Tailored Carotid Protection:
Matching the Device to the Patient

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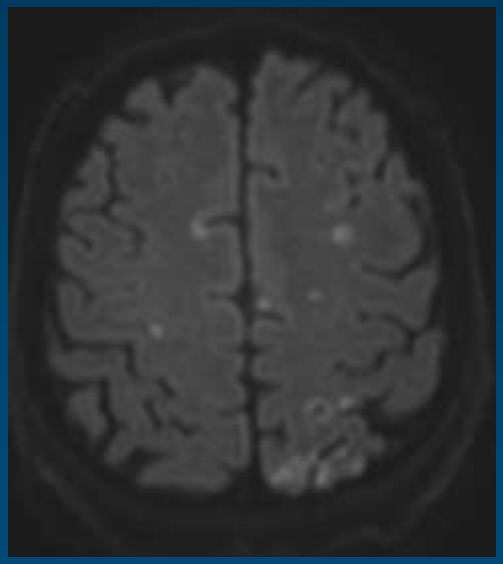
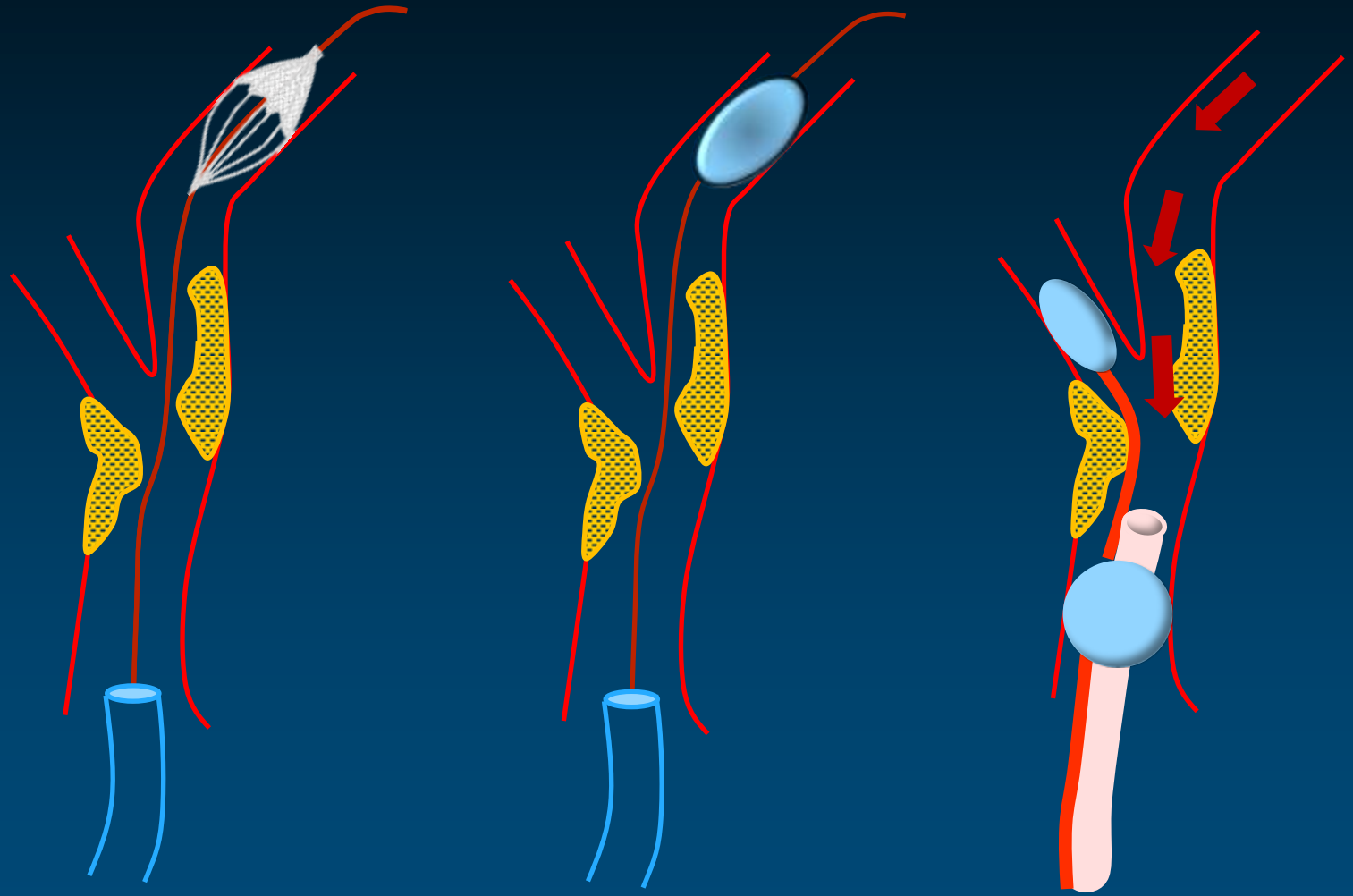
CAS Risk

- **The greatest risk associated with CAS is periprocedural stroke or asymptomatic brain infarction due to embolization**



Different Protection Devices



Distal filter

Distal occlusion

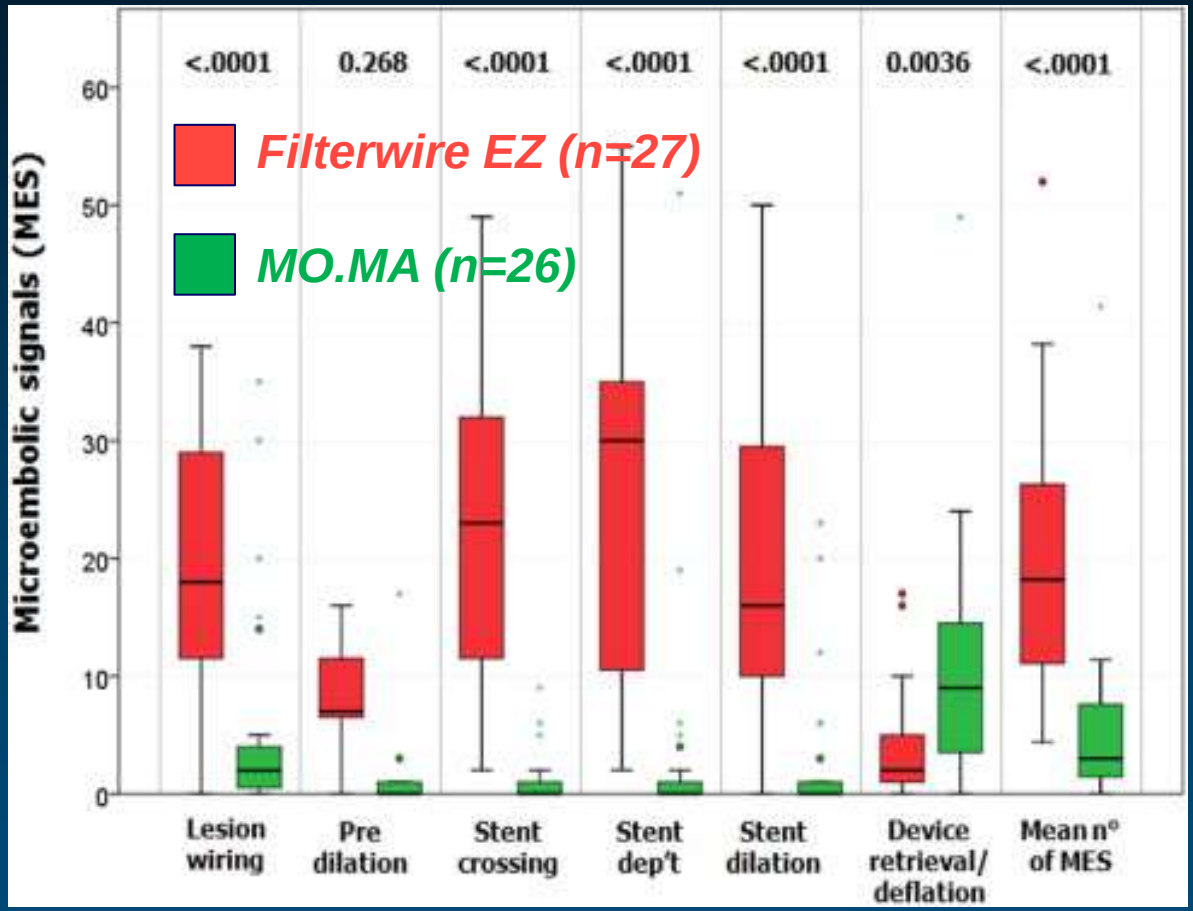
Proximal protection

Proximal vs. Distal Protection

Randomized TCD MES Comparison for High-Risk, Lipid-Rich Plaque

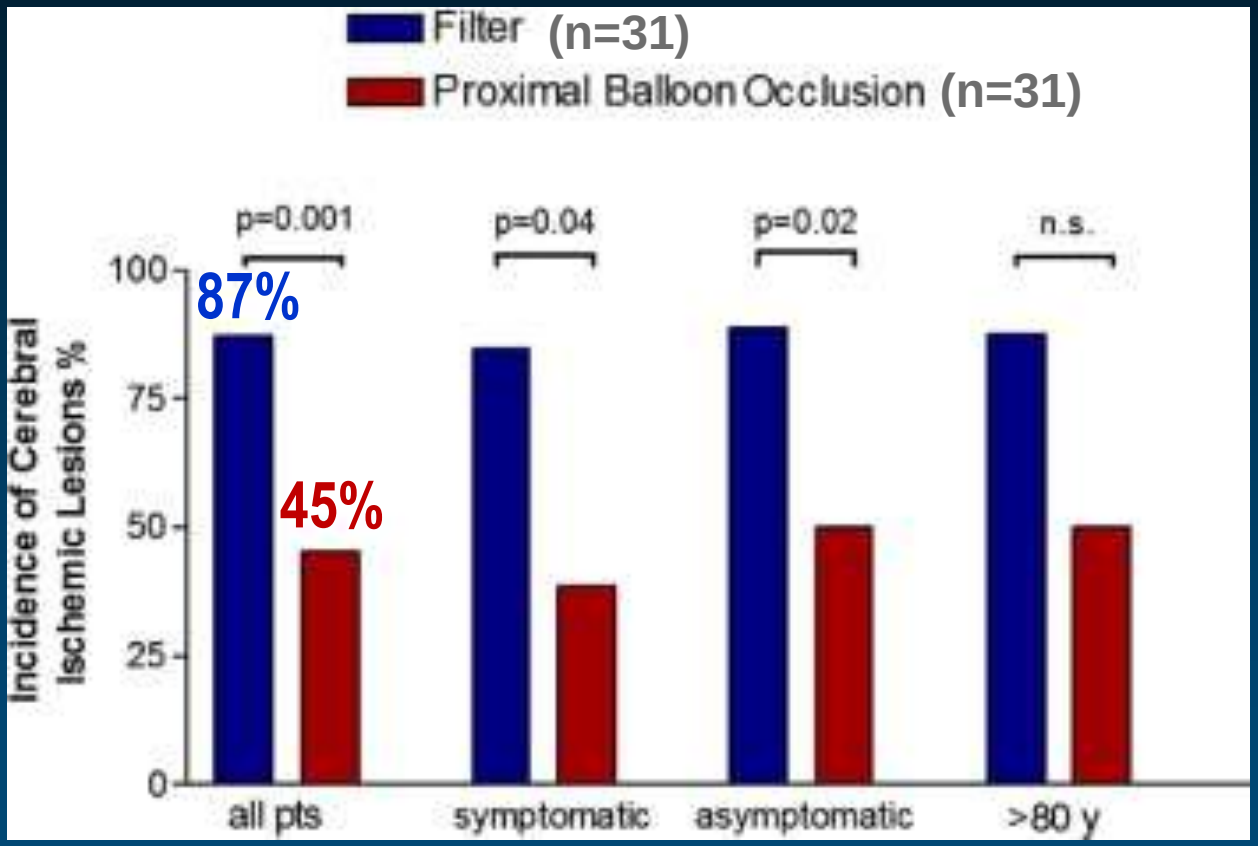
Table 3 Patients With Detectable MES During the Different Phases of CAS

Steps	FilterWire EZ (n = 27)	MO.MA (n = 26)	p Value
Lesion wiring	26 (96%)	19 (73%)	0.145
Pre-dilation*	6/7 (86%)	4/10 (40%)	0.578
Stent crossing of the lesion	27 (100%)	7 (27%)	<0.0001
Stent deployment	27 (100%)	7 (27%)	<0.0001
Stent post-dilation	26 (96%)	7 (27%)	<0.0001
Device retrieval/deflation	22 (81%)	25 (96%)	0.721



Montorsi P et al. JACC 2011;58:1656-63

Proximal vs. Distal Protection
Randomized DWMRI Comparison



Bijuklic K et al. JACC 2012;59:1383-89

A Meta-Analysis of Proximal Protection (n=2,397)

