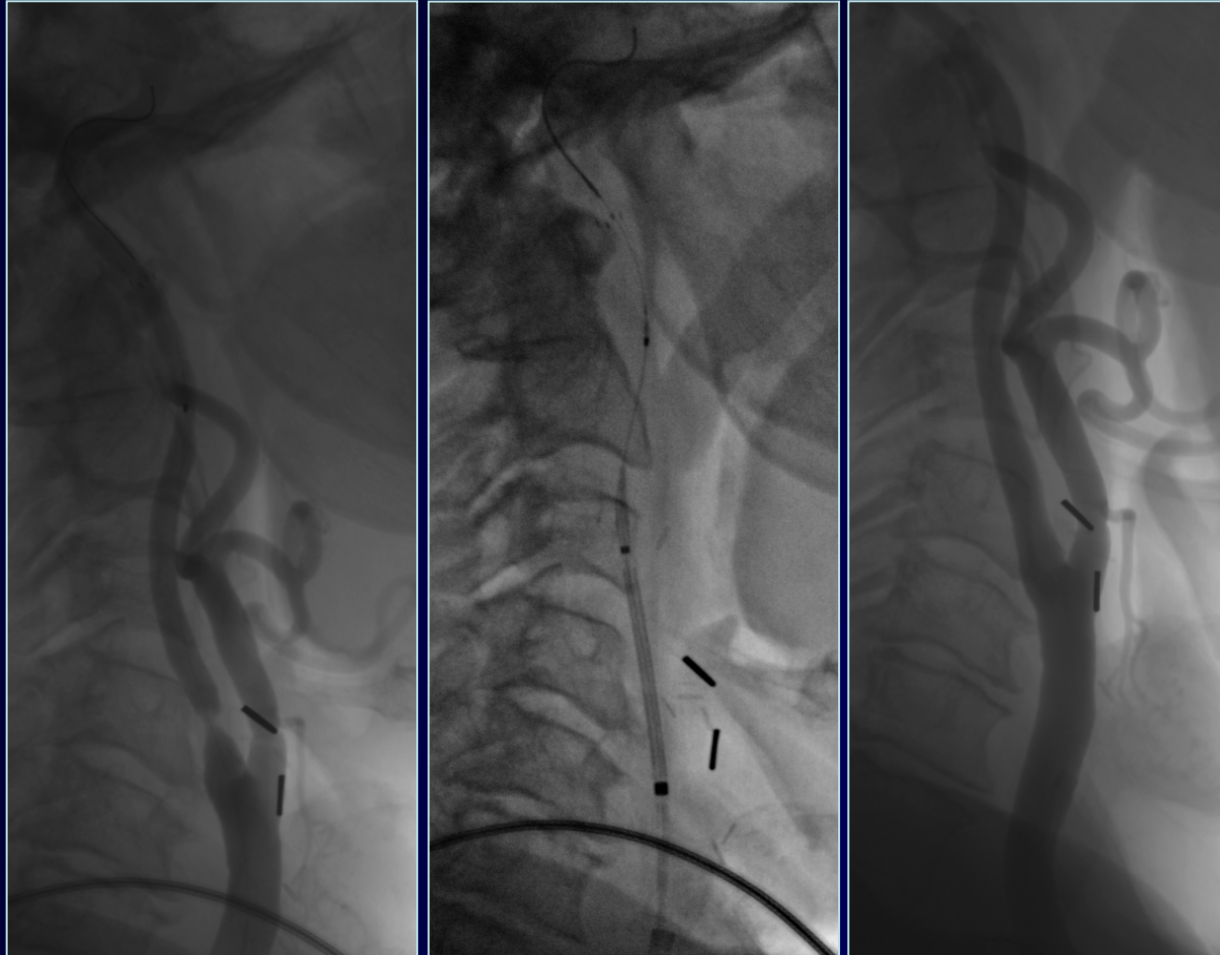


Mr x...62 ans AIT à J3  
Thrombus sur plaque



Mme D...81ans amaurose  
transitoire à J18 sur  
bourgeon calcifié

## Les lésions focales, lisses sont les meilleurs indications



- Guide 8F VBL Cordis ; filtre Accunet Guidant 6.5 ;
- Prédilatation par un ballon de 4 mm (échec sans prédilatation)
- stent Acculink Guidant 8x30 ; Ballon Viatrak Guidant 6x20



