

# Innovation in Carotid Revascularization

By Joshua N. Hernandez, MD

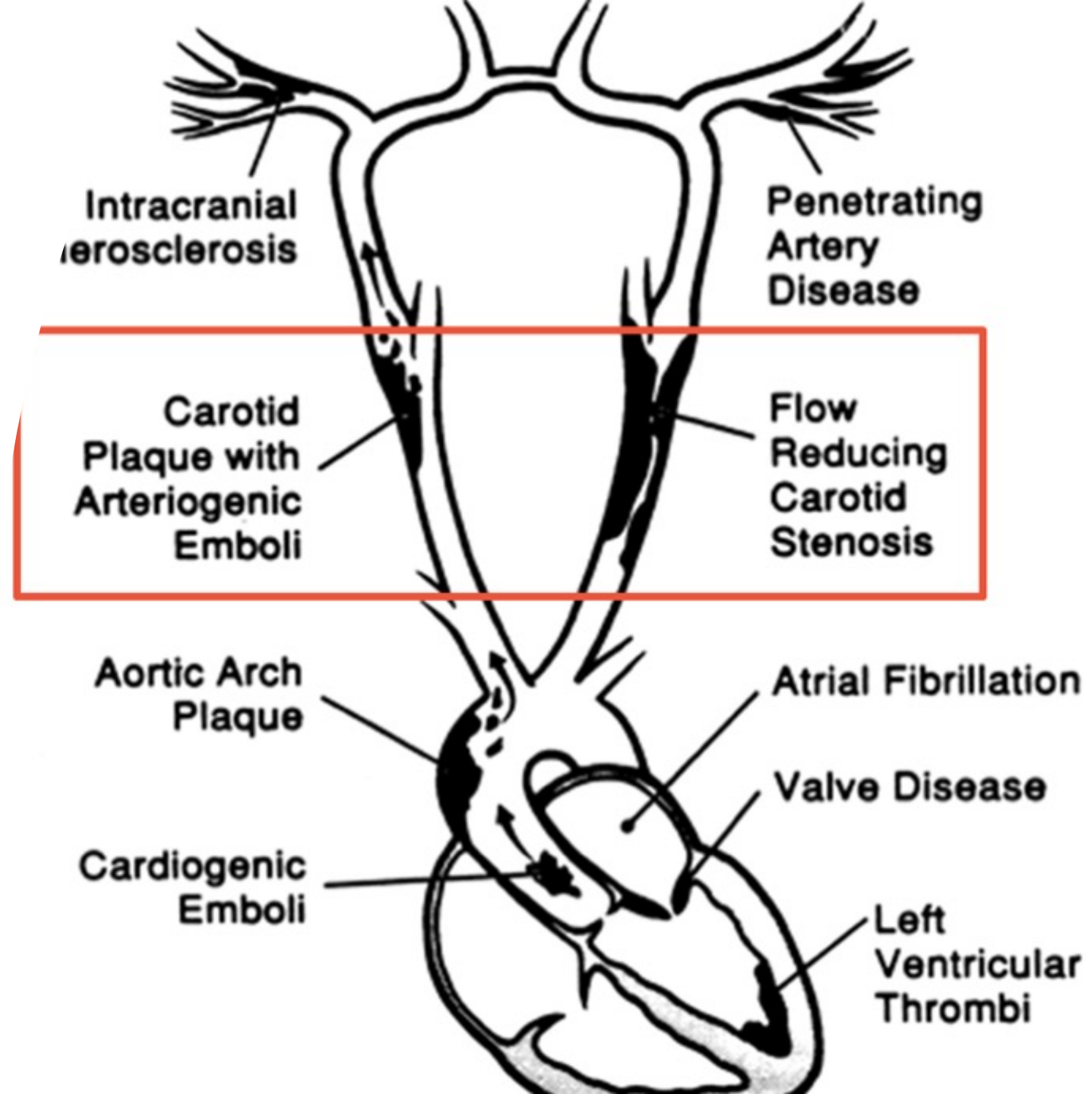
Department of Vascular Surgery

Fairfield Medical Center

# Carotid Artery Stenosis

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- Nearly 800,000 people in the US have a CVA every year; 3 of 4 are 1<sup>st</sup> time CVA.
- 85% ischemic
  - Up to 52% from carotid
- 50% preceded by TIA
- 15-33% are fatal



# Optimal Medical Therapy

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- Goal is to prevent CVA & stabilize plaque.
- Addressing modifiable risk factors.
- Antiplatelet, statin, antihypertensives, glycemic control.
- DAPT/AC?



HIGH BLOOD  
PRESSURE



HIGH  
CHOLESTEROL



OBESITY



DIABETES



OLDER  
AGE



HISTORY OF  
SMOKING



LACK OF PHYSICAL  
ACTIVITY



CLOGGED  
ARTERIES



# Diagnosis: Clinical

## **Bruit**

- Less than 1/3 hemodynamically significant
  - Good predictors of overall atherosclerotic risk
- 

## **Symptoms**

- Unilateral Weakness (crossed)
  - Unilateral Numbness (crossed)
  - Amaurosis Fugax (transient monocular blindness) (ipsilateral)
  - Expressive aphasia (left hemispheric)
  - Receptive aphasia (left hemispheric)
- 

## **USUALLY NOT**

- Dizziness, Loss of consciousness, Seizures, Bilateral weakness
- Drop attacks, Syncope

# Carotid Screening Options



**DUPLEX  
ULTRASOUND**



**CT  
ANGIOGRAM**



**CAROTID  
BRUIT**

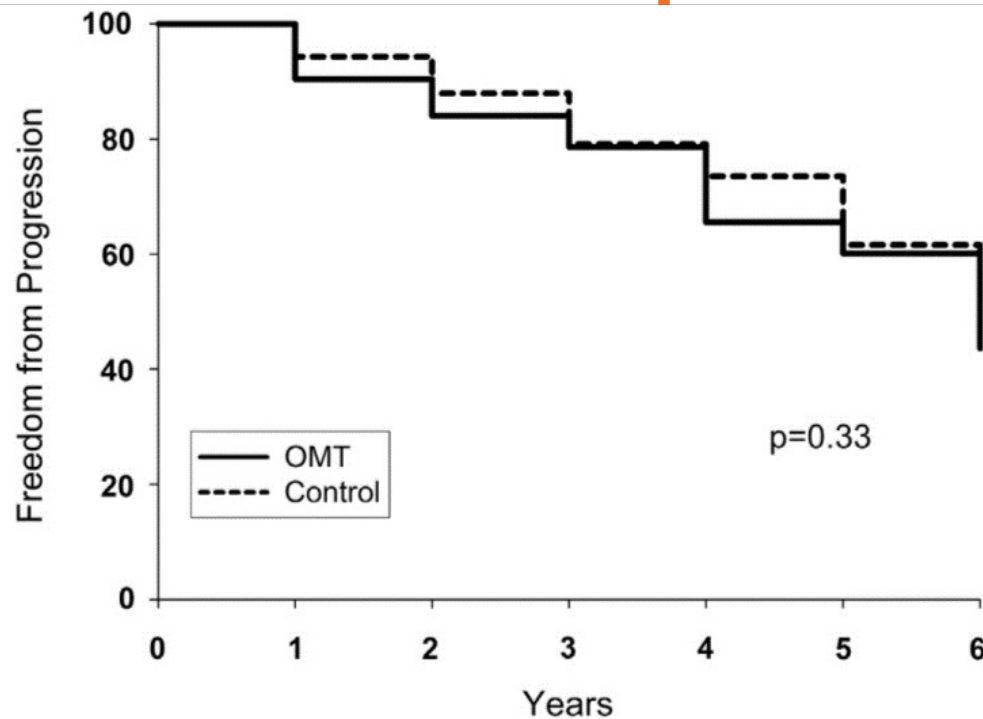
# SVS 2021 Screening Guidelines

- Recommend against routine screening for clinically asymptomatic CAS.
- Patients who are at increased risk of CAS, especially if they are willing to consider carotid intervention, include patient with:
  - PAD, DM, HTN, CAD
  - Undergoing CABG
  - >55yo w/2+ traditional atherosclerotic risk factors
  - >55yo active cigarette smokers
  - Clinically occult CVA on imaging
- Recommend CDU over CTA, MRA, or other imaging modality.