TABLE I. Baseline Demographics and Clinical Characteristics by Study

	1	2	3	4	5[a]	Full sample
Study device	MO.MA	MO.MA	MO.MA	MO.MA	Gore FRS	(*N* = 2,397)
			Age			
Mean ± SD (*N*)	71.62 ± 8.86 (233)	74.61 ± 8.80 (262)	68.31 ± 8.69 (157)	69.84 ± 7.65 (1,270)	70.21 ± 9.59 (475)	70.51 ± 8.52 (2,397)
Median	71.00	76.64	70.00	70.00	70.00	70.92
Range (min,max)	(42.00,92.22)	(42.38,95.88)	(45.00,85.00)	(40.00,91.00)	(30.00,90.00)	(30.00,95.88)
Age ≥ 80	18.88% (44/233)	29.01% (76/262)	14.65% (23/157)	9.06% (115/1,270)	24.63% (117/475)	15.64% (375/2,397)
Male	72.53% (169/233)	66.79% (175/262)	76.43% (120/157)	71.87% (912/1,269)	66.95% (318/475)	70.70% (1694/2,396)
Hypertension	77.68% (181/233)	87.02% (228/262)	78.98% (124/157)	89.06% (1,131/1,270)	86.32% (410/475)	86.52% (2,074/2,397)
Hyperlipidemia	53.22% (124/233)	84.06% (211/251)	69.43% (109/157)	75.83% (963/1,270)	76.84% (365/475)	74.27% (1,772/2,386)
History of diabetes	37.77% (88/233)	37.69% (98/260)	29.30% (46/157)	38.77% (492/1,269)	34.95% (166/475)	37.18% (890/2,394)
Symptomatic (stroke, TIA, amaurosis fugax ≤ 180 days)	36.91% (86/233)	16.03% (42/262)	71.34% (112/157)	27.75% (351/1,265)	30.32% (144/475)	30.73% (735/2,392)
Current smoking	36.91% (86/233)	14.84% (38/256)	NR[b]	58.04% (498/858)	26.32% (125/475)	41.00% (747/1,822)
Contralateral occlusion of ICA	1.29% (3/233)	NR[b]	NR[b]	4.41% (56/1,270)	6.95% (33/475)	4.65% (92/1,978)

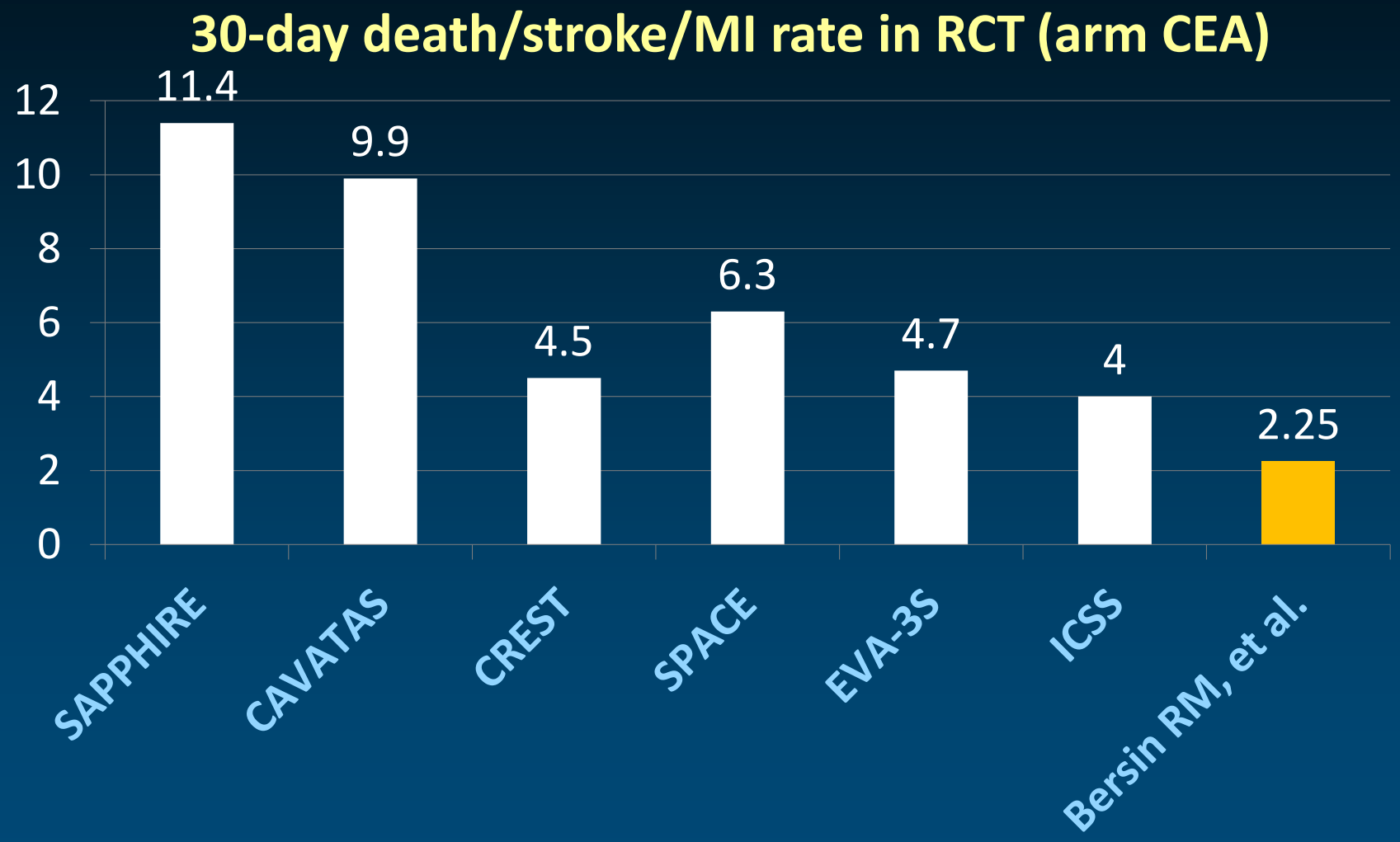
TABLE II. Events by Study

	1	2	3	4	5[a]	
Study device	MO.MA	MO.MA	MO.MA	MO.MA	Gore FRS	Meta-analytic combined rate (%)
Composite rate of MACCE to 30 days postprocedure	0.86% (2/233)	2.29% (6/262)	5.73% (9/157)	1.50% (19/1270)	2.95% (14/475)	2.25
Myocardial infarction	0.00% (0/233)	0.00% (0/262)	0.00% (0/157)	0.00% (0/1270)	0.63% (3/475)	0.02
Death	0.43% (1/233)	0.76% (2/262)	0.64% (1/157)	0.55% (7/1270)	0.63% (3/475)	0.40
Stroke	0.43% (1/233)	1.91% (5/262)	5.10% (8/157)	1.02% (13/1270)	2.32% (11/475)	1.71
Intolerance: device use interruption[b]	NR[c]	0.38% (1/261)	1.91% (3/157)	0.16% (2/1270)	1.47% (7/475)	0.63
Intolerance: alternate device use[d]	NR[c]	0.00% (0/261)	0.64% (1/157)	0.16% (2/1270)	1.26% (6/475)	0.35

[a]Two databases (8, 10) were provided as a single data file.
[b]Defined as intolerance that resulted in interruption of use of the POD to complete the procedure without the use of an alternate protection device.
[c]NR denotes not recorded and indicates that the data was not collected.
[d]Defined as intolerance that resulted in the use of an alternate protection device.

Catheterization and Cardiovascular Interventions 2012;80:1072–1078

A Meta-Analysis of Proximal Protection (n=2,397)
Compared with CEA



Catheterization and Cardiovascular Interventions 2012;80:1072–1078

National Cardiovascular Data Registry Analysis

TABLE 2 Major Adverse Events Based on Embolic Protection Type

	In-Hospital Outcomes (n=10,246)					
	Before Propensity Matching			After Propensity Matching		
	F-EPD (n = 9,656)	P-EPD (n = 590)	p Value	F-EPD (n = 2,032)	P-EPD (n = 508)	p Value
Death or stroke	234 (2.4)	9 (1.5)	0.164	40 (2.0)	8 (1.6)	0.560
Mortality	40 (0.4)	1 (0.2)	0.730	9 (0.4)	1 (0.2)	0.697
Stroke	209 (2.2)	9 (1.5)	0.296	33 (1.6)	8 (1.6)	0.937

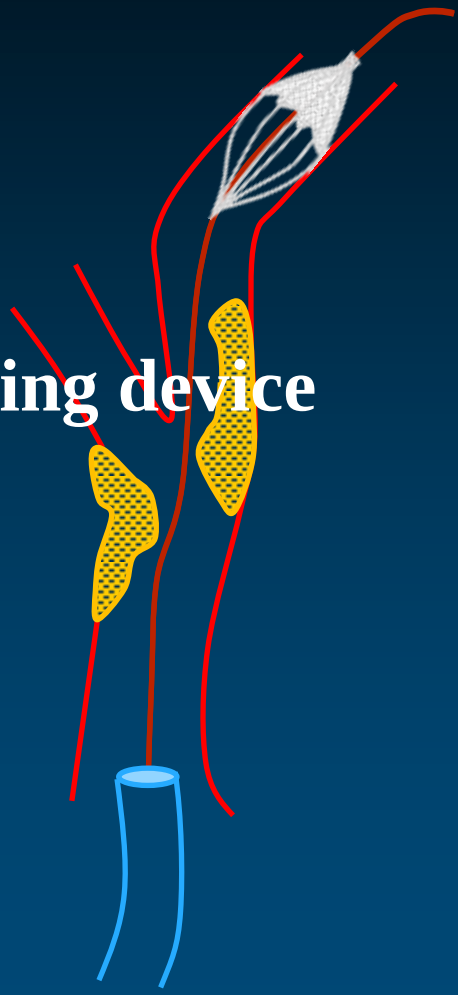
	30-Day Outcomes (n=7,693)					
	Before Propensity Matching			After Propensity Matching		
	F-EPD (n = 7,211)	P-EPD (n = 482)	p Value	F-EPD (n = 1,469)	P-EPD (n = 406)	p Value
Death or stroke	300 (4.2)	12 (2.5)	0.072	59 (4.0)	11 (2.7)	0.219
Mortality	53 (0.7)	2 (0.4)	0.582	12 (0.8)	2 (0.5)	0.747
Stroke	264 (3.7)	11 (2.3)	0.114	49 (3.3)	10 (2.5)	0.373

Giri J et al. JACC 2015;8:609–15

Distal Filter Protection

Advantages

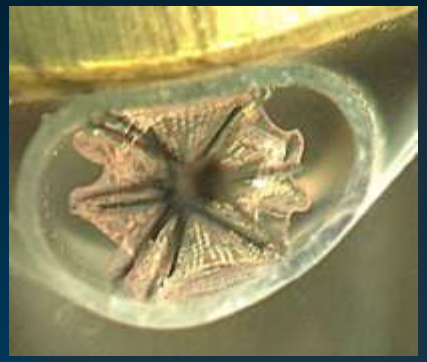
- **Continuous carotid artery blood flow**
  - **Less intolerable**
- **Permits visualization of carotid artery during device deployment**
- **Smaller introducer (6-7 Fr)**



Distal Filter Protection

Disadvantages

- Unprotected passage from the beginning
- Diameter selection
- Injury to the internal carotid artery
- Inflexible, low torquability
- Disputable efficiency in bended artery
- Inefficient for microemboli
- Possibility of thrombosis
- Plough effect if accidently retracted
- In-stent entrapment
- Retrieval difficulty



Proximal Embolic Protection

Disadvantages

- Intolerance possible with poor collateral or contralateral occlusion
- Some loss of visualization due to occluded flow
- Larger device (8~9 Fr introducer)
- More manipulation of aortic arch

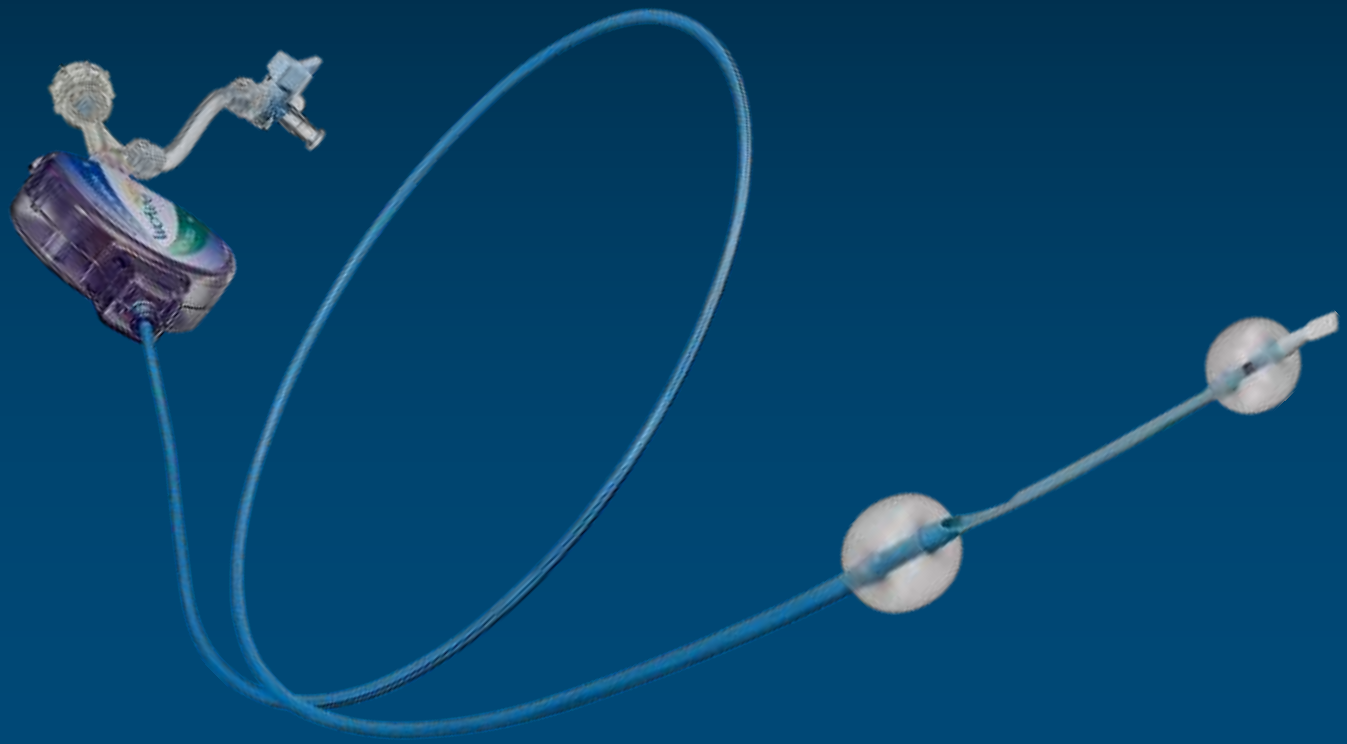
Proximal Embolic Protection

Advantages

- Easy to use with experience
- Intolerance is rare, and usually reversible
- Do not require crossing of the stenotic lesion without protection
- Landing zone tortuosity doesn't matter
- Less emboli get to brain… on TCD & DWI
- Great results especially elderly and symptomatic patients