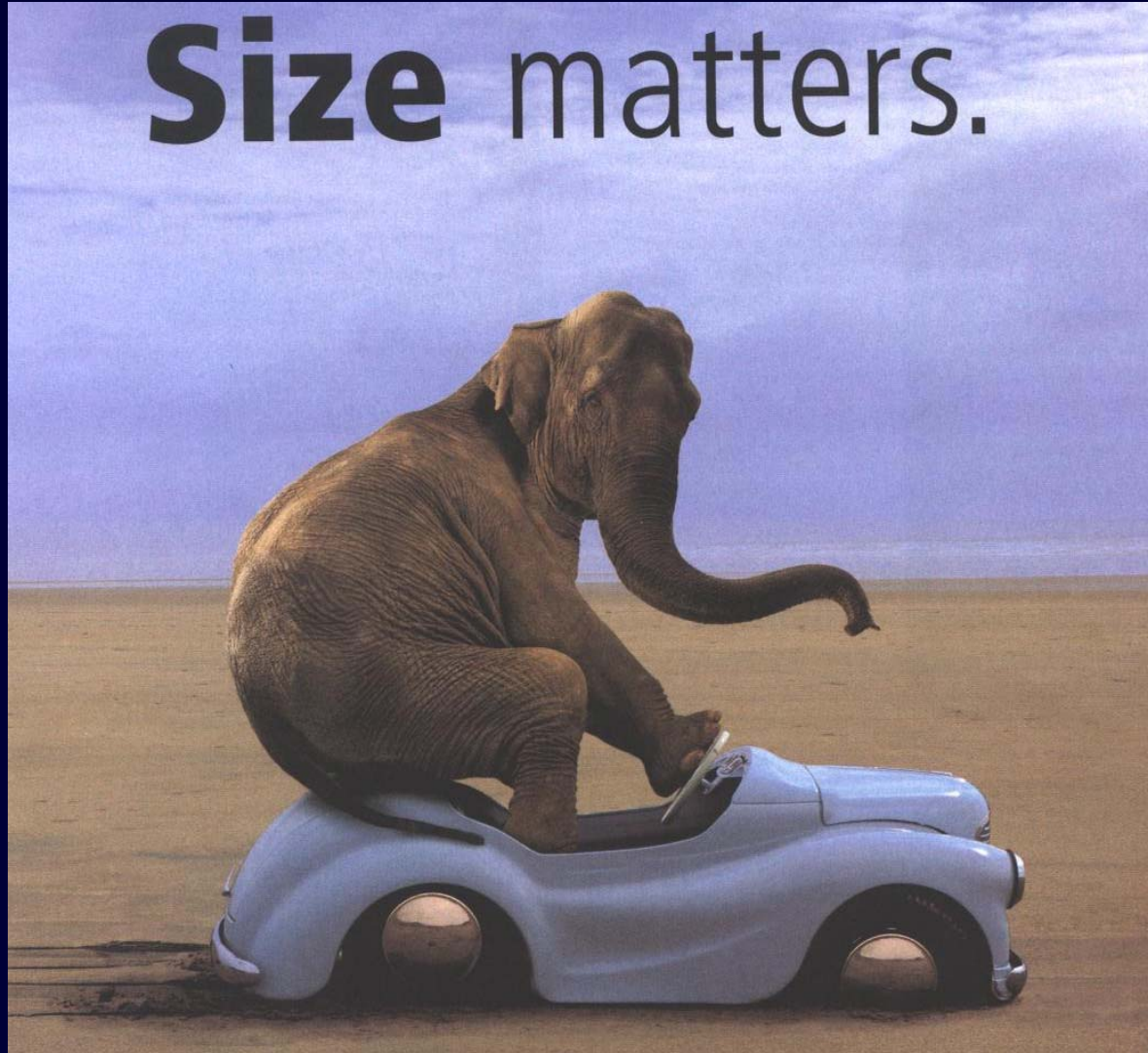
## Traitement médical encadrant l'angioplastie

- Prémédication soigneuse
  - Aspirine
  - Clopidogrel
  - Traitement anti-hypertenseur adapté
  - Hydratation si insuffisance rénale
  - Statines et régime crêtois
- Pendant l'angioplastie :
  - Sédation et analgésie
  - Anticoagulation efficace dès la ponction
  - Surveillance tensionnelle soigneuse +++
  - Prévenir la bradycardie par l'atropine
  - si besoin vasopresseurs : neosynephrine (10 à 100 mg/min)
  - Surveillance de l'état neurologique