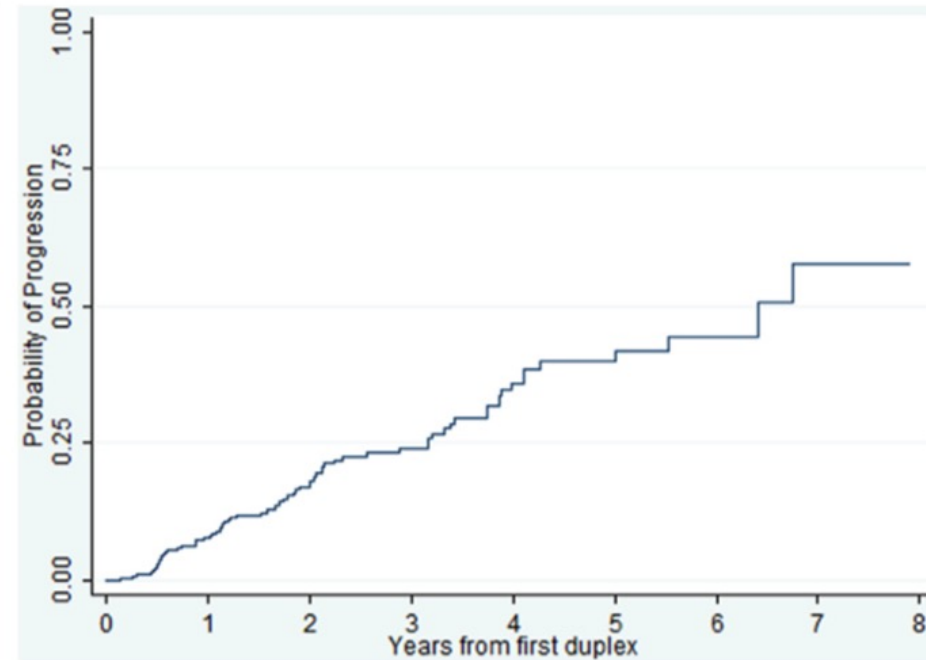
# SVS 2021 Treatment Guidelines

- LSR patients w/asymptomatic stenosis >70%, rec CEA + BMT; 1B
- LSR-SSR patients w/symptomatic stenosis >50%, rec CEA over TF-CAS; 1A
- Patients w/symptomatic stenosis >50% & Rankin 0-2, rec revascularization 48hrs-14days after onset of Symptoms; 1B
- Patients undergoing revasc w/in 14days after onset of Symptoms, rec CEA over TF-CAS; 1B
- Rec against revasc in patients w/disabling stroke, Rankin  $\geq 3$ , area of infarct >30% of ipsi MCA territory, or who are altered to minimize risk of post-op hemorrhage. Re-eval later; 1C

# Asymptomatic



|         |     |     |     |     |     |     |    |
|---------|-----|-----|-----|-----|-----|-----|----|
| At Risk |     |     |     |     |     |     |    |
| OMT     | 262 | 219 | 188 | 144 | 96  | 58  | 13 |
| Cohort  | 638 | 520 | 421 | 311 | 236 | 117 | 73 |



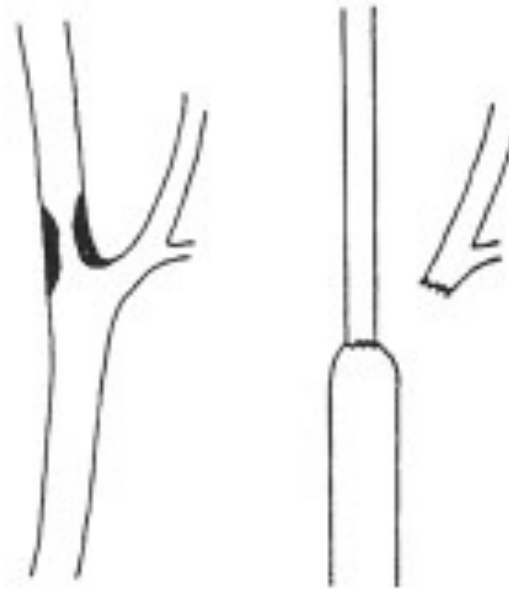
**Fig. 1.** Probability of progression from moderate ASCAS to severe stenosis. The rate of disease progression followed a linear trend, including 7.6% progression at 1 year, 17.6% at 2 years, and 35.9% at 4 years. Overall, disease progression from moderate ASCAS to severe stenosis occurred in 25.1% of patients.

# Carotid Endarterectomy

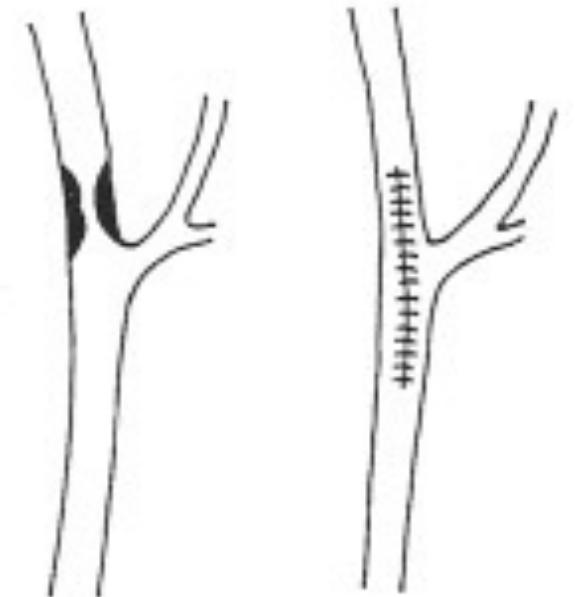
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Carrea, et al., 1951