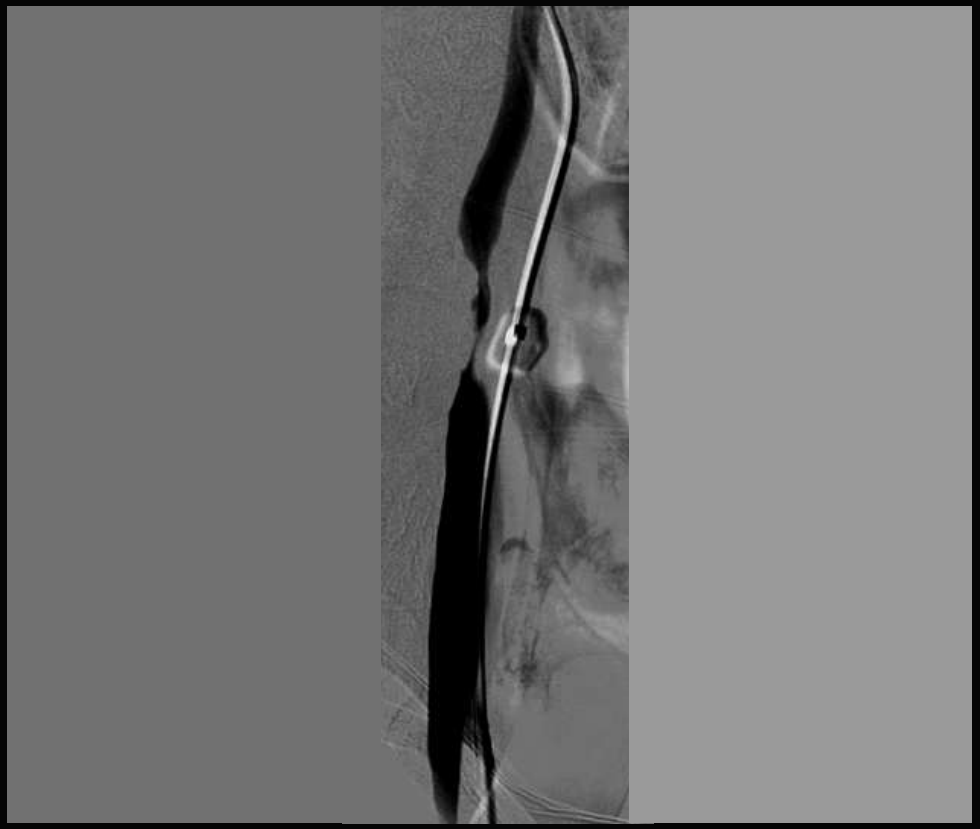
MO.MA in Korea

- **KFDA approval in Nov. 2011**
- **Increasingly using since 2012**
- **But, Filter protection is still majority in Korea**



My Memorable 4th MOMA case

Symptomatic 76 YO man

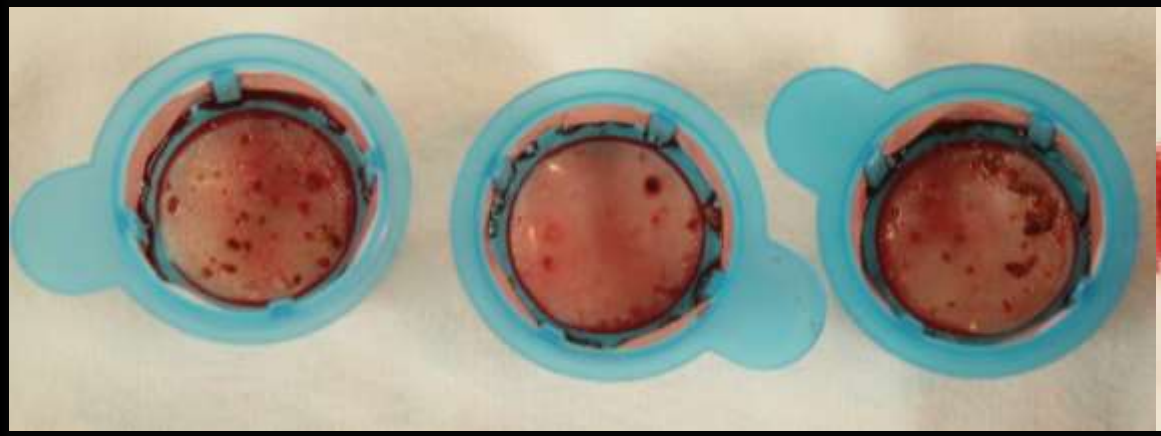


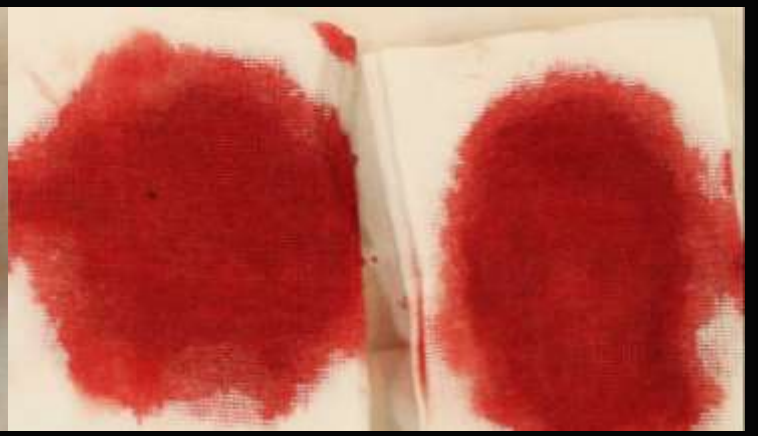
- **Occlusion duration**

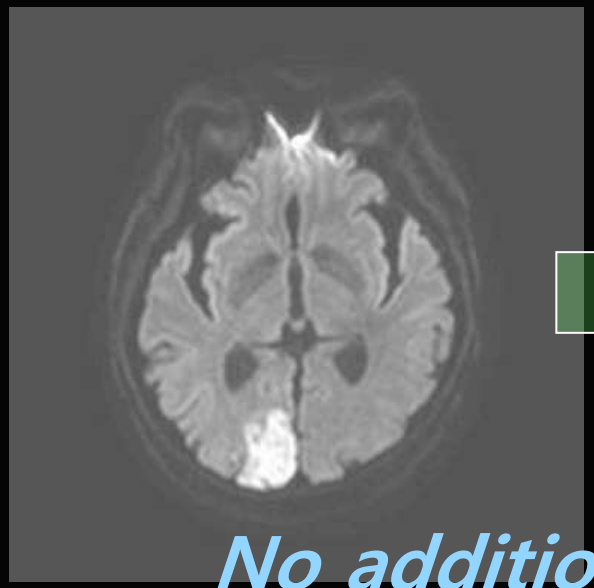
  - 6 min 30 sec

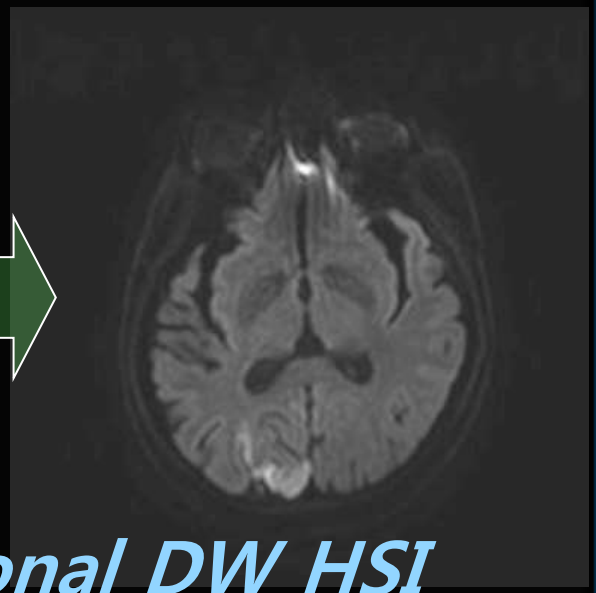
- **The pt. revealed motor weakness and fell into stuporous mentality.**
- **Attending neurologist was very anxious.**