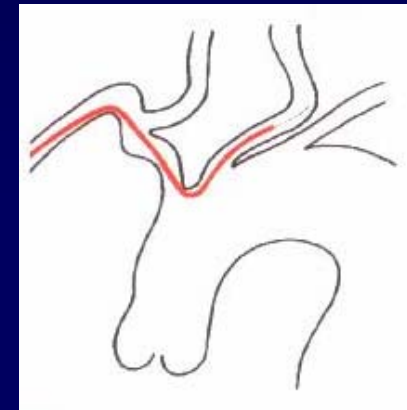
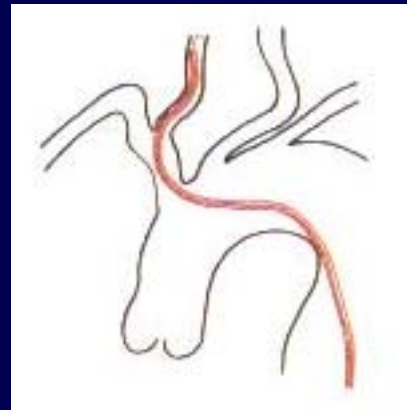
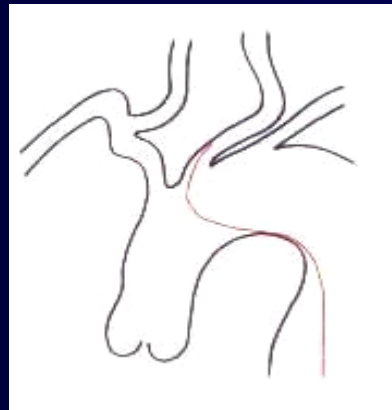
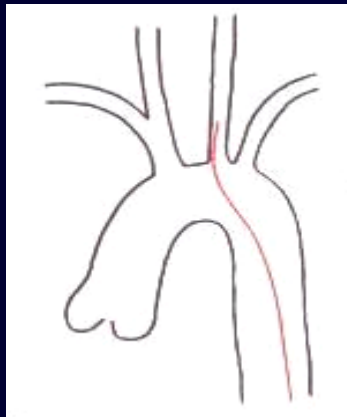
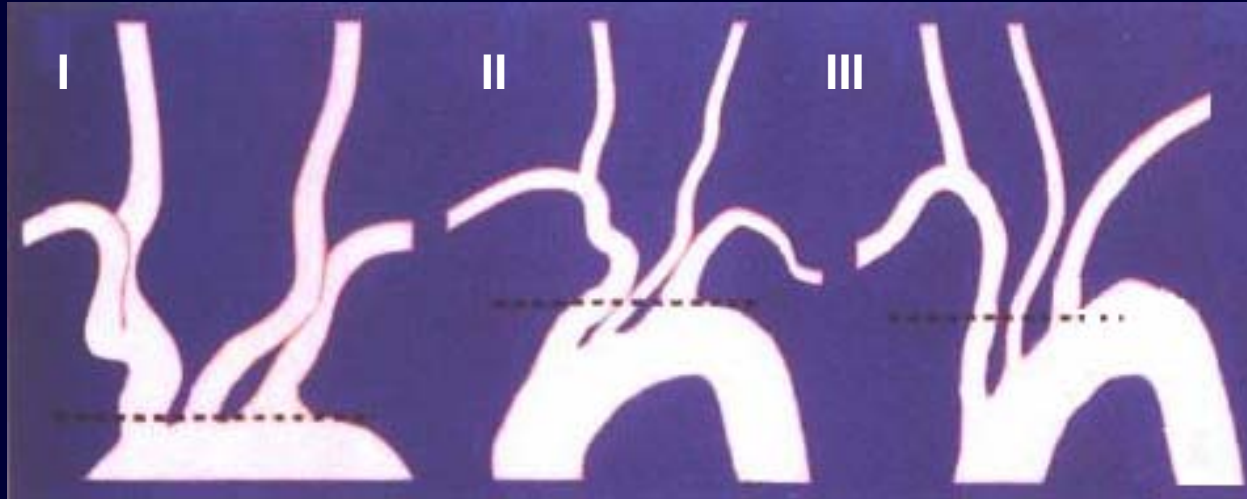
## Le choix du guiding est essentiel