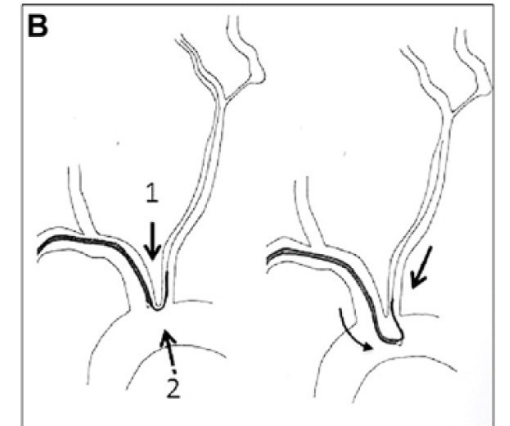
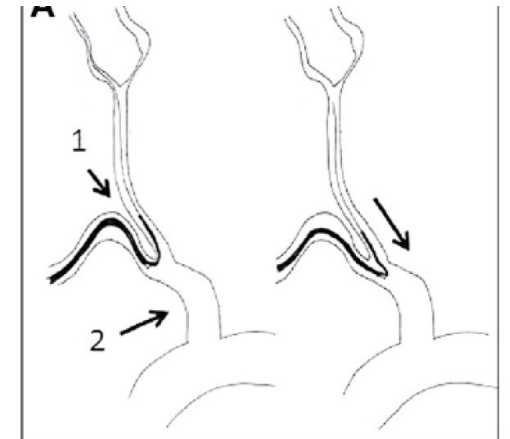
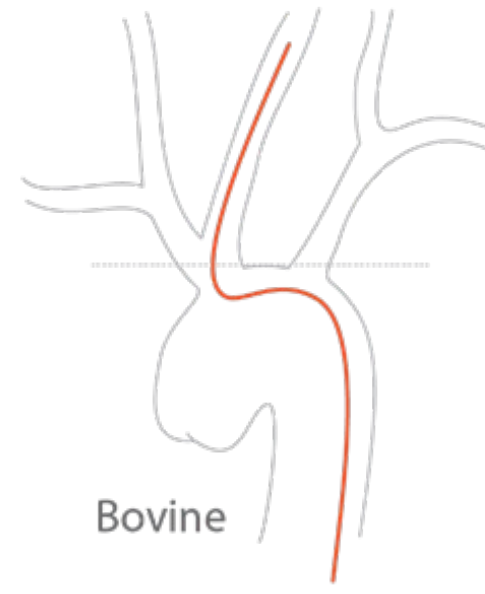
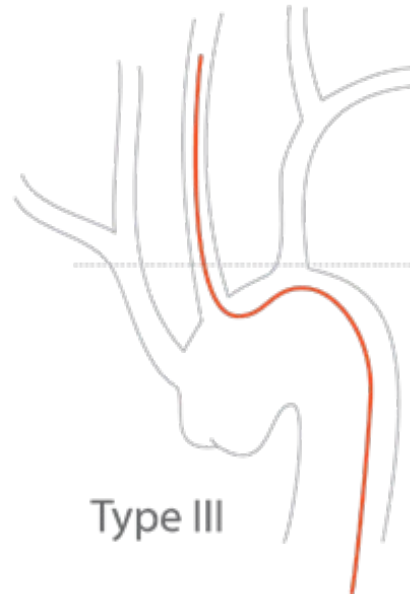
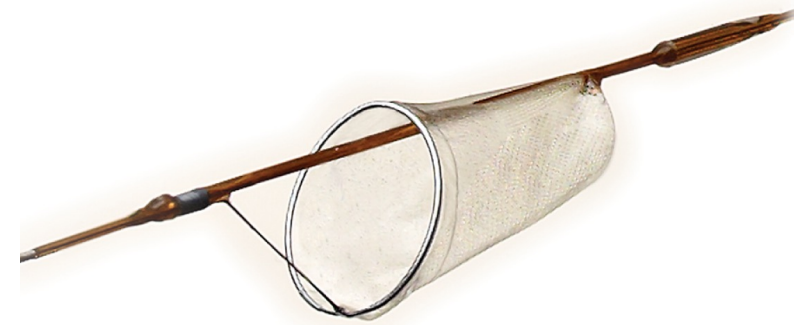
Eastcott, et al., 1954



DeBakey, 1953

# Carotid Artery Stenting

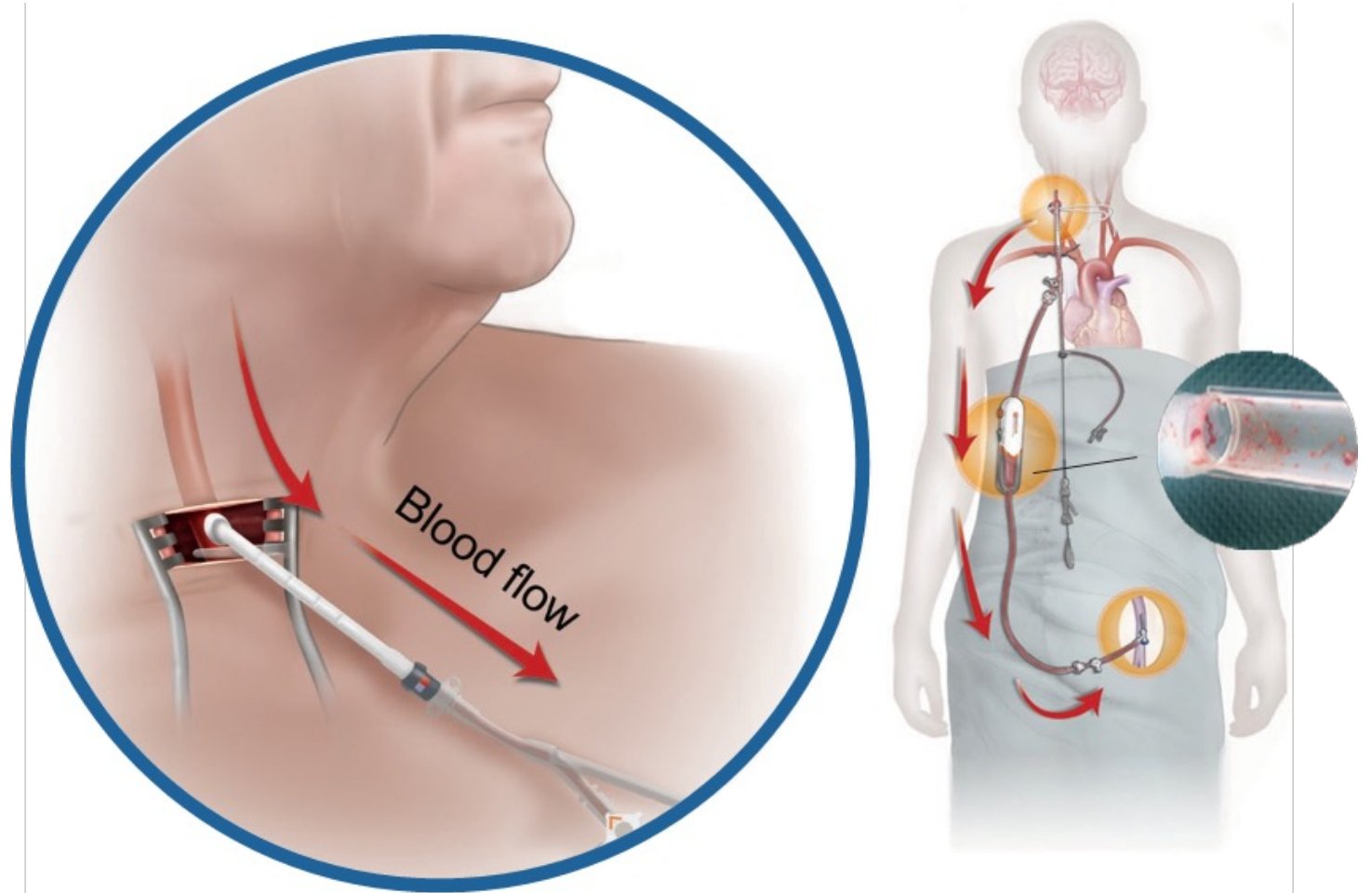
- TF-CAS
- TR/TB-CAS
- High lesions (@ or above C2)
- Hx of neck radiation
- Tracheostomy
- Hx of prior CEA (higher risk of CNI not CVA)