4th case – Symptomatic 76 YO man









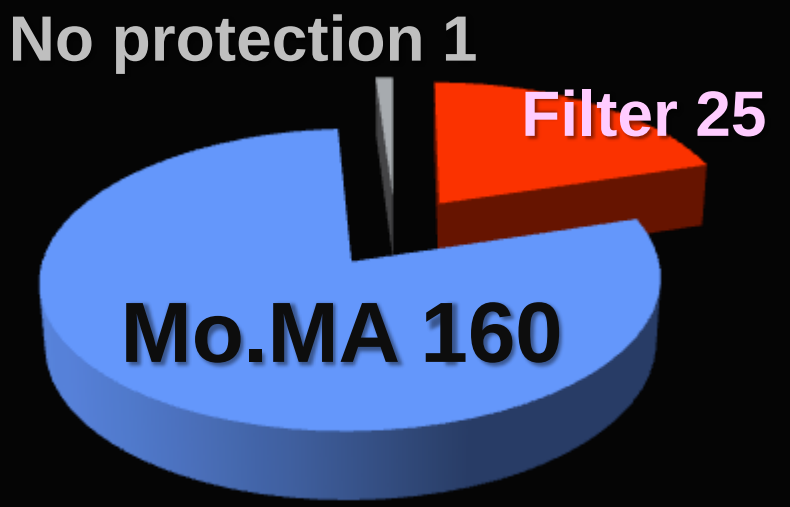
No additional DW HSI

My Protection After Mo.MA

Filter Era

July 2012

After Mo.MA Available

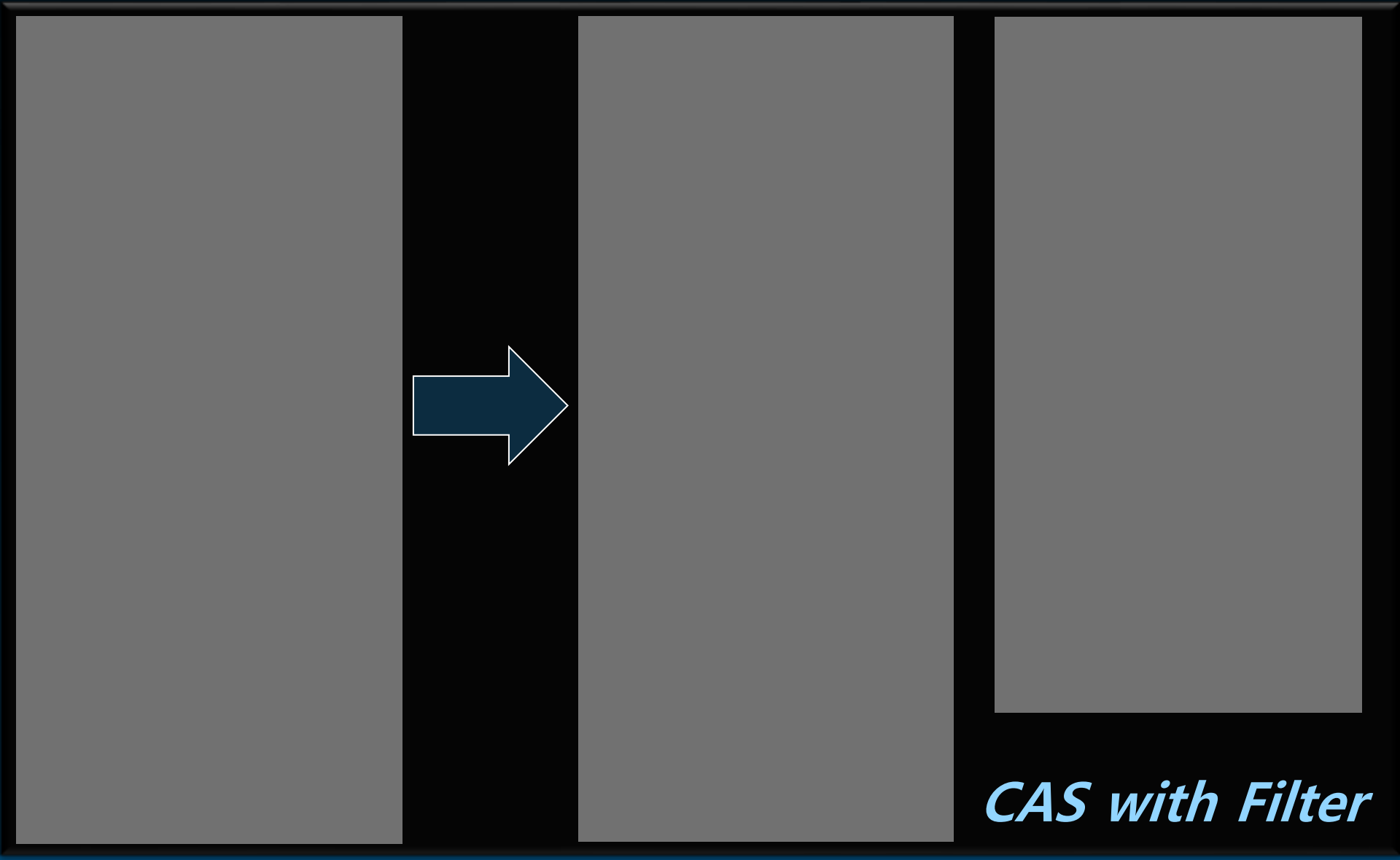


Thrombi Containing Lesions

Right carotid angiogram

Filter Era, Case 1

Warfarinization for 6 weeks



CAS with Filter

Case 2

58 years old man

HT, Smoker

Recurrent right weakness

for 10 days

Visible thrombi in left ICA

Filter Era, Case 2

Warfarinization for 6 weeks

Dissolved initial thrombi

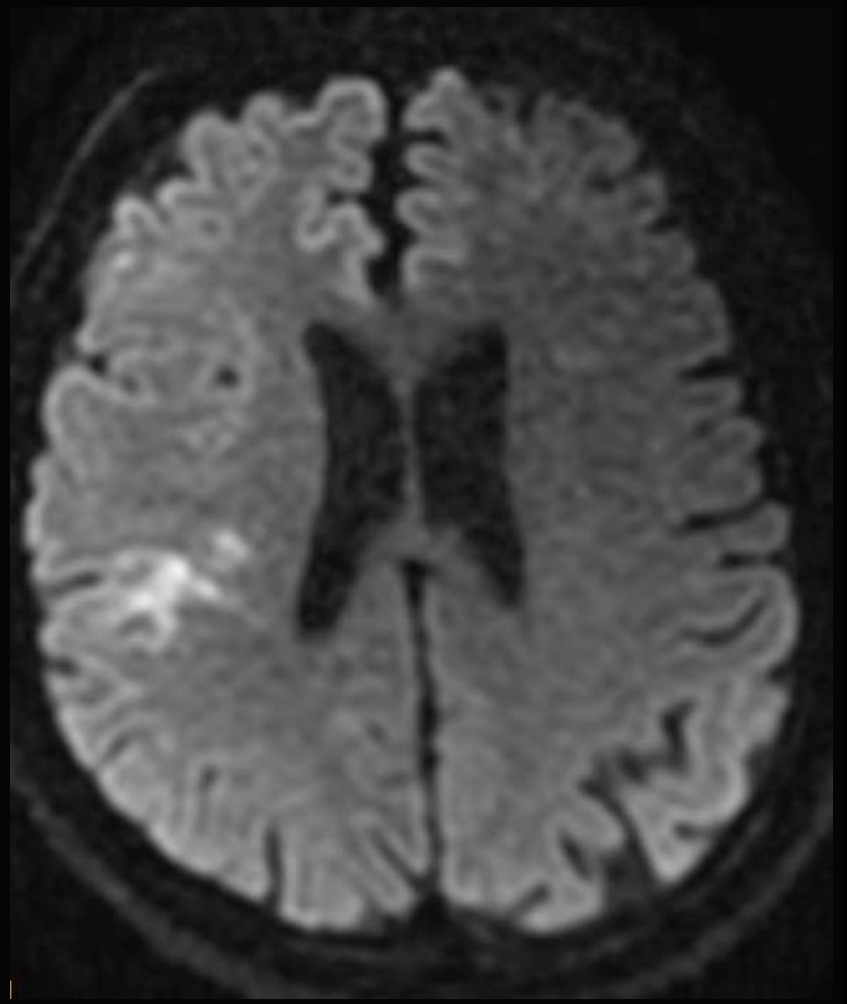
CAS with filter protection

Case 3

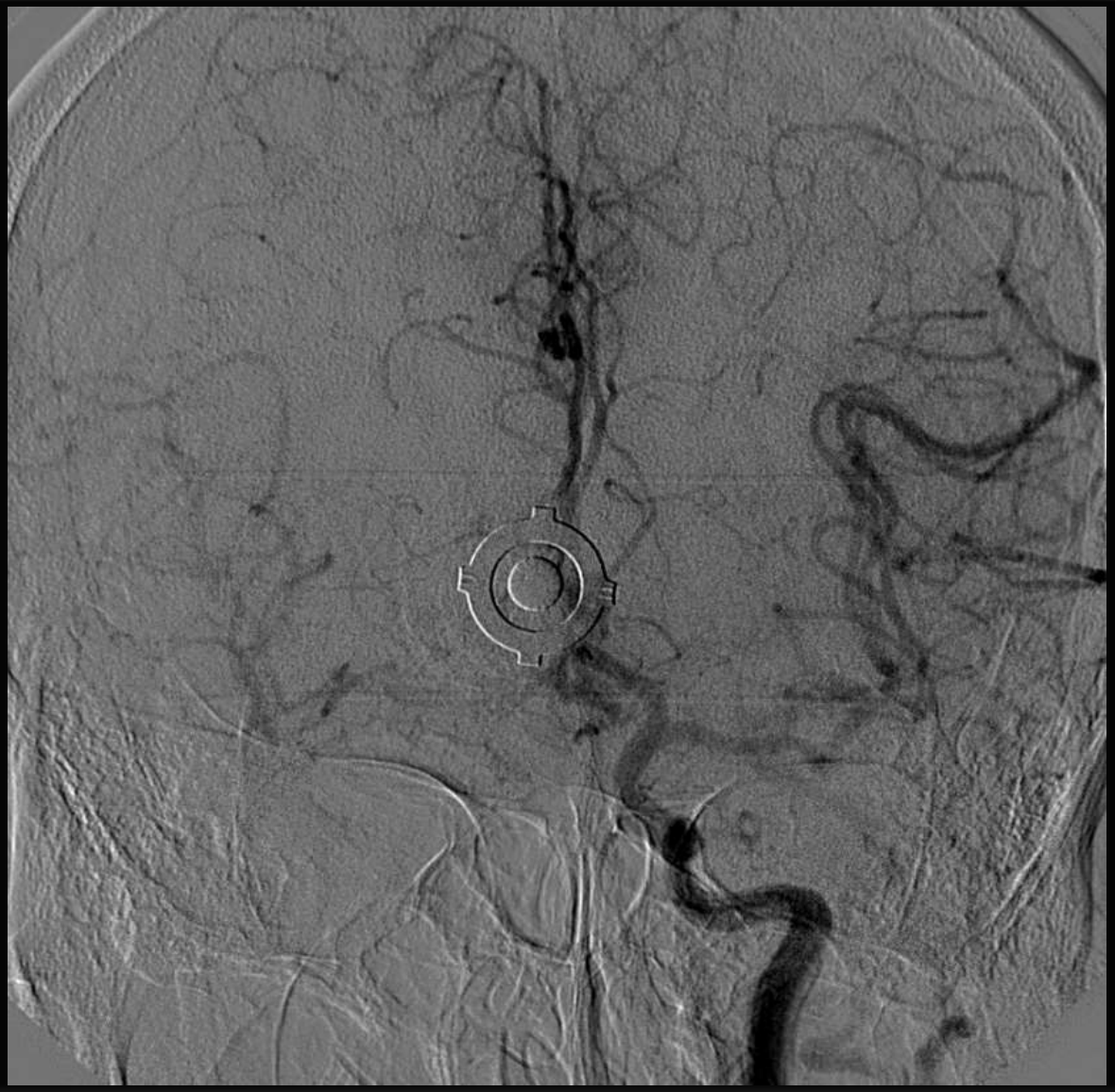
69 years old man

DM, Exsmoker

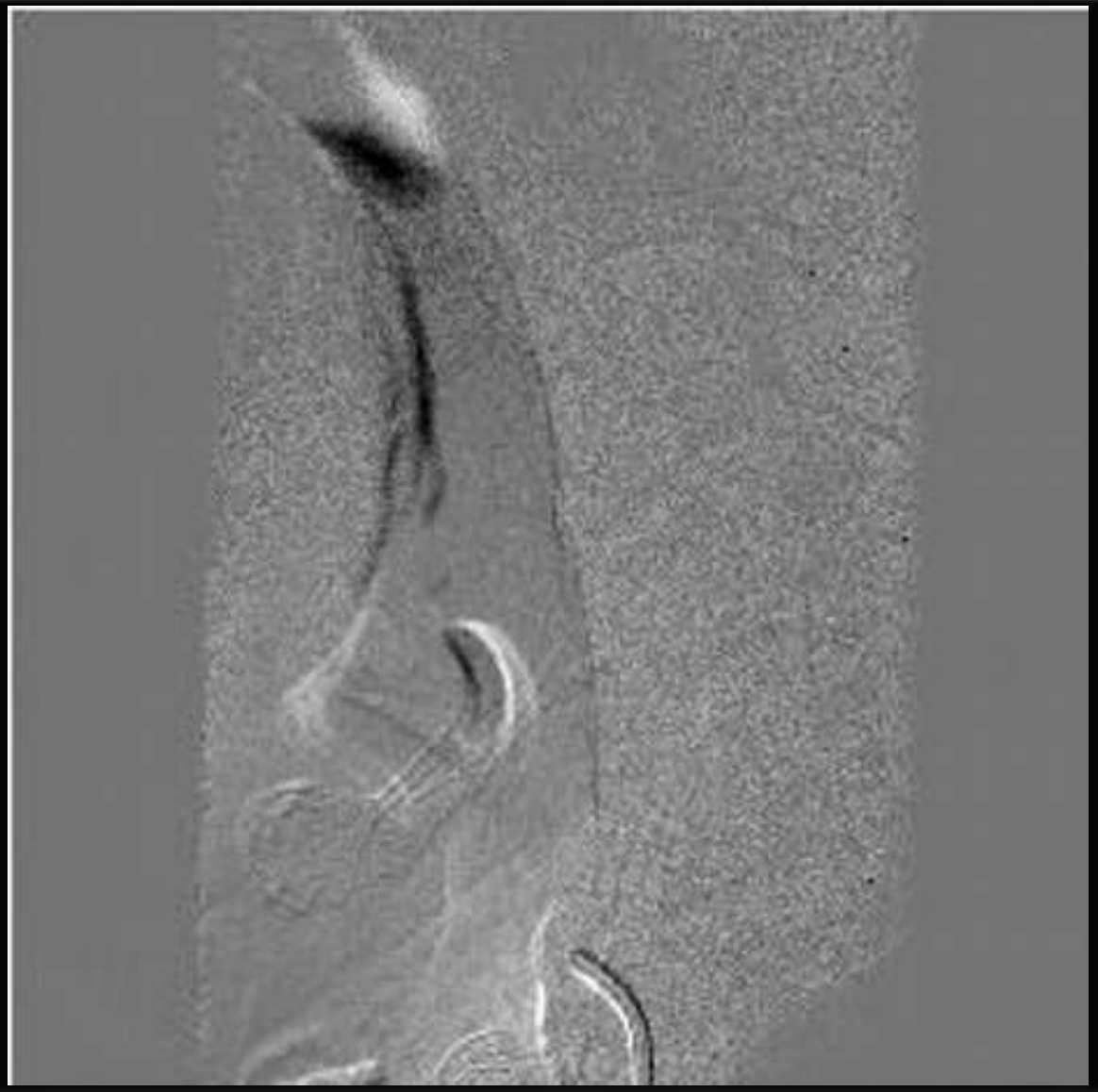
Dysarthria and falling tendency in the morning