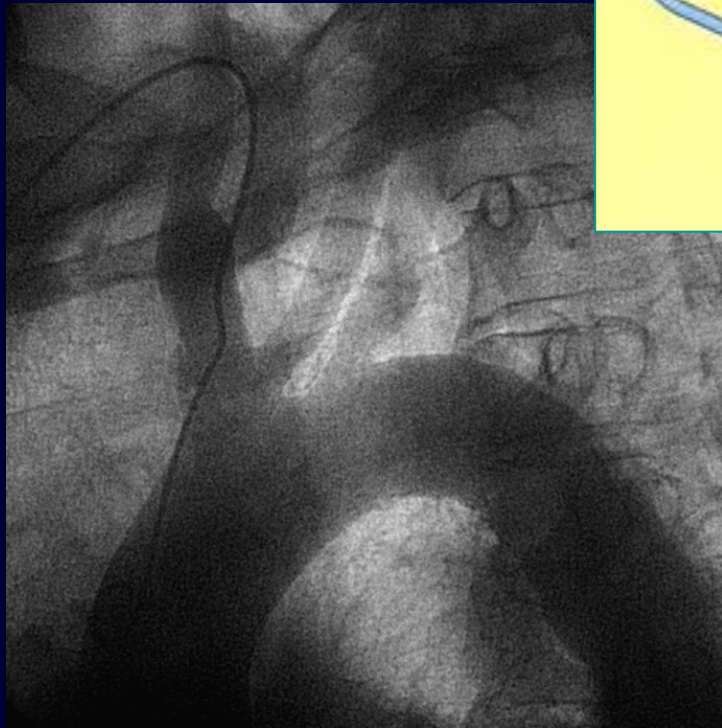
- 2 systèmes efficaces (internal lumen : 0.087 to 0.090 inches)
  - L'introducteur interventionnel armé long 6F (type Terumo)
  - Le guiding cathéter (8F, voire plus pour certaines protections)
- Le choix du matériel conditionne le support +++
- Mais il influence aussi le risque de complications :
  - *Fragmentation, dissection de plaque*
  - *Dissection de la carotide primitive*
  - *Embolies fibrino-cruoriques ou gazeuses*
    - *purge +++ et flush continu*
    - *Héparinisation efficace pendant toute la procédure*
- Par sa taille
- par son agressivité pour pénétrer la carotide
  - Variable selon la rigidité
  - Mais surtout selon la forme +++
- Rendant compte des AVC contro-latéraux

**Size** matters.



## Les 3 types d'arche aortique







## Faut-il protéger ou pas ?

- En théorie, c'est logique : risque majeur de fragmenter la plaque en la passant, en la craquant ou en la pressant (+ risque d'embolies fibrino-cruorique en provenance du cathéter)
- En pratique : discutable
  - Ne protège pas certains temps délicats comme l'intubation
  - Risque d'embolies en passant les systèmes de protection qui se positionnent en aval de la lésion
  - Obligation d'utiliser des guides orientables plus agressifs et moins performants pour la plupart des systèmes
  - Risques de dissection ou de spasme induit par la protection
  - Impose des temps supplémentaires qui allongent la procédure
  - Risques de blocage de flux par caillotage dans le filtre
  - Risques de difficultés de retrait du matériel à travers le stent



## Quels études alimentent ce débat ?

- Les études montrant de bons résultats de l'angioplastie utilisent systématiquement la protection : Sapphire, Beach, Create...
- Les médiocres résultats des études qui ne l'ont pas utilisée chez tous les patients vont dans le même sens (EVA 3S, SPACE) ...

### **Carotid Angioplasty and Stenting With and Without Cerebral Protection**

#### **Clinical Alert From the Endarterectomy Versus Angioplasty in Patients With Symptomatic Severe Carotid Stenosis (EVA-3S) Trial**

*Stroke. 2004;35:e18–e21.*

EVA-3S Investigators

*Summary of Report*—The Safety Committee recommended stopping unprotected CAS, because the 30-day rate of stroke was 3.9 (0.9 to 16.7) times higher than that of CAS with cerebral protection (4/15 versus 5/58).

*Conclusion*—Although this result was not based on a randomized comparison of unprotected versus protected CAS, it suggests that the use of cerebral protection devices during CAS reduces periprocedural strokes.

*mais elles ont surtout laisser œuvrer trop d'opérateurs inexpérimentés*

*Stroke*. 2004 ; 35 : 2134-9.

## Pro-CAS

### A Prospective Registry of Carotid Angioplasty and Stenting

Wolfram Theiss, MD; Peter Hermanek, MD; Klaus Mathias, MD; Ramazanali Ahmadi, MD; Lothar Heuser, MD; Franz-Josef Hoffmann, MD; Rüdiger Kerner, MD; Franz Leisch, MD; Horst Sievert, MD; Stefan von Sömmogy, MD; for the German Societies of Angiology and Radiology

**Background and Purpose**—The German Societies of Angiology and Radiology have instituted a prospective registry of carotid angioplasty and stenting (CAS) to limit uncontrolled use of CAS and to collect data about technique and results of CAS outside clinical trials.