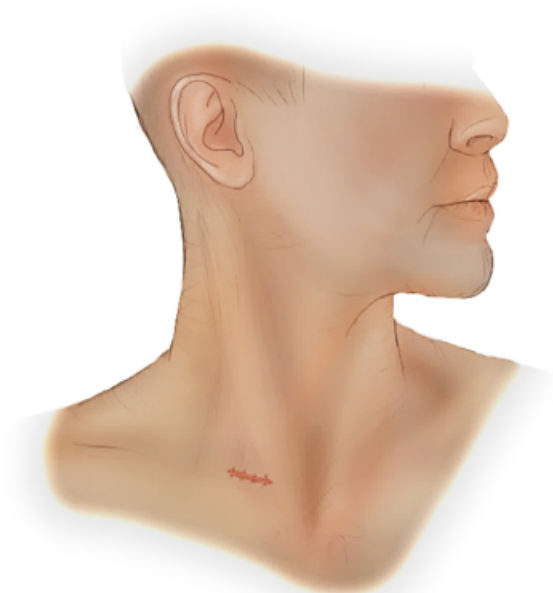
# Transcarotid Arterial Revascularization

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- >5cm working distance
- >6mm CCA diameter
- CCA free of significant disease
- DAPT
- Statin



# TCAR Paradigm Shift: Transcarotid



TCAR combines advantages from both worlds: **surgical principles** of neuroprotection and game-changing **endovascular technology**