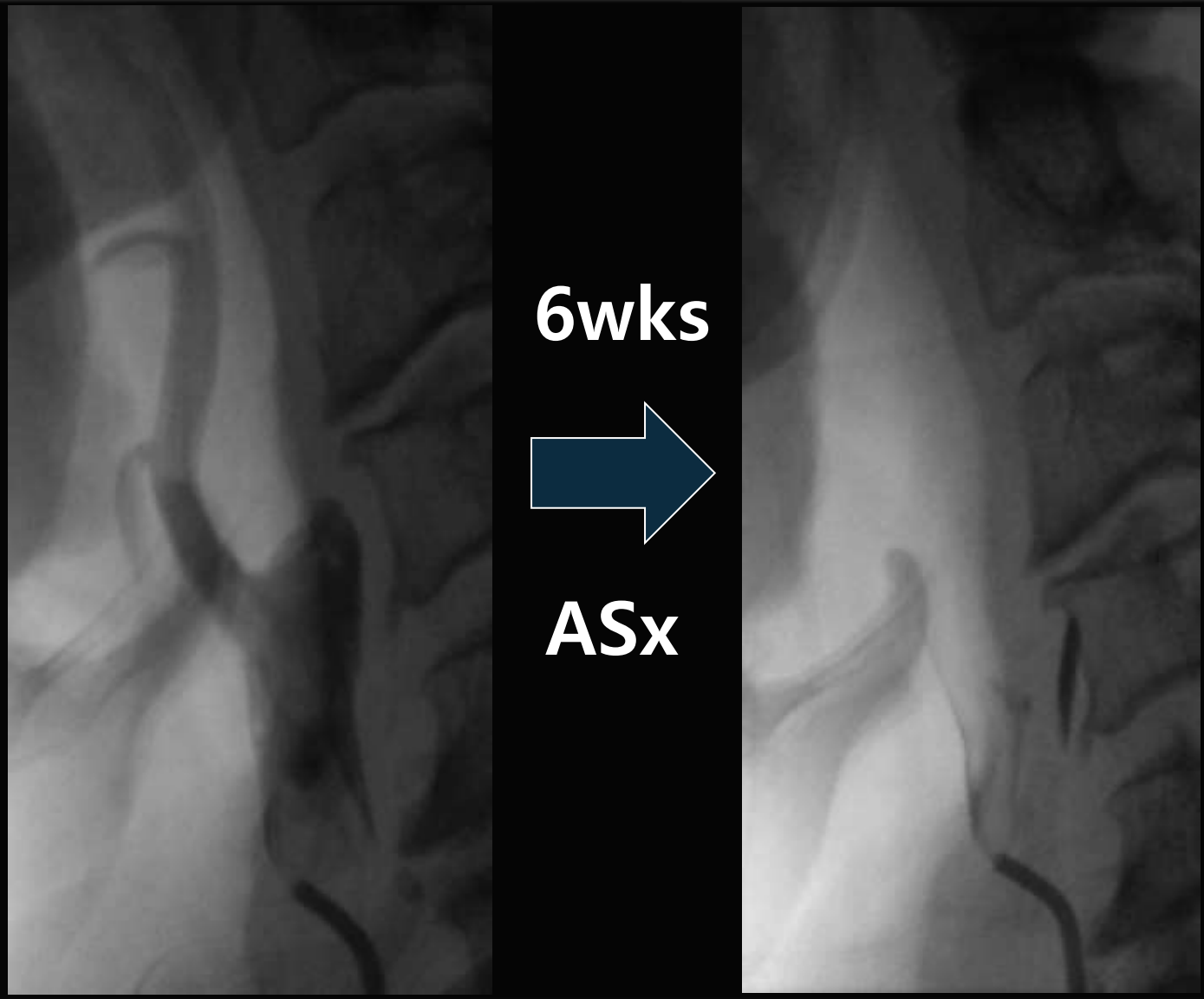
Left carotid angiogram



Right carotid angiogram



Warfarinization for 6 weeks



After MO.MA Available

since Jul. 2012

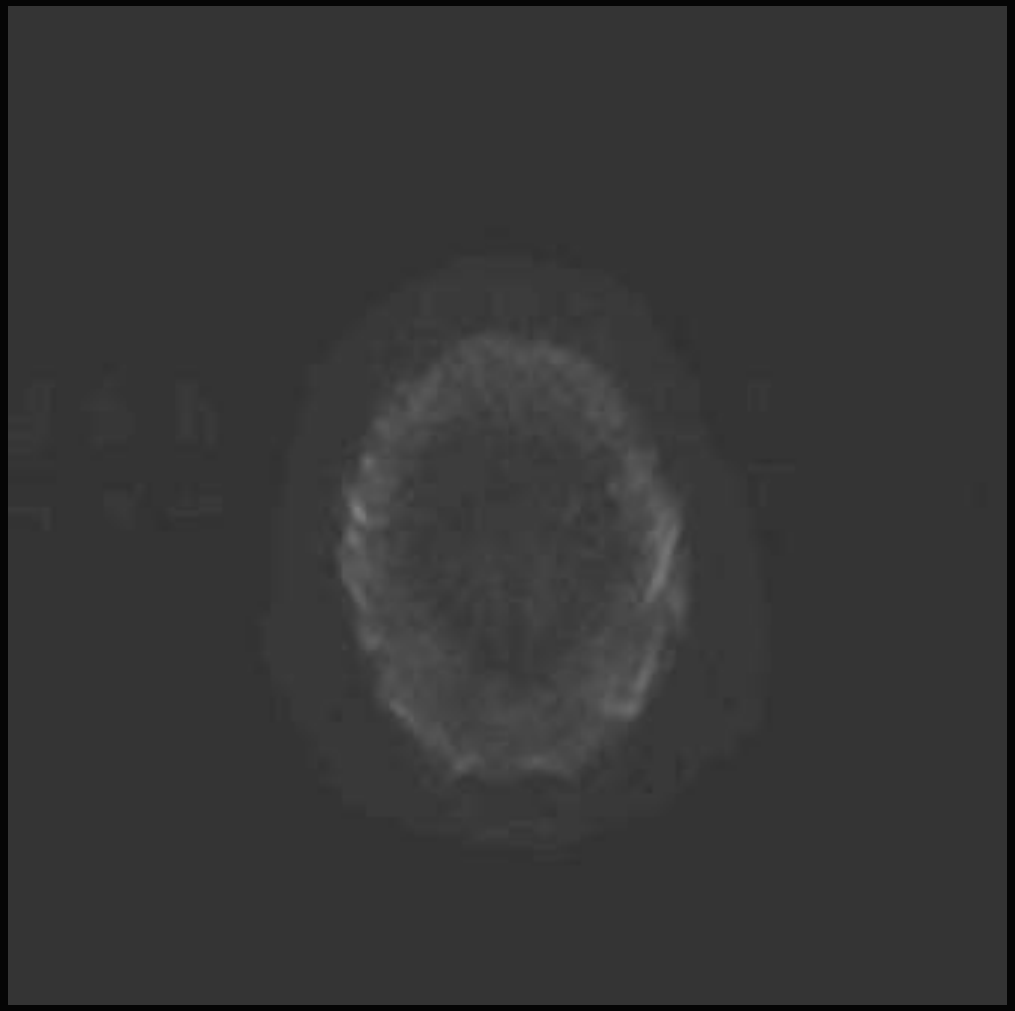
Case 4

73 years old man

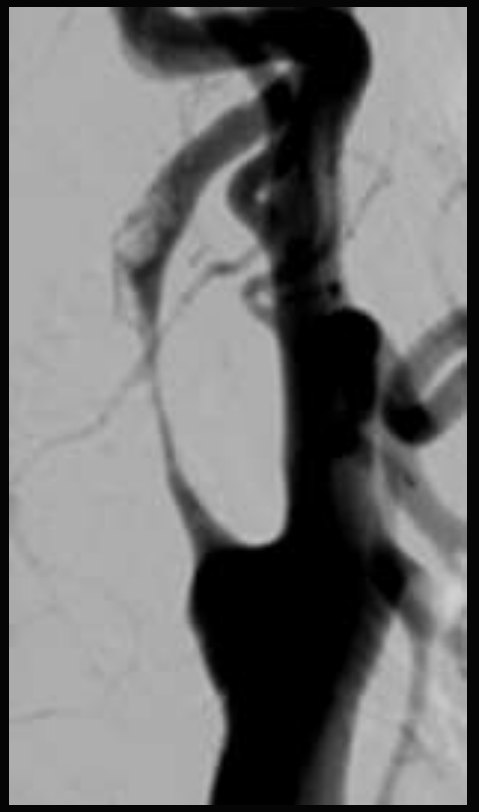
HT, Dyslipidemia

Right hemiparesis

and dysarthria

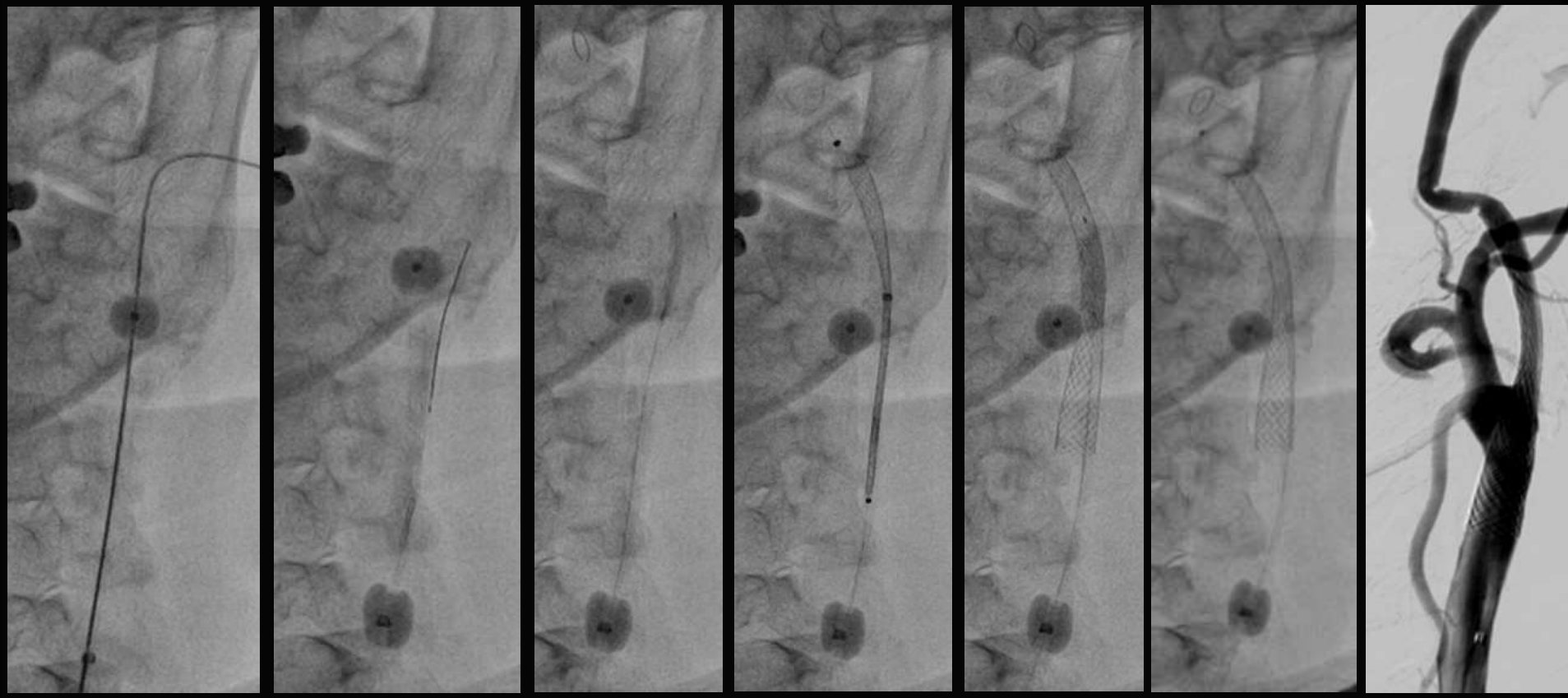


Left carotid angiogram in 7 days



Visible intraluminal thrombi

CAS with Dual Embolic Protection



MO.MA

Filterwire Passage

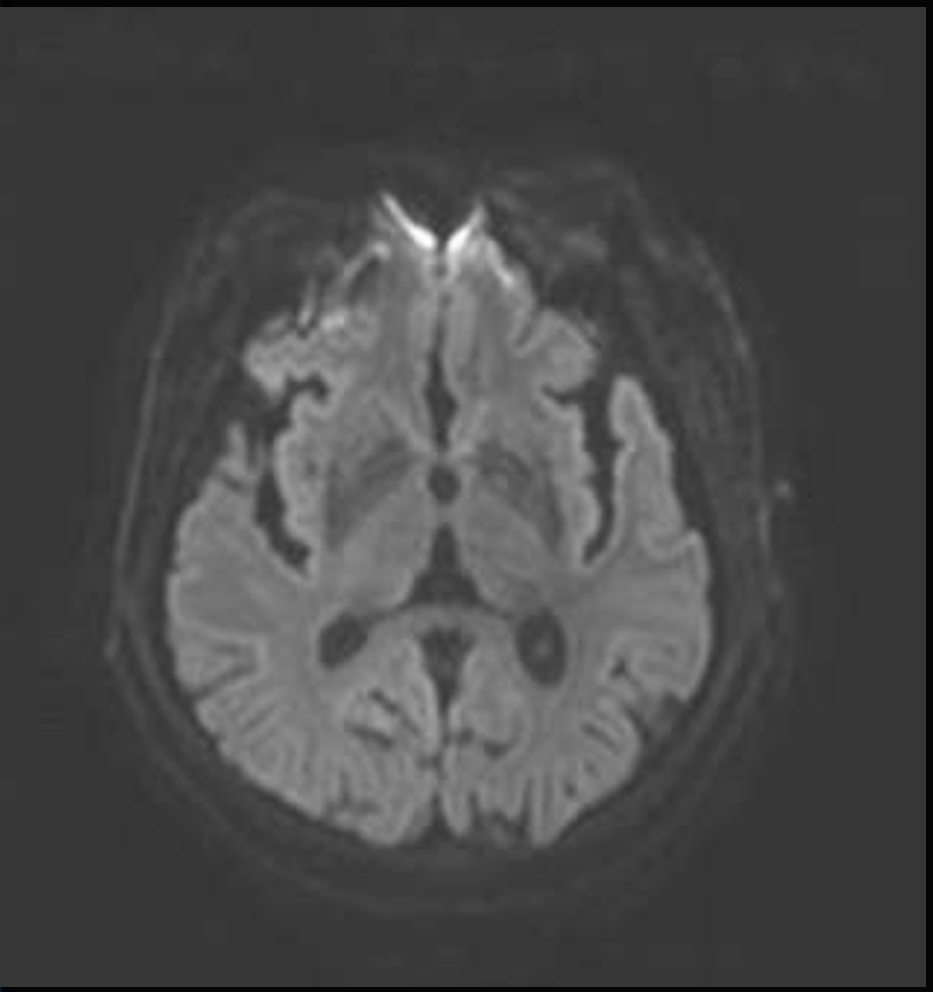
Predil

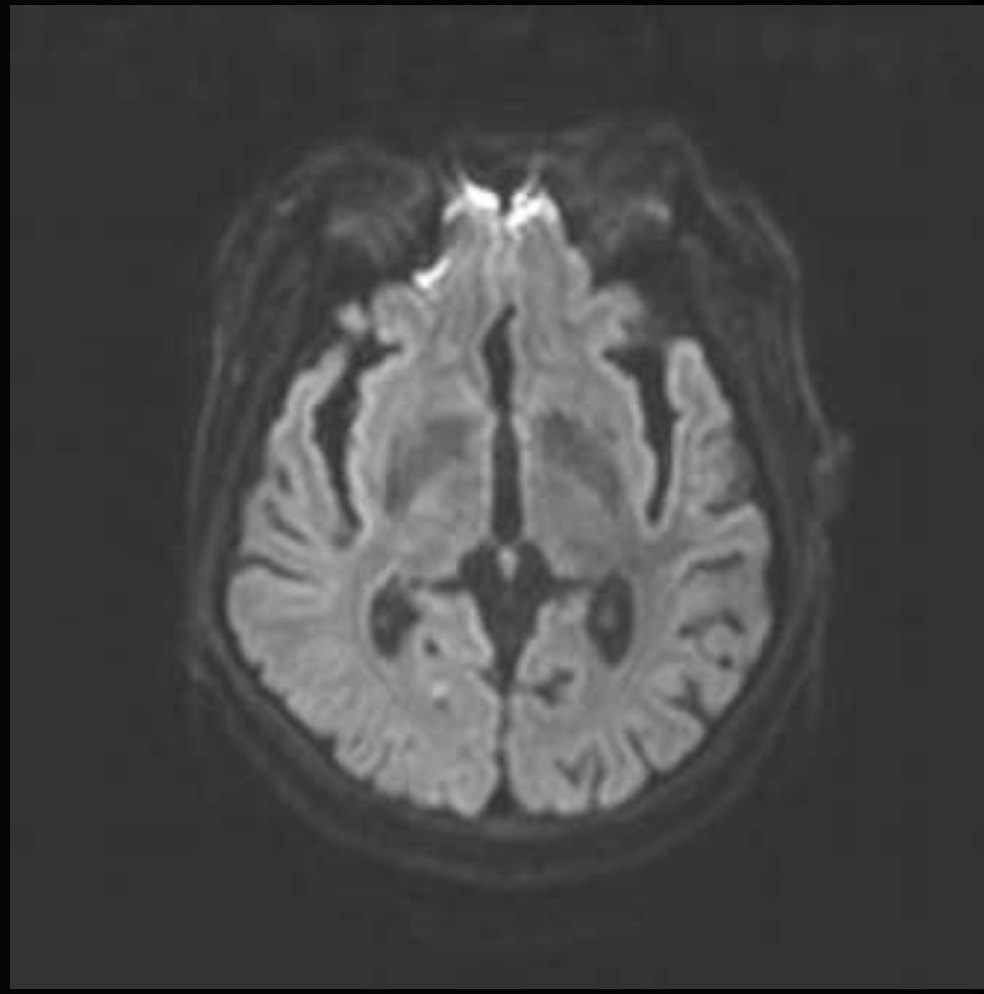
Wall stent

Postdil

1st Suction
Filter retrieval
2nd Suction

No New DW HSI after CAS





Case 5

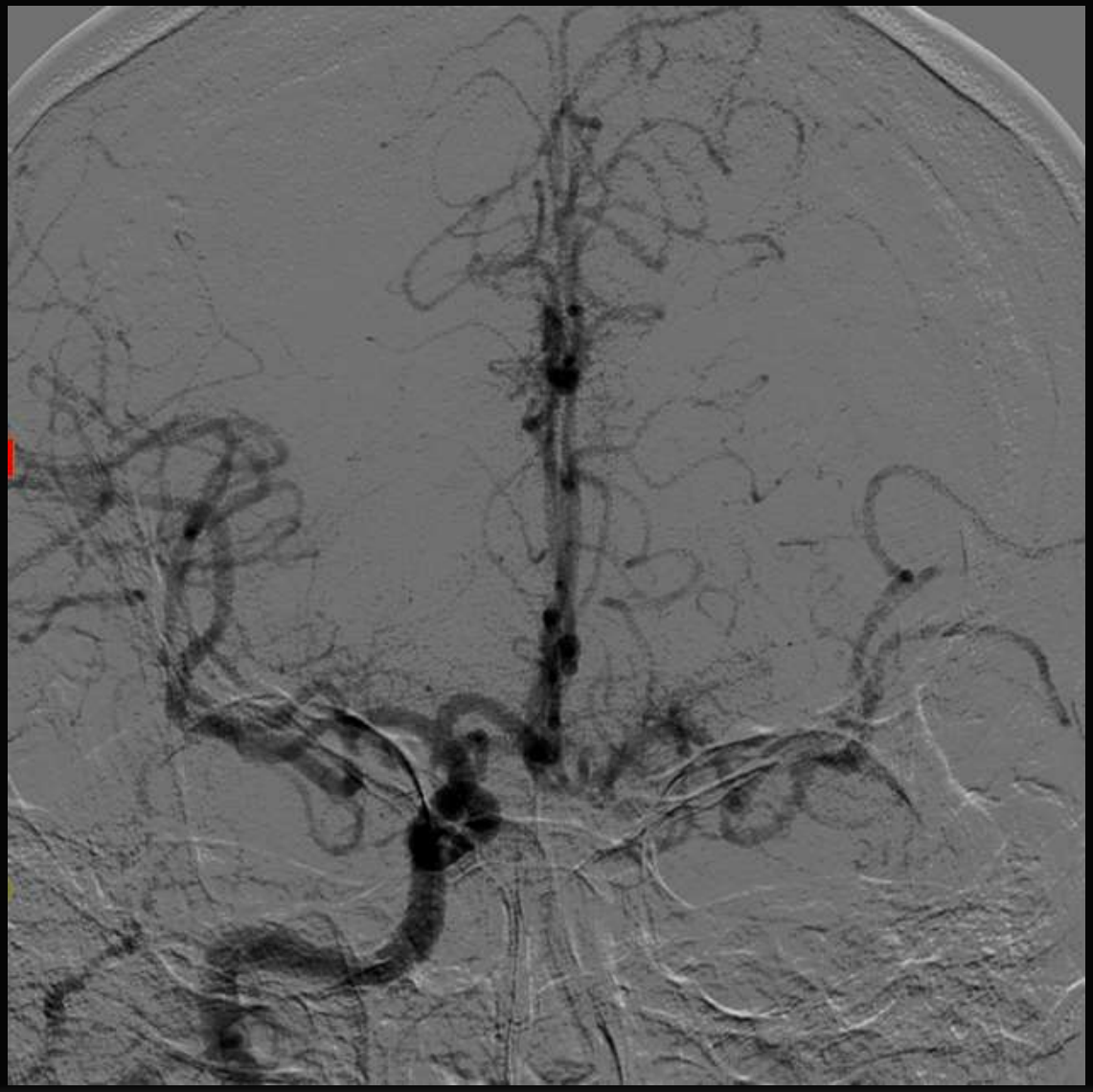
68 years old woman

DM, HT

Lacunar CI, 1YA