**Methods**—A total of 38 centers register their patients prospectively before CAS is performed. At discharge, technical details, periprocedural medication, and the clinical course are reported on a standardized form.

**Results**—During the first 48 months, 3853 planned interventions were recorded, and CAS was actually attempted on 3267 patients of whom 1827 (56%) were symptomatic and 1433 (44%) were asymptomatic. In 3127 (98%) cases, stents were used, of which 2784 (89%) were of the self-expanding type. Other technical aspects such as the use of guiding catheters and protection devices varied widely among the centers. Periprocedural medication rather uniformly included aspirin and clopidogrel before and after CAS and high-dose heparin and atropin during CAS. CAS was successful in 3207 (98%) cases. There was a 0.6% (n=18) mortality rate, a 1.2% (n=38) major stroke rate, and a 1.3% (n=41) minor stroke rate. The combined stroke and death rate was 2.8% (n=90).

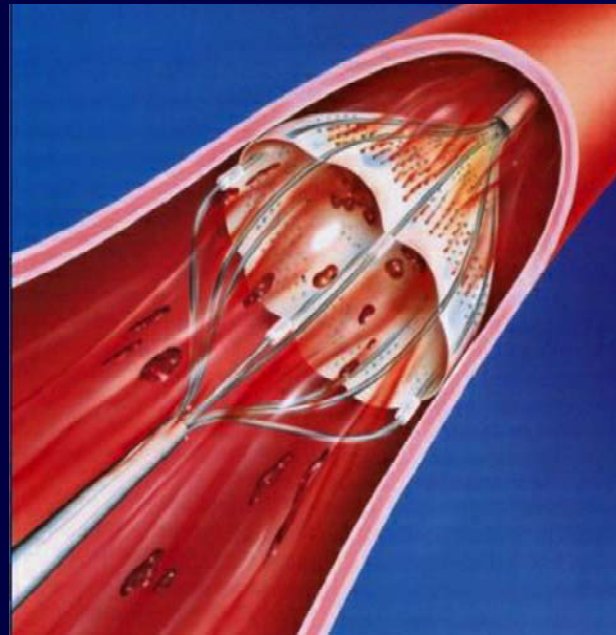
**Conclusions**—These prospective multicenter data are likely to give a realistic picture of the possibilities and limitations of CAS in the general community. They suggest that CAS may be performed with similar results in the general community as they have been reported by highly specialized centers and in clinical studies. (*Stroke*. 2004;35:2134-2139.)

Neurological Complications Without and With Protection Device (Patients Treated From October 2000 to June 2003) and in Patients Treated Before October 2000

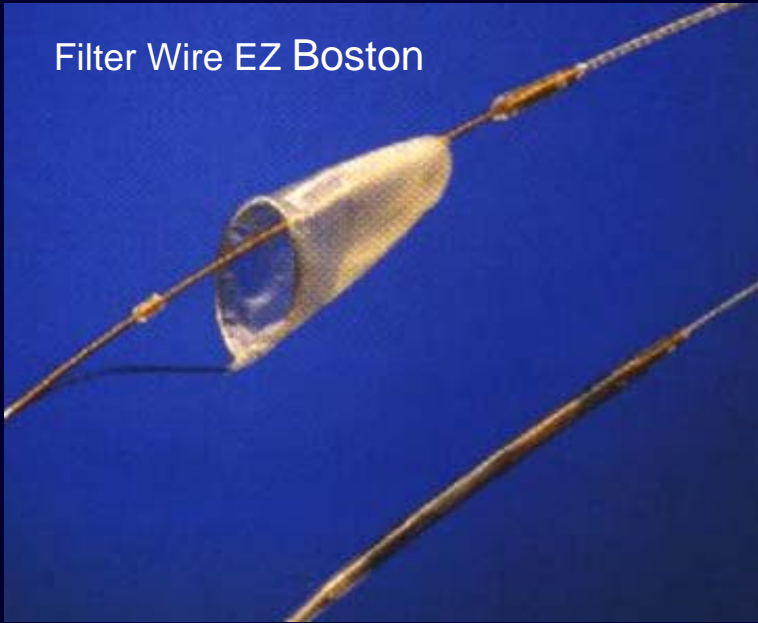
<i>Stroke</i> . 2004 ; 35 : 2134-9.	No Protection Device	With Protection Device	Treated Before October 2000
No. of interventions	923 (100%)	1609 (100%)	735 (100%)
Mortality	2 (0.2%)	9 (0.6%)	7 (1.0%)
Combined mortality/permanent neurological deficit	20 (2.2%)	33 (2.1%)	34 (4.6%)
Permanent deficit (total)	19 (2.1%)	27 (1.7%)	34 (4.6%)
Major stroke	9 (1.0%)	13 (0.8%)	14 (1.9%)
Minor stroke	10 (1.1%)	12 (0.7%)	19 (2.6%)
Visual defect	0	2 (0.1%)	1 (0.1%)
Transient symptoms (total)	42 (4.6%)	122 (7.6%)	67 (9.1%)
PRIND	9 (1.0%)	16 (1.0%)	10 (1.4%)
Transient ischemic attack >10 minutes	11 (1.2%)	39 (2.4%)	24 (3.2%)
Transient ischemic attack <10 minutes	20 (2.2%)	61 (3.8%)	30 (4.1%)
Transient monocular blindness	2 (0.2%)	6 (0.4%)	3 (0.4%)