Minimally Invasive



Avoids Aortic Arch



Avoids Cranial Nerve Plexus

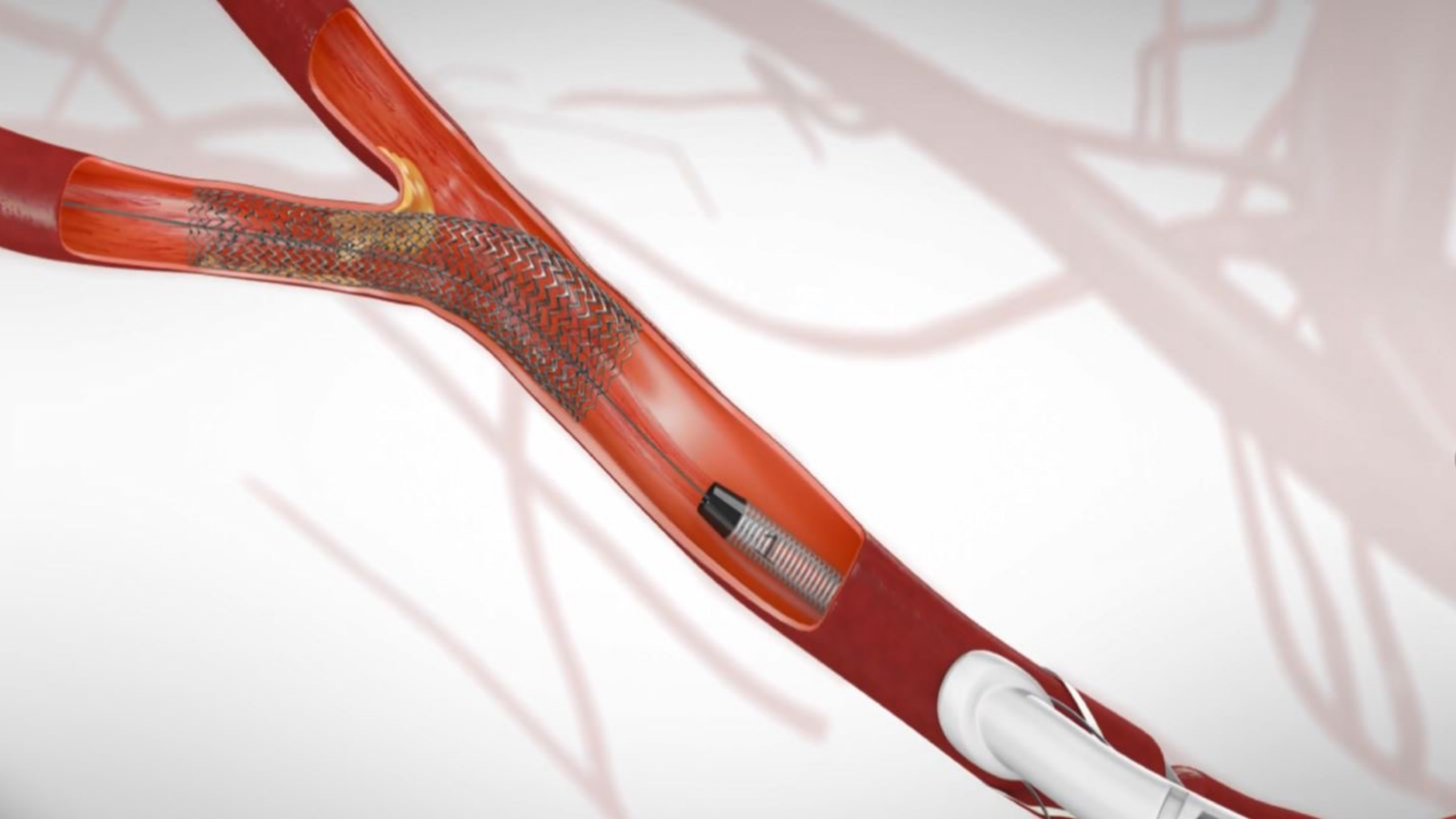


High-Rate Flow Reversal Neuroprotection



Accurate stenting

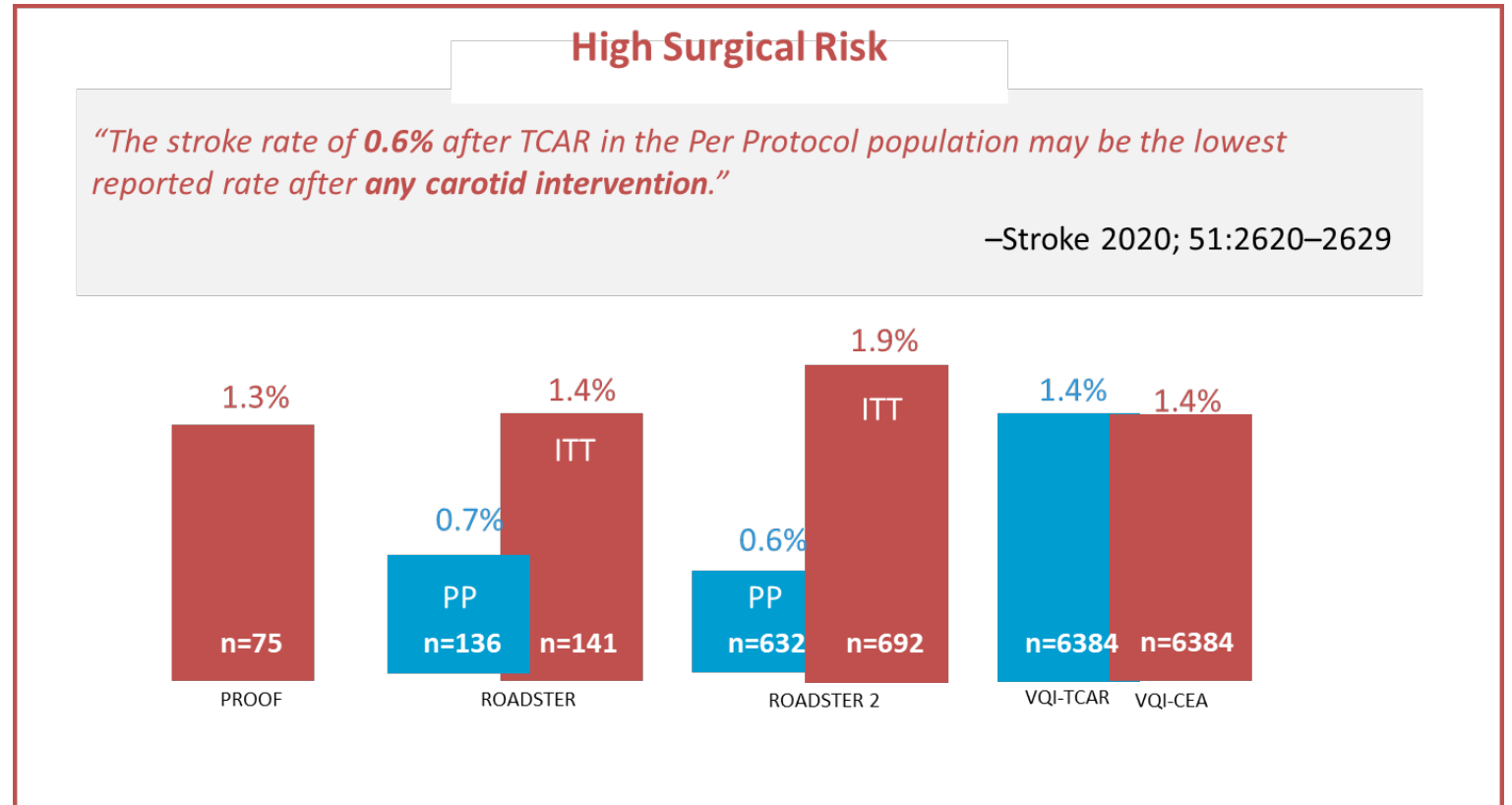
Source: Schermerhorn ML, Liang P, Eldrup-Jorgensen J, et al. Association of Transcarotid Artery Revascularization vs Transfemoral Carotid Artery Stenting With Stroke or Death Among Patients With Carotid Artery Stenosis. JAMA. 2019;322(23):2313–2322. doi:10.1001/jama.2019.18441  
Caution: Federal (USA) law restricts this device to sale by or on the order of a physician.  
Please refer to package insert for indications, contraindications, warnings, precautions, and instructions for use.