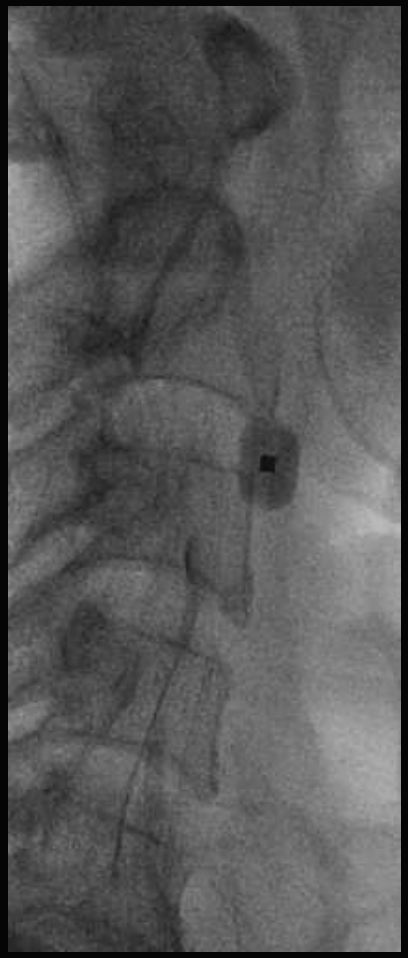
Acute onset dysarthria and hearing difficulty for 1 hour

Right carotid angiogram



Left carotid stenting in 2.5 hrs

Occluded left ICA



MO.MA

Difficult passage

Parallel wiring

Left carotid angiogram in 2.5 hrs

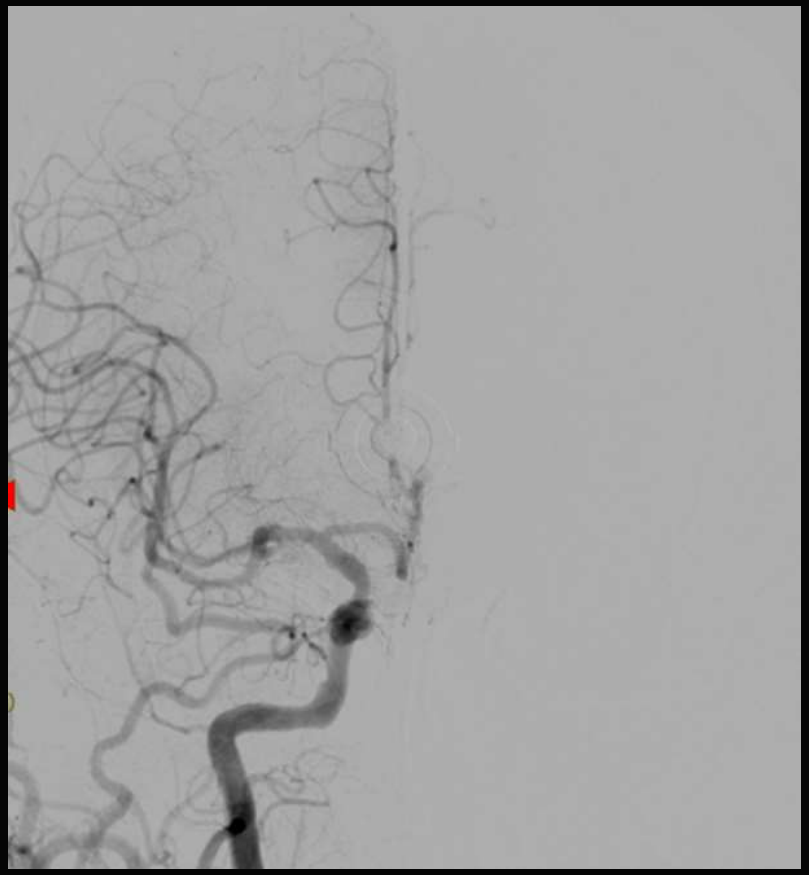
Predilation

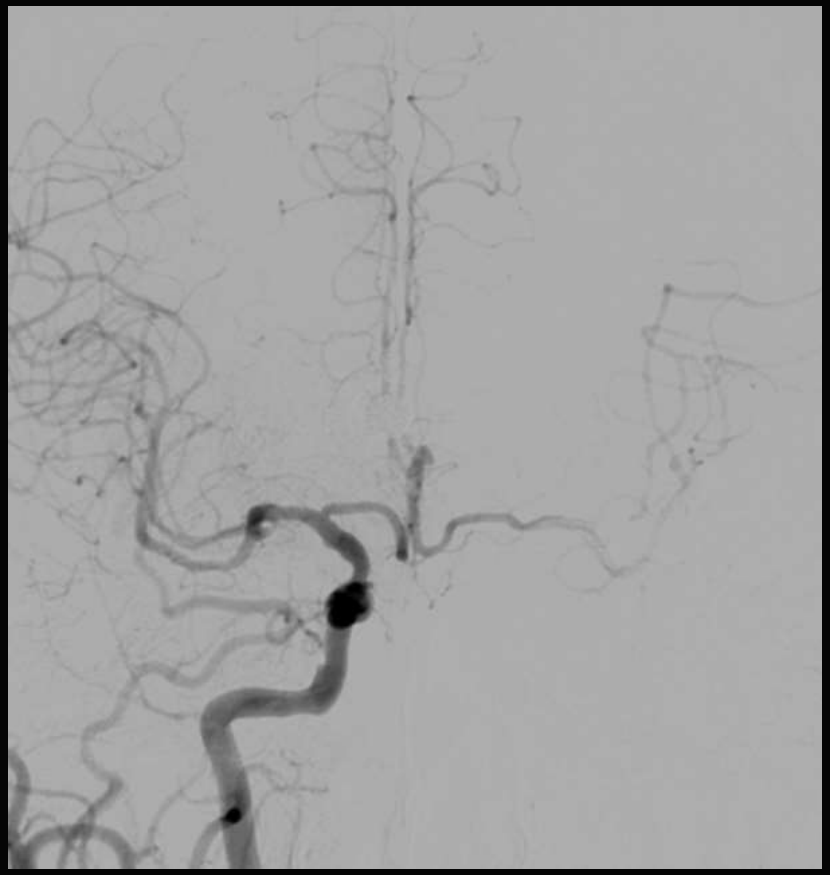
Suction
Stenting
Postdilation

Completely recovered
neurologic function

What I Have Learned In My MO.MA Experience

Simple Way To Check Patient Tolerability





Lesion site CCA compression

→ assess A-com connection

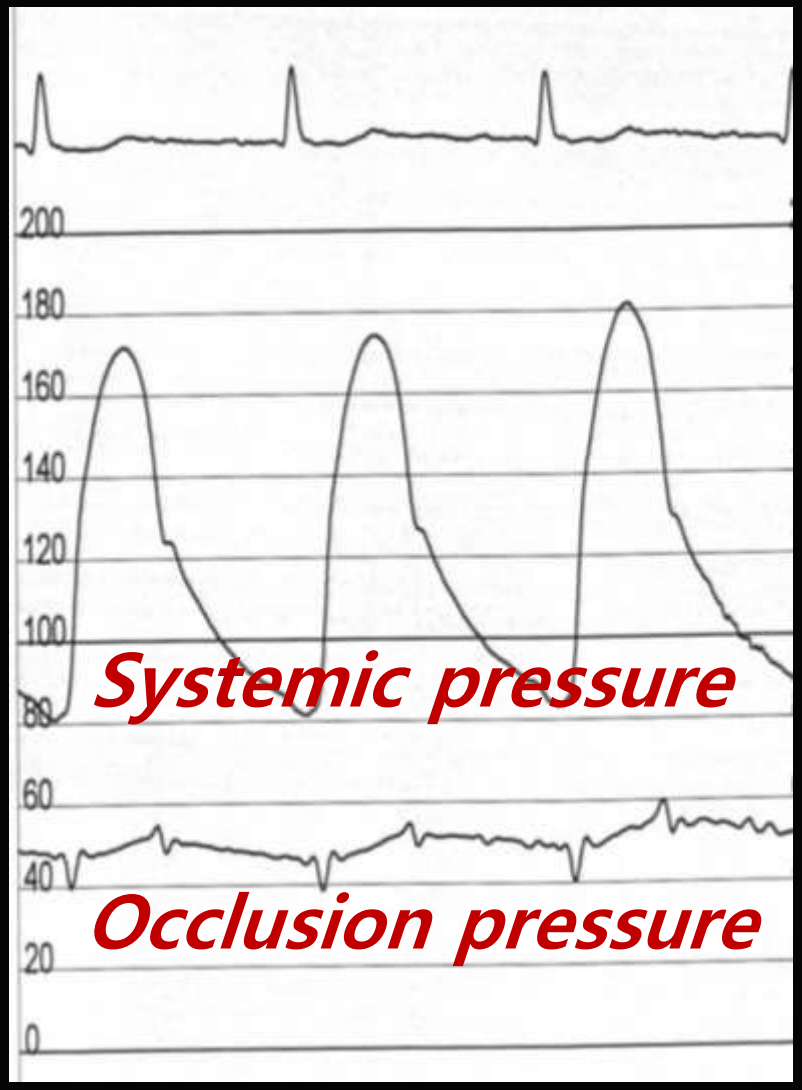
Simple Way To Reduce Clamping Time

After ECA occlusion,
Before CCA occlusion,

Touch proximal entry of lesion with a floppy tip of the 0.014" GW.
Reshape GW tip if needed