## Les systèmes de protection cérébrale

- 2 types de protection :
  - Les filtres positionnés en aval recueillant les embolies
  - Les systèmes d'interruption ou renversement de flux carotidien avec aspiration des débris



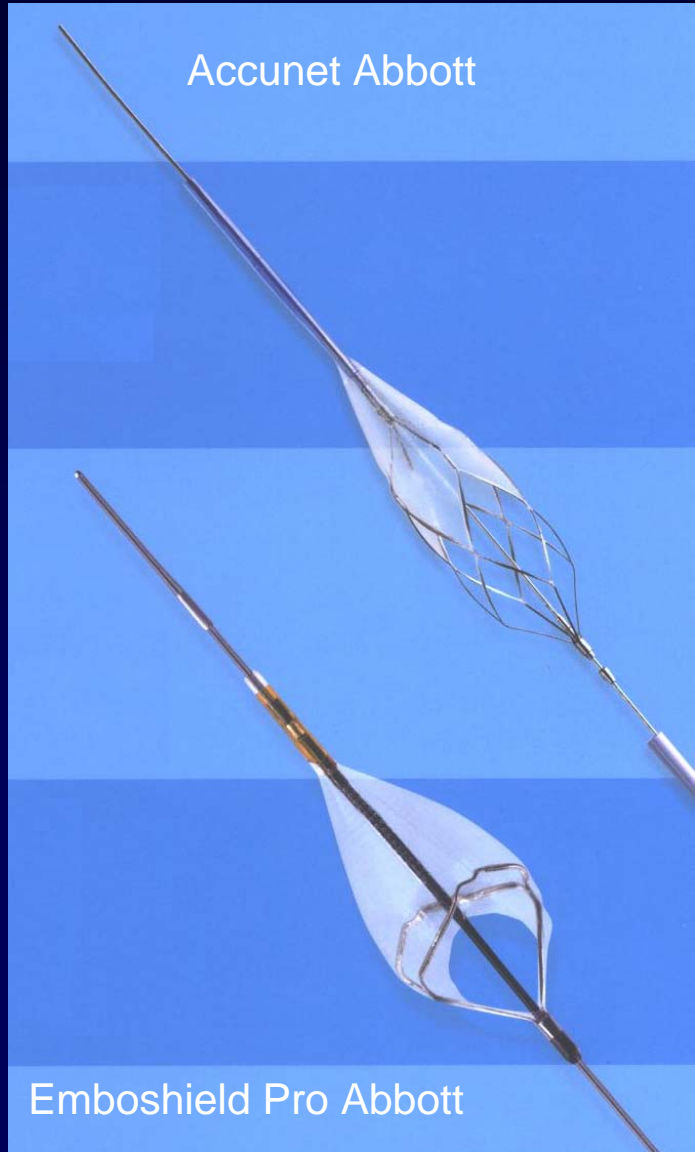
Filter Wire EZ Boston



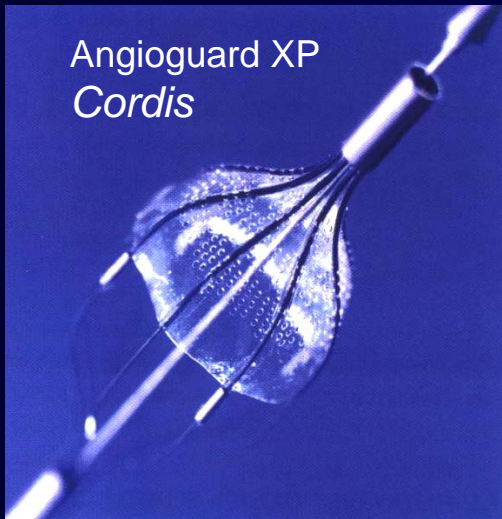
Spider Filter EV3



Accunet Abbott



Angioguard XP  
Cordis



Emboshield Pro Abbott



## Systèmes d'interruption de flux carotidien

### Type Medtronic percusurge



Le principe, très simple :