# TCAR

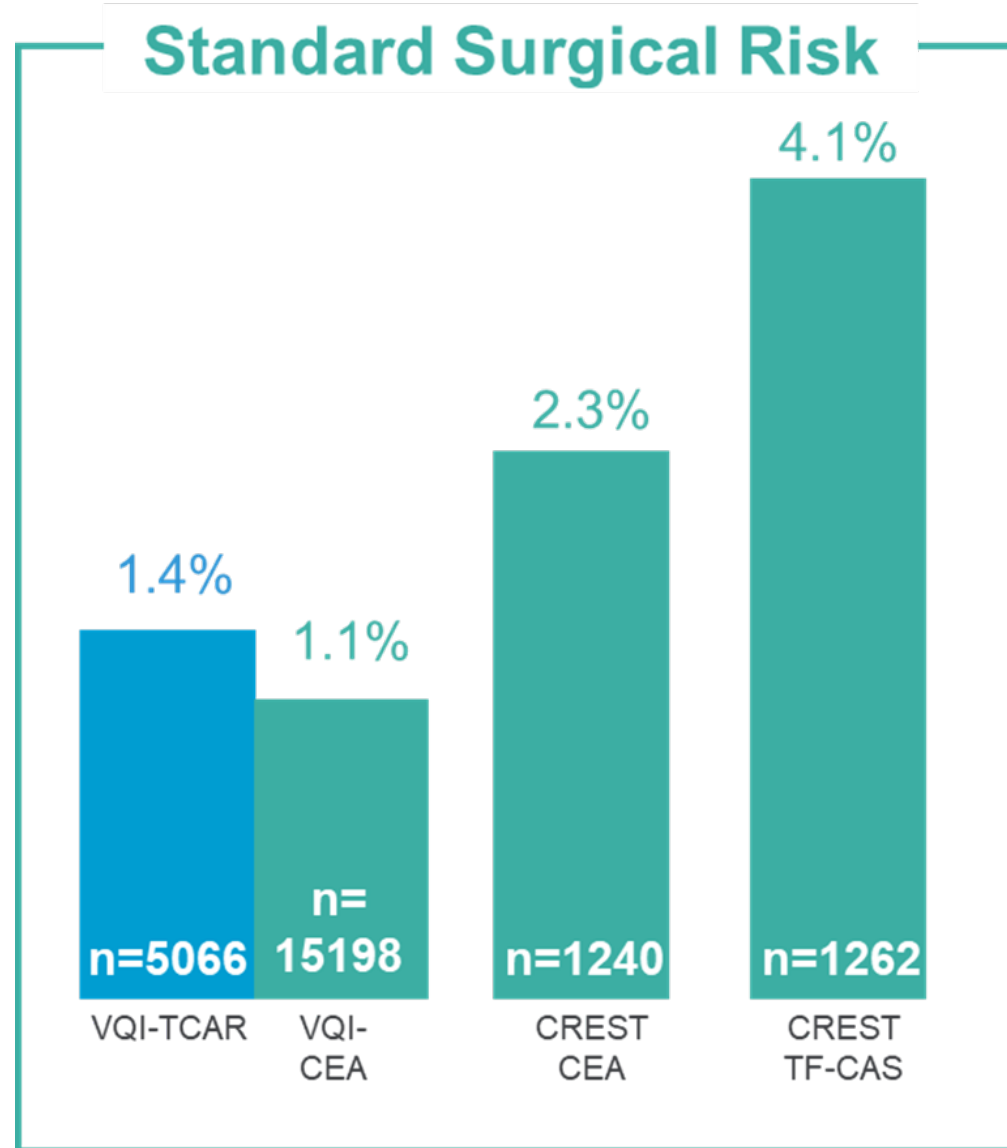
## Periprocedural Stroke Rates

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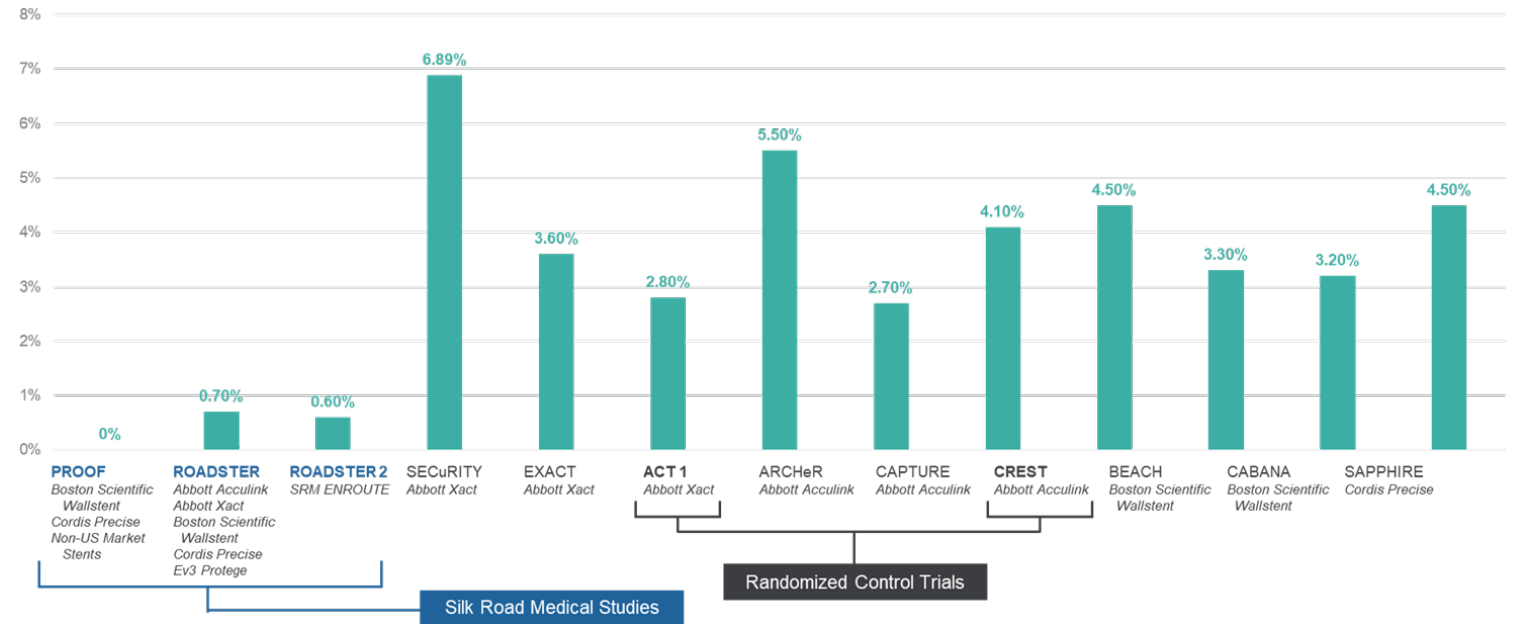


# Periprocedural Stroke Rates

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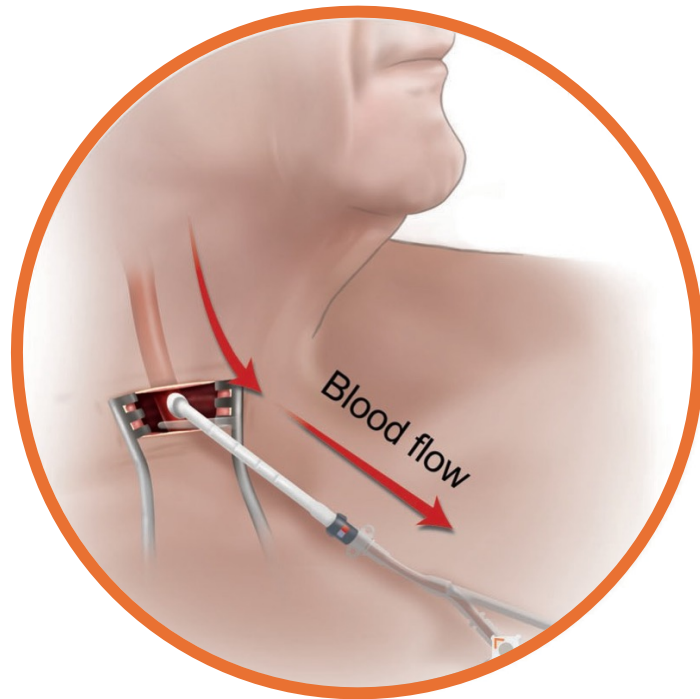
# Stroke rates across CAS studies



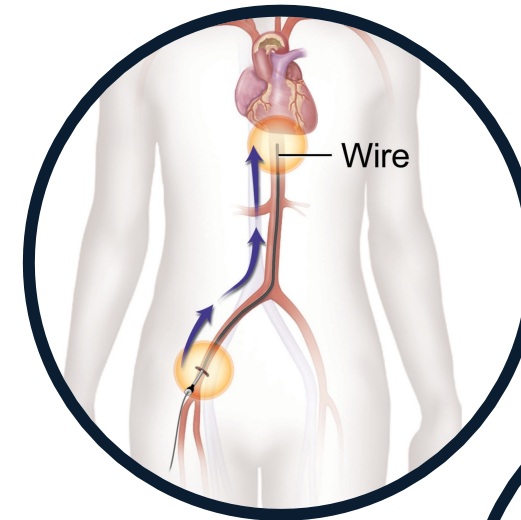
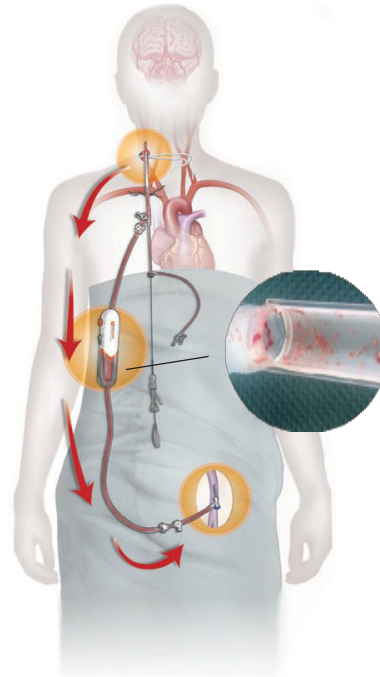
# TCAR vs. TFCAS

## Benefits of Direct Access

Brain is protected with flow reversal

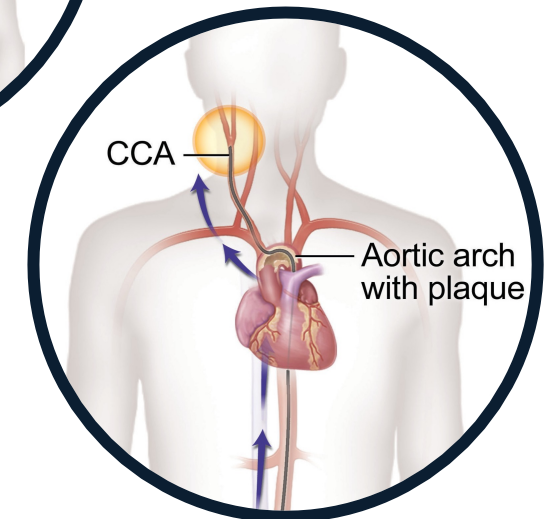


TCAR



Wire/sheath moves up femoral artery and across aortic arch to common carotid artery (CCA)