Predilation balloon is ready before GW insertion

9 Fr Long Femoral Sheath for 9 Fr MO.MA



- Less femoral artery damage
- Less MO.MA tip and shaft damage
- Overcome iliac tortuosity

- Dual pressure monitoring (systemic and CCA)

Intermittent drainage of CCA blood during proximal protection

- **Disadvantage**

  - Blood will be stolen from the Circle of Willis

  → potential intolerance

  - Blood loss

- **Advantage**

  - Prevent thrombi migration to brain

Various Situation

Tortuous proximal anatomy

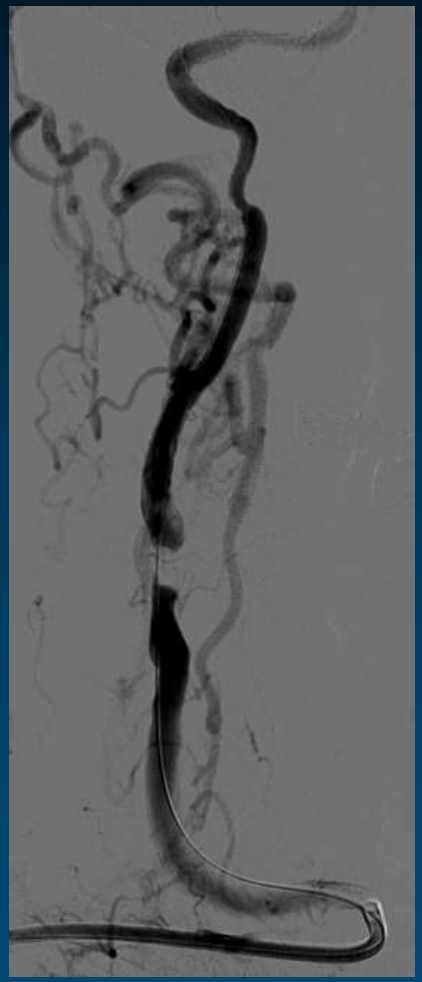
Slippage to the ascending aorta

Tortuous proximal anatomy with ECA occlusion

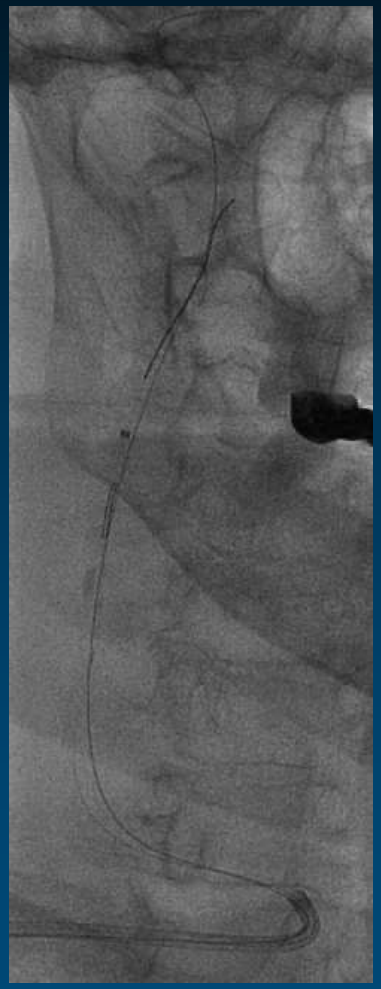
Impossible ECA engagement

Tortuous proximal anatomy with ECA occlusion

Transradial
7 Fr IMA



Buddywire



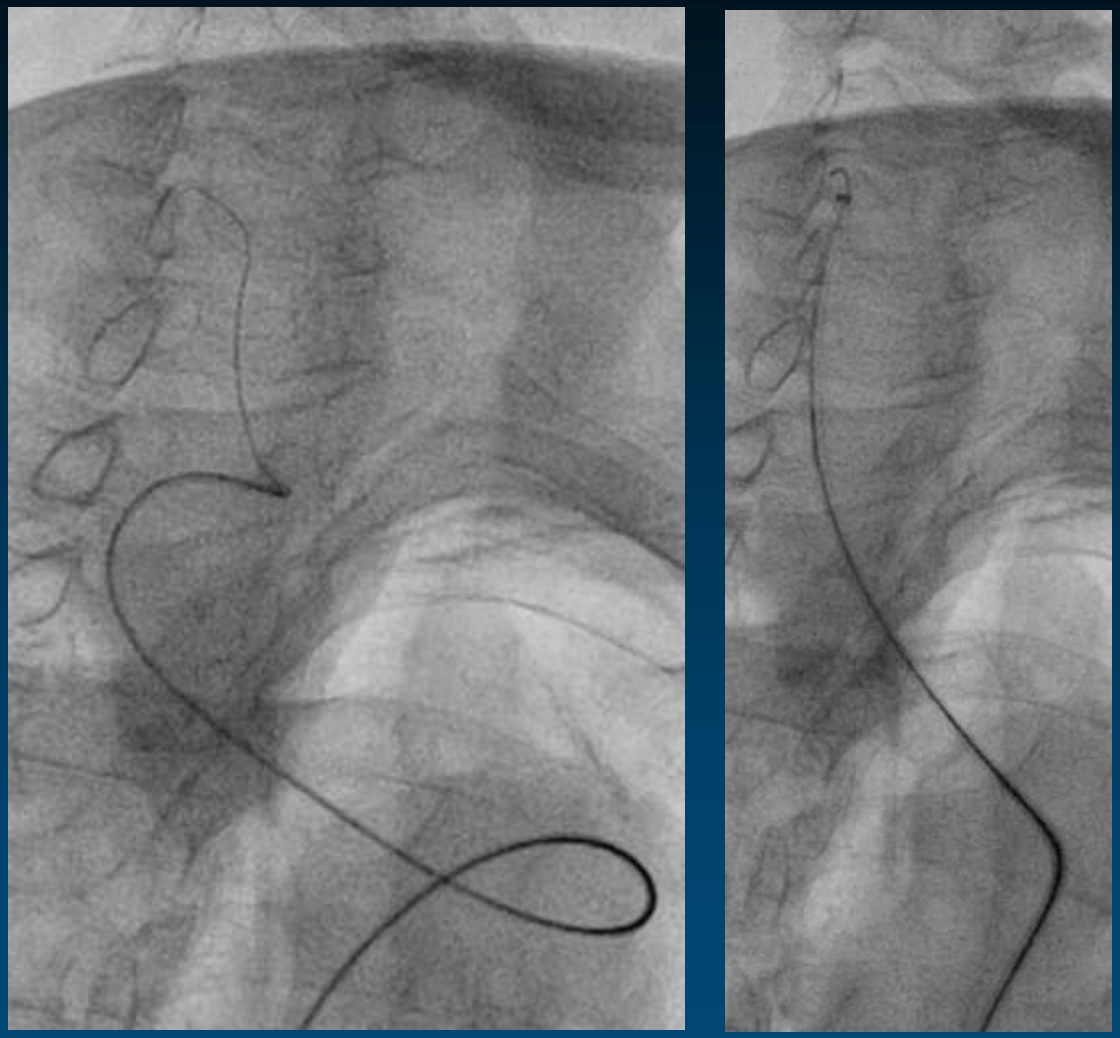
Filtering

Stenting

Tortuous filter landing zone

Buddy wire for filter passage

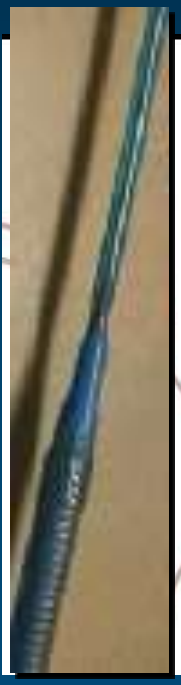
Severe proximal tortuosity

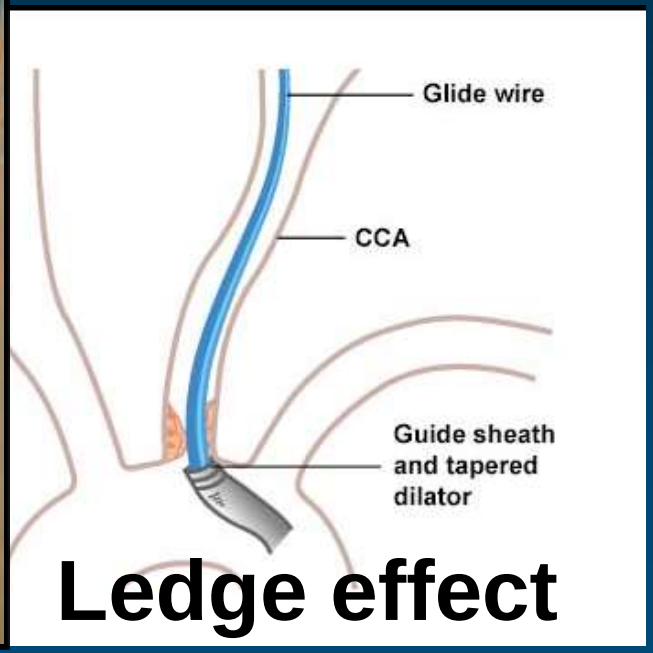


6 Fr Shuttle sheath with Filter

CCA ostial stenosis

Left proximal ICA stenosis
Left CCA ostial stenosis

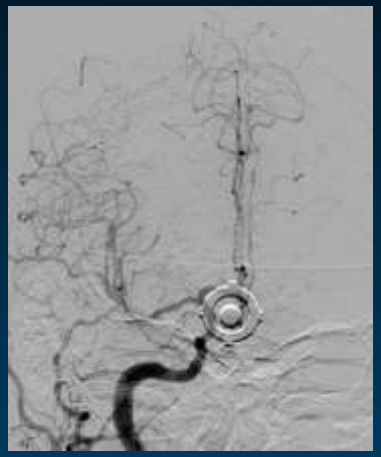


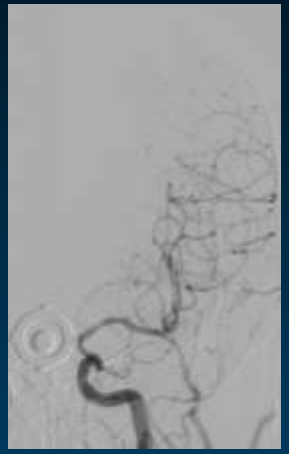


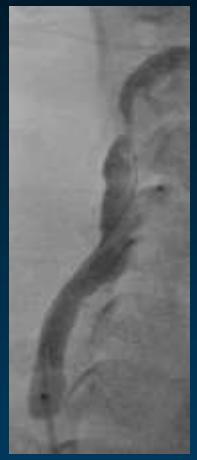
Ledge effect

Severe Mo.MA Intolerance

Poor left ACA-MCA connection





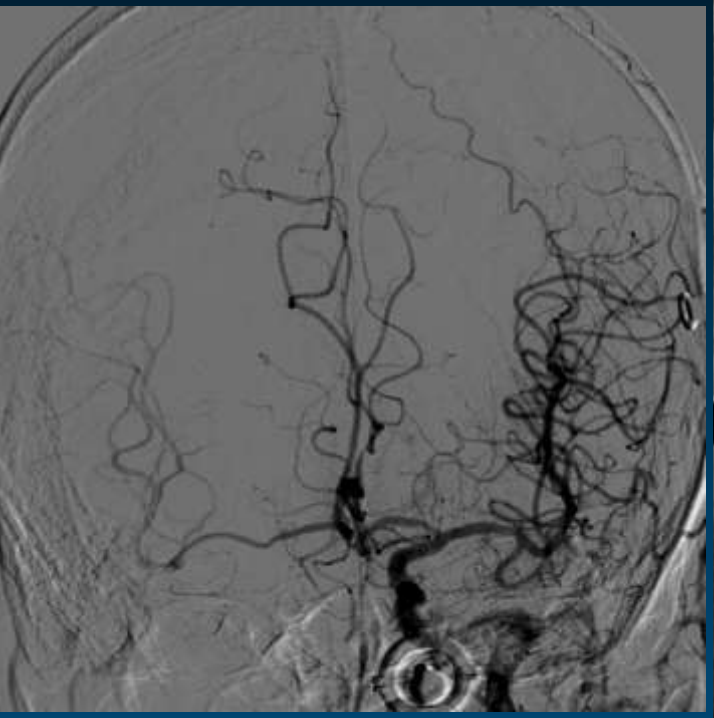


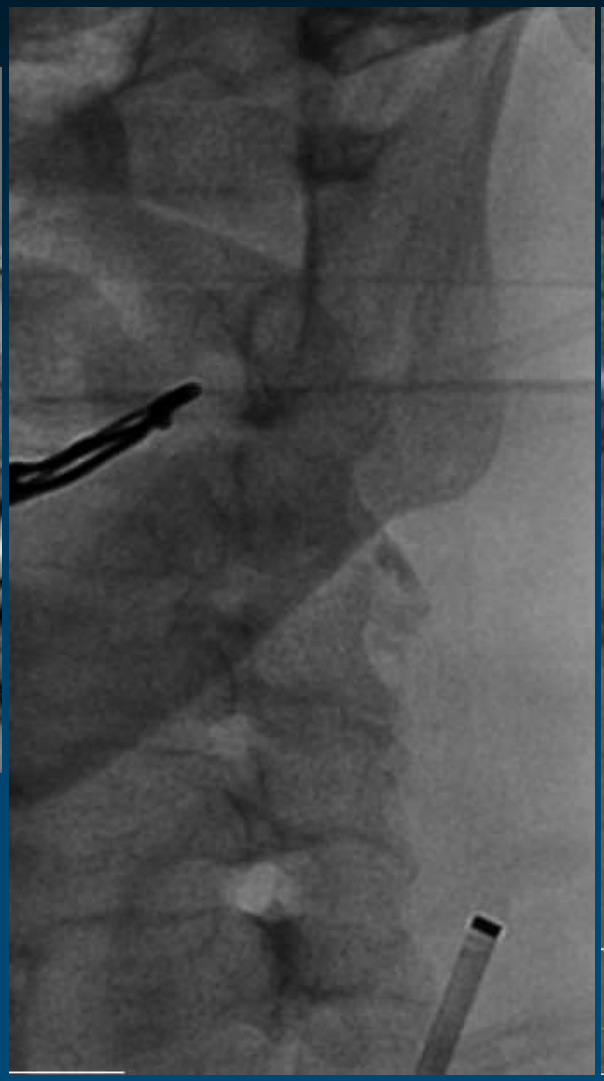
Filter protection

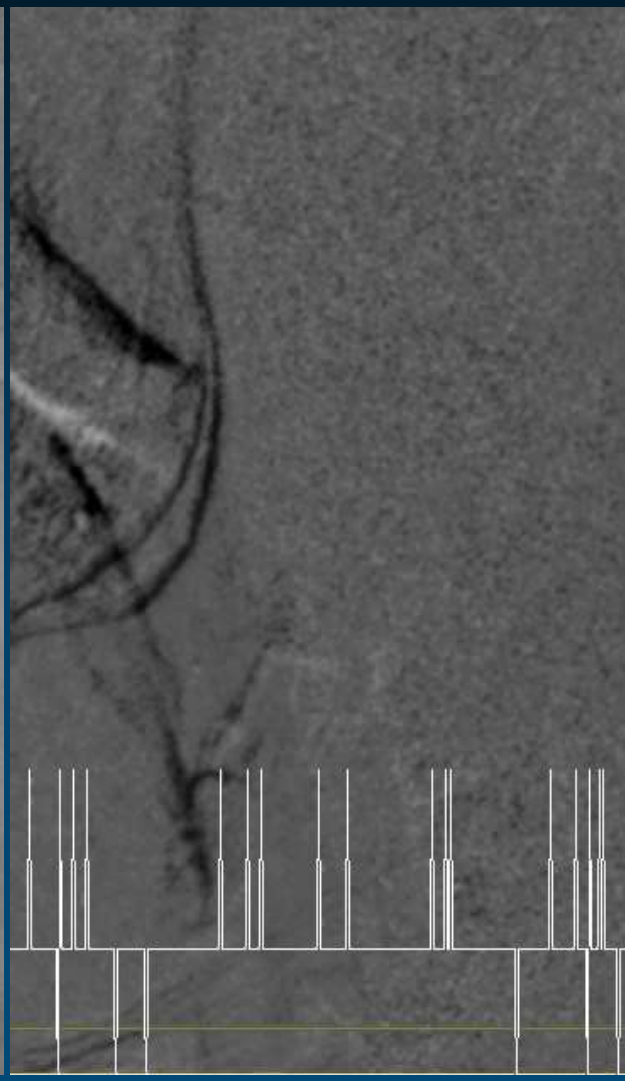
w/o CCA blockage