Ballonnet occusif positionné en aval de la lésion pour stopper les débris qui sont aspirés

Les inconvénients :

Risques d'embolies en passant la lésion

Interruption de perfusion parfois mal tolérée

Gène les repérages angiographiques

Risques de spasme et dissection du lit d'aval



# Neuro Protection... Flow Reversal

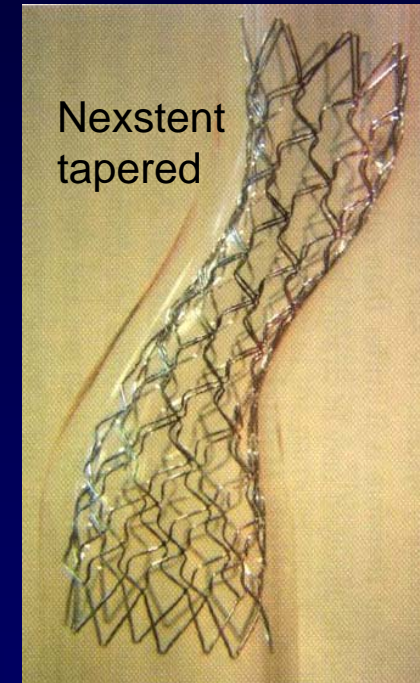


FLOW REVERSAL INNOVATION BY  
**JUAN PARODI**

Inconvénient : la taille du guiding cathéter, génératrice de complications !

## Les stents utilisables :

- Stents rigides en métal montés sur ballon
  - Bonne résistance à la rétraction élastique
  - Facilité de positionnement
  - Plus grande rigidité, moindre conformabilité
  - Risque d'écrasement plus important
  - À privilégier sur les courts bourgeons calcifiés
  - Et sur les ostia de la CPG ou du TABC
- Les stents autoexpansibles à mémoire de forme
  - Plus grande conformabilité
  - Meilleure couverture longitudinale de la lésion
  - Existent en forme droite ou conique
  - 2 types : cellules ouvertes ou fermées

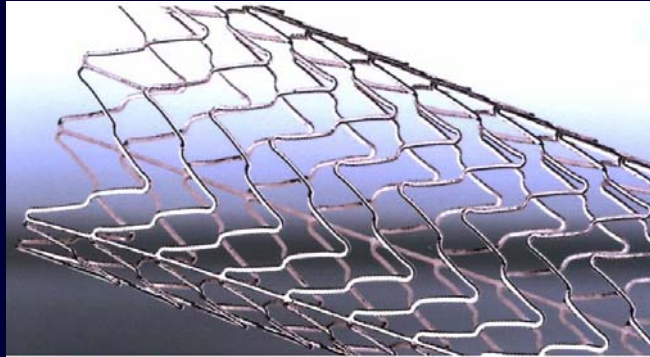


## Stents carotidiens auto-expansibles



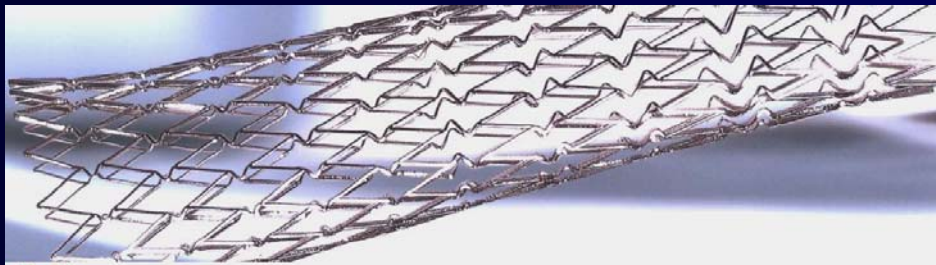
Stent Type	Company	Name	Tapered Stent Prox/ Dist Diameter (mm) Length (mm)	Straight Stent Diameter (mm) Length (mm)
Stainless steel	Boston Scientific	Wallstent	Not available	6 (×22), 8 (×21, 29, 36), 10 (×24, 31, 37)
Open-cell nitinol	Guidant	Acculink	10/7, 8/6 30, 40	5, 6, 7, 8, 9, 10 20, 30, 40
	Medtronic	Exponent	20, 30, 40	6, 7, 8, 9, 10 20, 30, 40
	Bard	Vivexx	12/8, 10/7, 8/6 30, 40	5, 6, 7, 8, 9, 10, 12 20, 30, 40
	ev3	Protege	10/7, 8/6 30, 40	6, 7, 8, 9, 10 20, 30, 40, 60
	Cordis	Precise	Not available	5, 6, 7, 8, 9, 10 20, 30, 40
	Closed-cell nitinol	Endotex	NexStent	Not available
Abbott Vascular		Xact	10/8, 9/7, 8/6 30, 40	7, 8, 9, 10 20, 30
Medinol		Nirtinol	10/7, 8/6 30, 44	5, 6, 7, 8 21, 30, 44