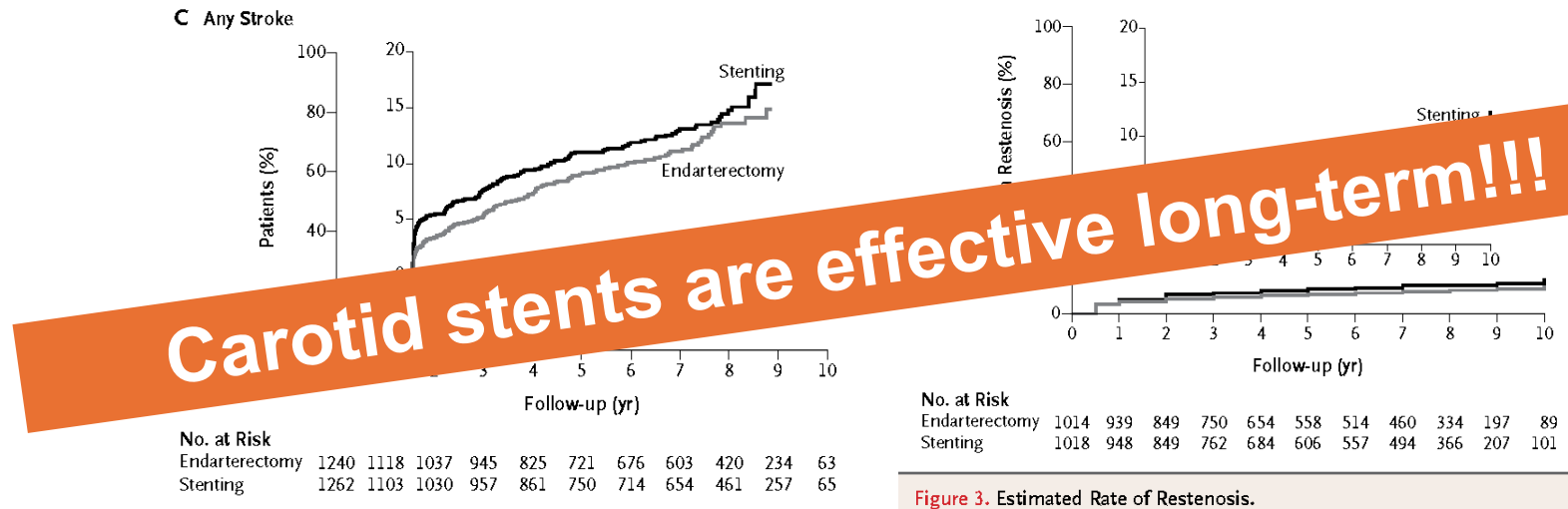
Distal embolic device is deployed which can sometimes create more problems.



TF-CAS

# Challenge: “Delivery”, Not “Performance Durability”

## Long-Term Results of Stenting versus Endarterectomy for Carotid-Artery Stenosis

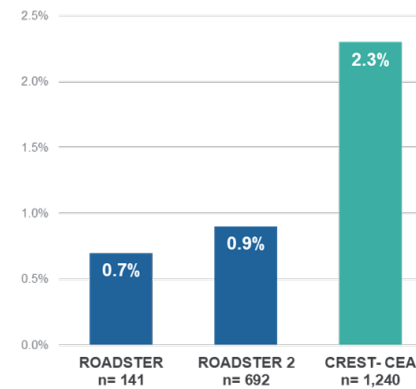


CREST (10 years data): **NO** difference in postprocedural **ipsilateral stroke** or **restenosis**

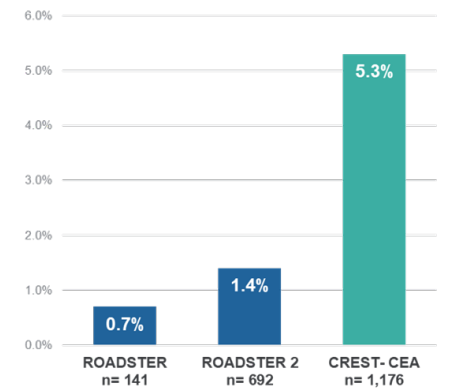
# TCAR vs CEA

| 30-Day Outcomes    | TCAR<br>(N= 5,066) | CEA<br>(N= 15,198) | P-Value          |
|--------------------|--------------------|--------------------|------------------|
| Stroke/Death/MI    | 2.0%               | 2.0%               | 0.88             |
| Stroke/Death       | 1.6%               | 1.4%               | 0.29             |
| Stroke             | 1.4%               | 1.1%               | 0.11             |
| Death              | 0.3%               | 0.4%               | 0.69             |
| <b>CNI</b>         | <b>0.3%</b>        | <b>2.7%</b>        | <b>&lt;0.001</b> |
| 1 Year Outcomes    | TCAR<br>(N=5,066)  | CEA<br>(N=15,198)  | P-Value          |
| Ipsilateral Stroke | 1.4%               | 1.1%               | 0.06             |
| Death              | 1.9%               | 2.0%               | 0.67             |