DPD landing zone tortuosity

Uncooperative patient with continuous movement
Contralateral occlusion / Fliter landing zone tortuosity



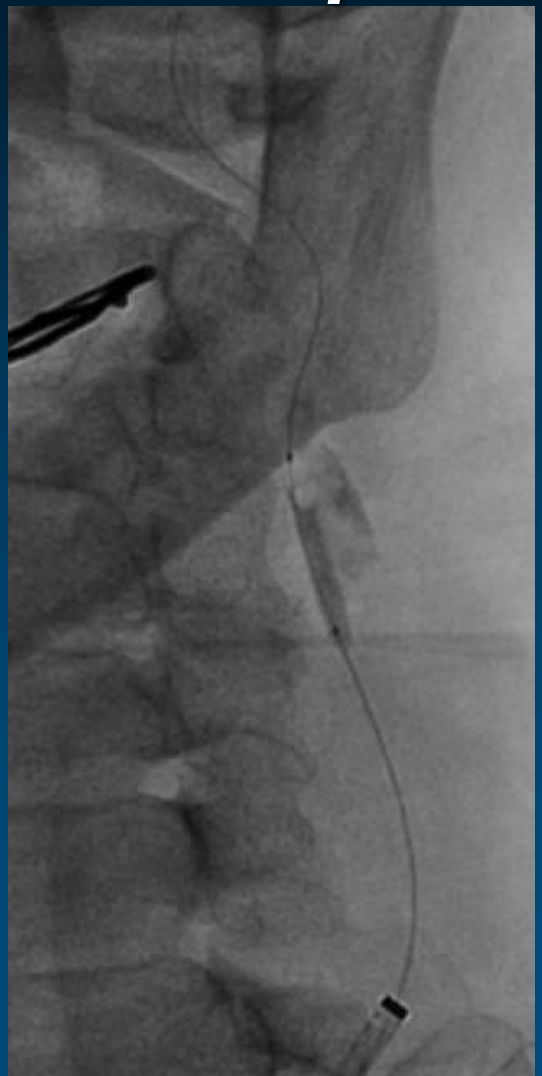


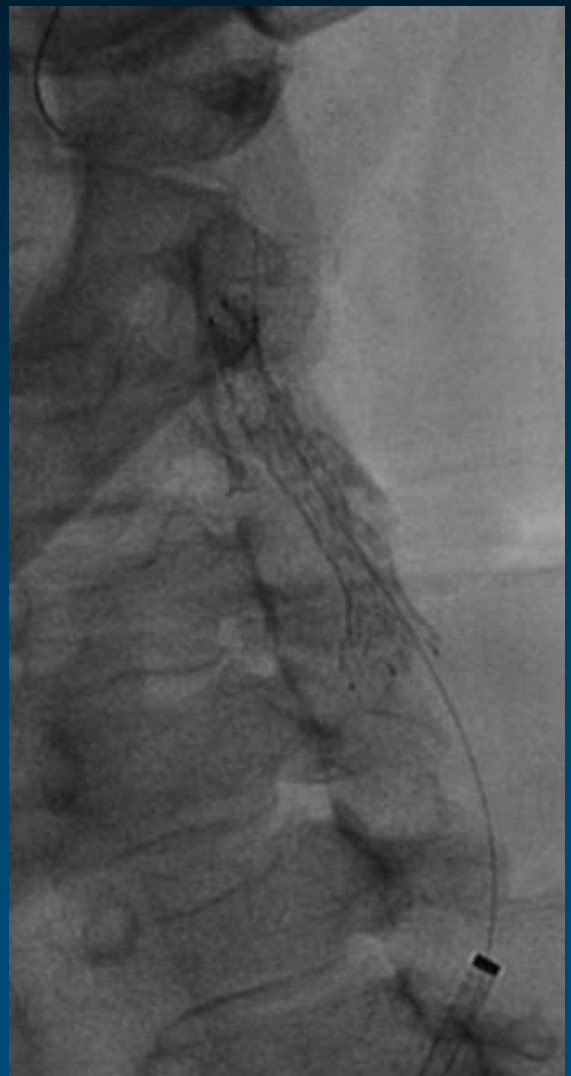


DPD landing zone tortuosity

Uncooperative patient with continuous movement

Unprotected stenting without DPD



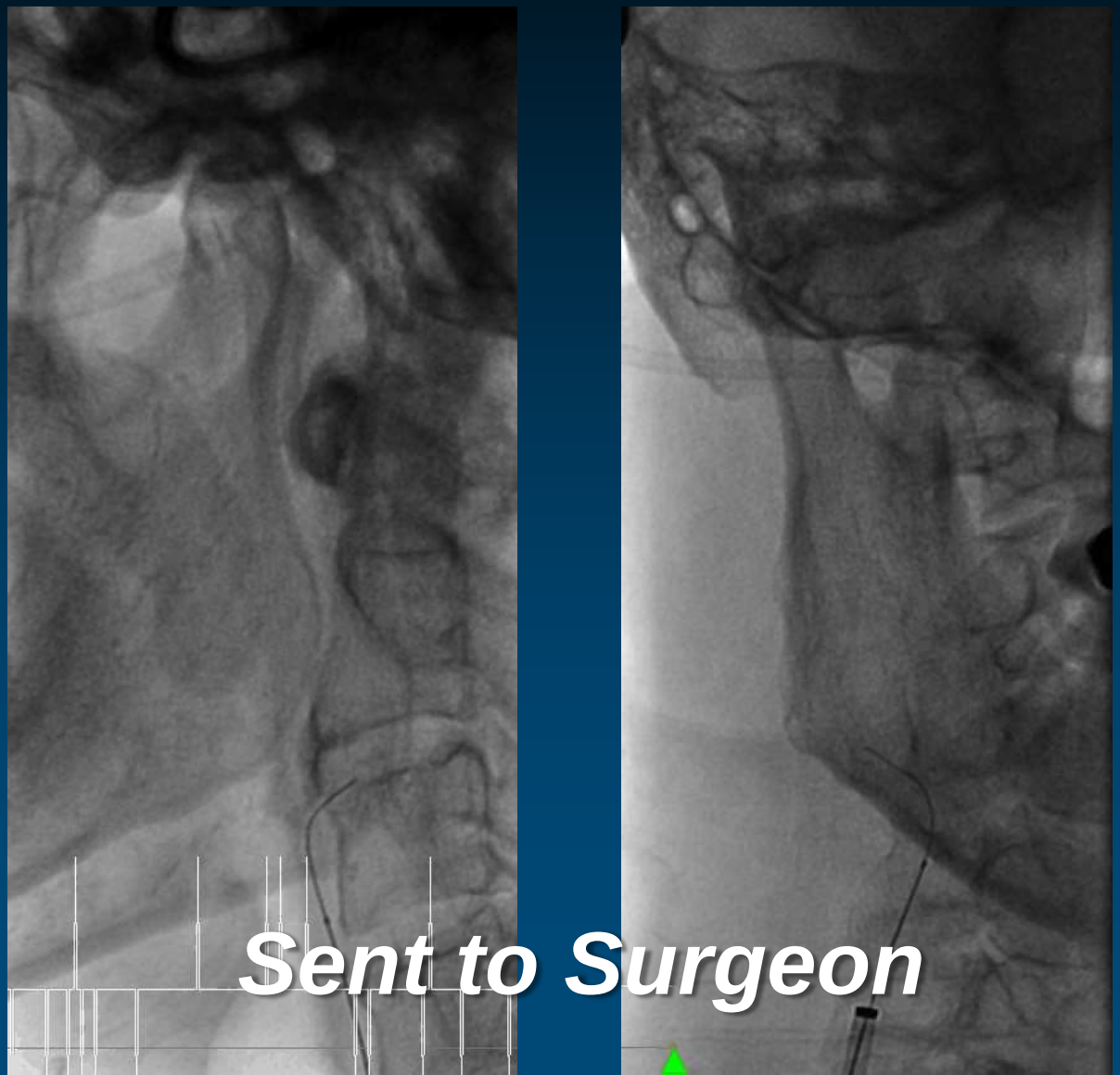


Symptomatic ICA Severe Stenosis

Proximal vs. Distal Protection?

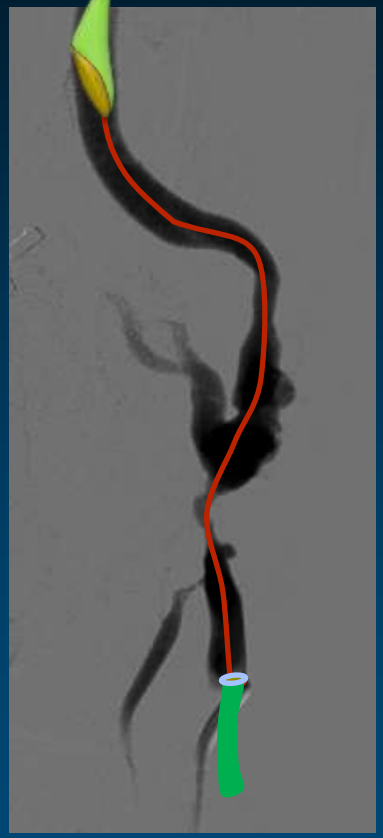
Symptomatic ICA Stenosis

Difficult Wire Passage



Sent to Surgeon

Various ECA Access Difficulties

ISR lesion	CCA disease	ECA ostial stenosis	ECA occlusion
			
Filter	Filter	Filter	Filter or Mono Mo.MA

Conclusion

Selection of Protection Devices

- ***Proximal Protection***
  - **Feasible in almost all CAS patients.**
  - **Clamping intolerance is transient and overcame easily.**
  - **Better for symptomatic near-total occlusion or intraluminal thrombi containing lesions**
  - **ICA tortuosity doesn’t matter**

My default strategy for standard CAS

Conclusion

Selection of Protection Devices

- ***Distal Protection***
  - **More familiar, More data**
  - **Contrast usage**
    - **→ better for difficult GW passage**
  - **Better for contralateral occlusion / poor collateral**
  - **Better for significant CCA or ECA stenosis**
  - **Less manipulation of aortic arch**
  - **Access from radial artery**

Should know how to use


infolive
Thanks for Your Attention
TROPHY
DETECTS, TRACKS AND CLASSIFIES