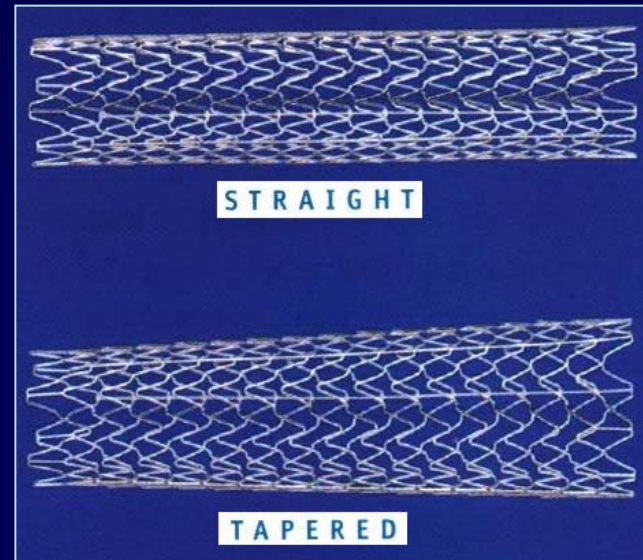
# RX Acculink

Carotid Stent System



# Xact with freestyle

Rapid Exchange Carotid Stent System



## Après l'angioplastie

- Fermeture du point de ponction (surtout si >6F) et surveillance clinique voire échographique de l'abord artériel
- Monitoring tensionnel (éviter les hypo / hypertensions +++)
- Examen neurologique soigneux avant et après angioplastie,
- Scanner/IRM cérébral au moindre AVC
- Bithérapie clopidogrel-aspirine pendant au moins un mois, puis monothérapie au long cours
  
- Écho-doppler à 1 mois, 6 mois puis tous les ans
  
- *“Cardiovascular risk factor modification to target levels with medical therapy is recommended to limit progression of atherosclerosis and decrease clinical events, irrespective of carotid artery revascularization.”*

*ACCF/SCAI/SVMB/SIR/ASITN Clinical Expert Consensus Document (JACC 2007)*

**ACCF/SCAI/SVMB/SIR/ASITN CLINICAL EXPERT CONSENSUS DOCUMENT**

## **ACCF/SCAI/SVMB/SIR/ASITN 2007 Clinical Expert Consensus Document on Carotid Stenting**

A Report of the American College of Cardiology Foundation Task Force  
on Clinical Expert Consensus Documents (ACCF/SCAI/SVMB/SIR/ASITN  
Clinical Expert Consensus Document Committee on Carotid Stenting)

*Developed in Collaboration With the American Society of Interventional & Therapeutic  
Neuroradiology, Society for Cardiovascular Angiography and Interventions, Society for Vascular  
Medicine and Biology, and Society of Interventional Radiology*



- **Carotid Endarterectomy (CEA)**

Current AHA guidelines recommend CEA in symptomatic patients with stenosis 50% to 99%, if the risk of perioperative stroke or death is less than 6%. For asymptomatic patients, AHA guidelines recommend CEA for stenosis 60% to 99%, if the risk of perioperative stroke or death is less than 3%.

The 2005 guidelines from the American Academy of Neurology recommend that eligible patients should be 40 to 75 years old and have a life expectancy of at least 5 years.

- **Carotid Stenting**

Carotid artery stenting is a reasonable alternative to CEA, particularly in patients at high risk for CEA. Although there are no randomized studies comparing CAS with and without embolic protection devices (EPDs), the use of EPDs appears to be important in reducing the risk of stroke during CAS.

Careful neurological assessment is required before and after CAS.

At the present time, there is insufficient evidence to support CAS in high-risk patients with asymptomatic stenosis less than 80% or in any patient without high-risk features.