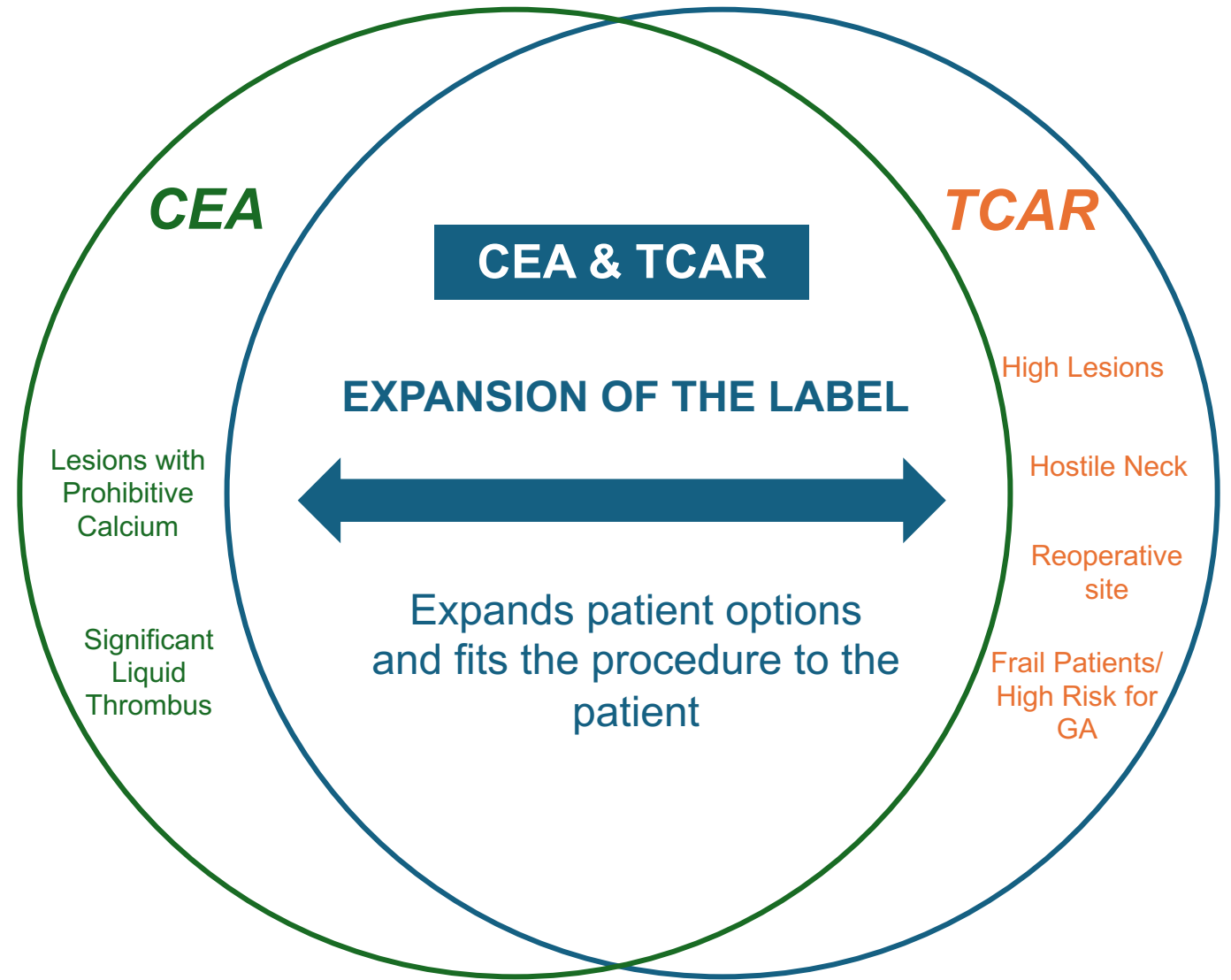
Myocardial Infarction



Cranial Nerve Injury



# Match the Patient with the Procedure

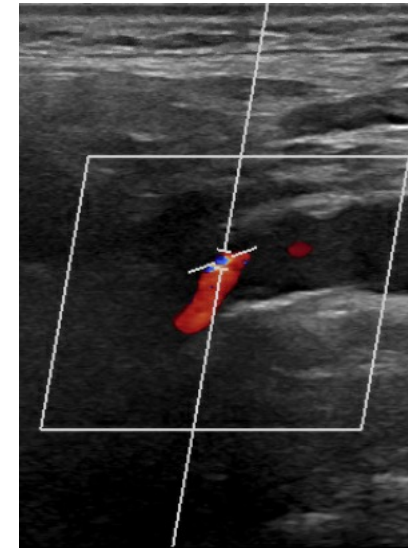


# Patient

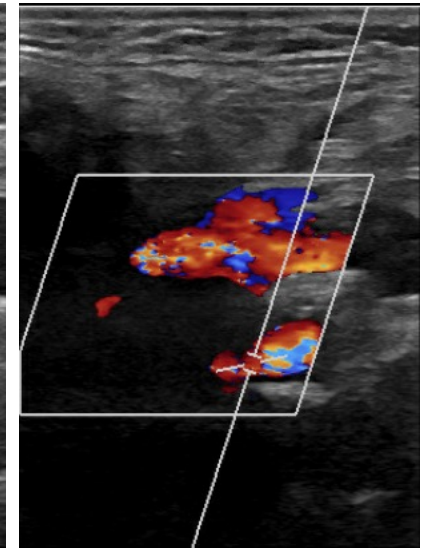
- 65M
  - PMH: HTN, HLD
  - Tonsillectomy and neck XRT for CA
  - Right hand dominant
  - Asymptomatic severe bilateral CAS diagnosed on screening US performed by PCP
- staged TCAR with 6-week interval

| Laterality    | Right | Left |
|---------------|-------|------|
| PSV (cm/s)    | 753   | 457  |
| EDV (cm/s)    | 292   | 220  |
| ICA/CCA ratio | 10.90 | 4.81 |

Right



Left



Pre-procedural CTA



Carotid angiogram



**STOP short  
6mm pre-  
dilation  
10x40mm stent**



Completion



# Patient

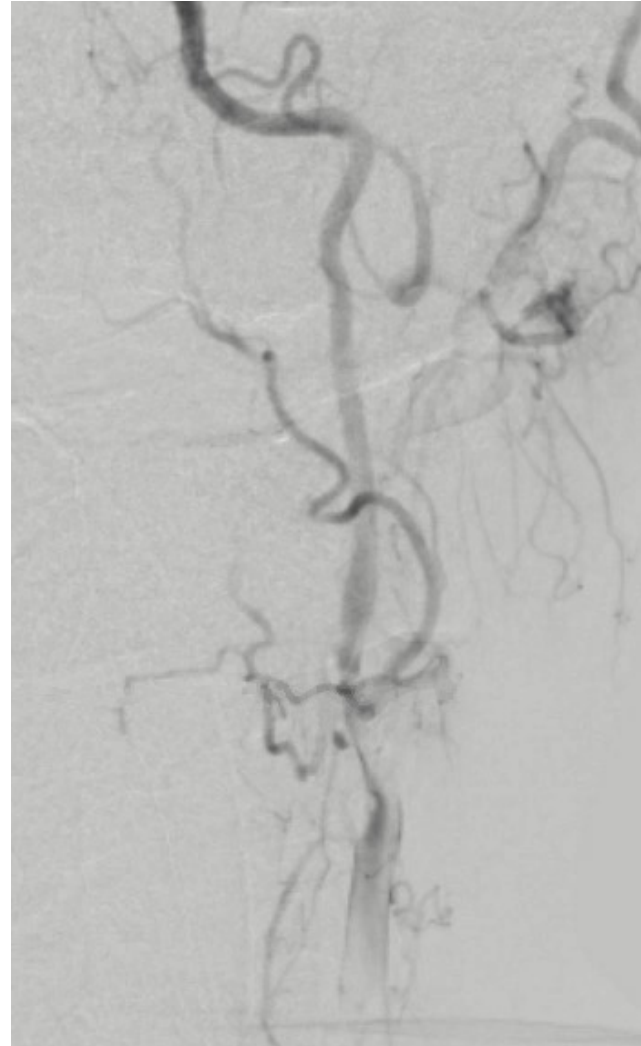
4-week follow-up



## Pre-procedural CTA



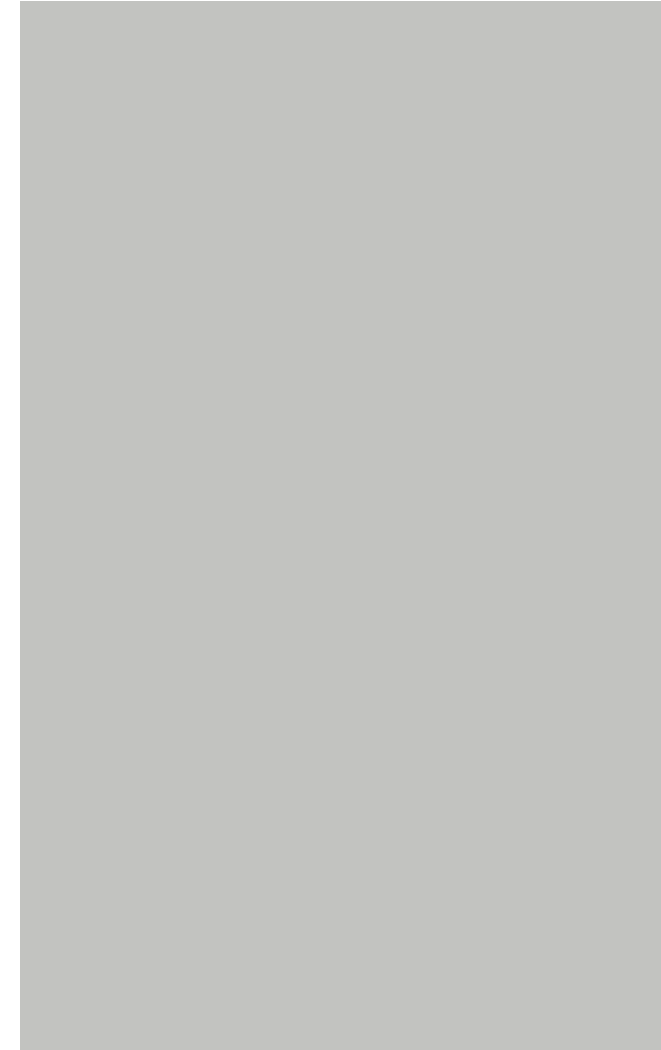
## Carotid angiogram



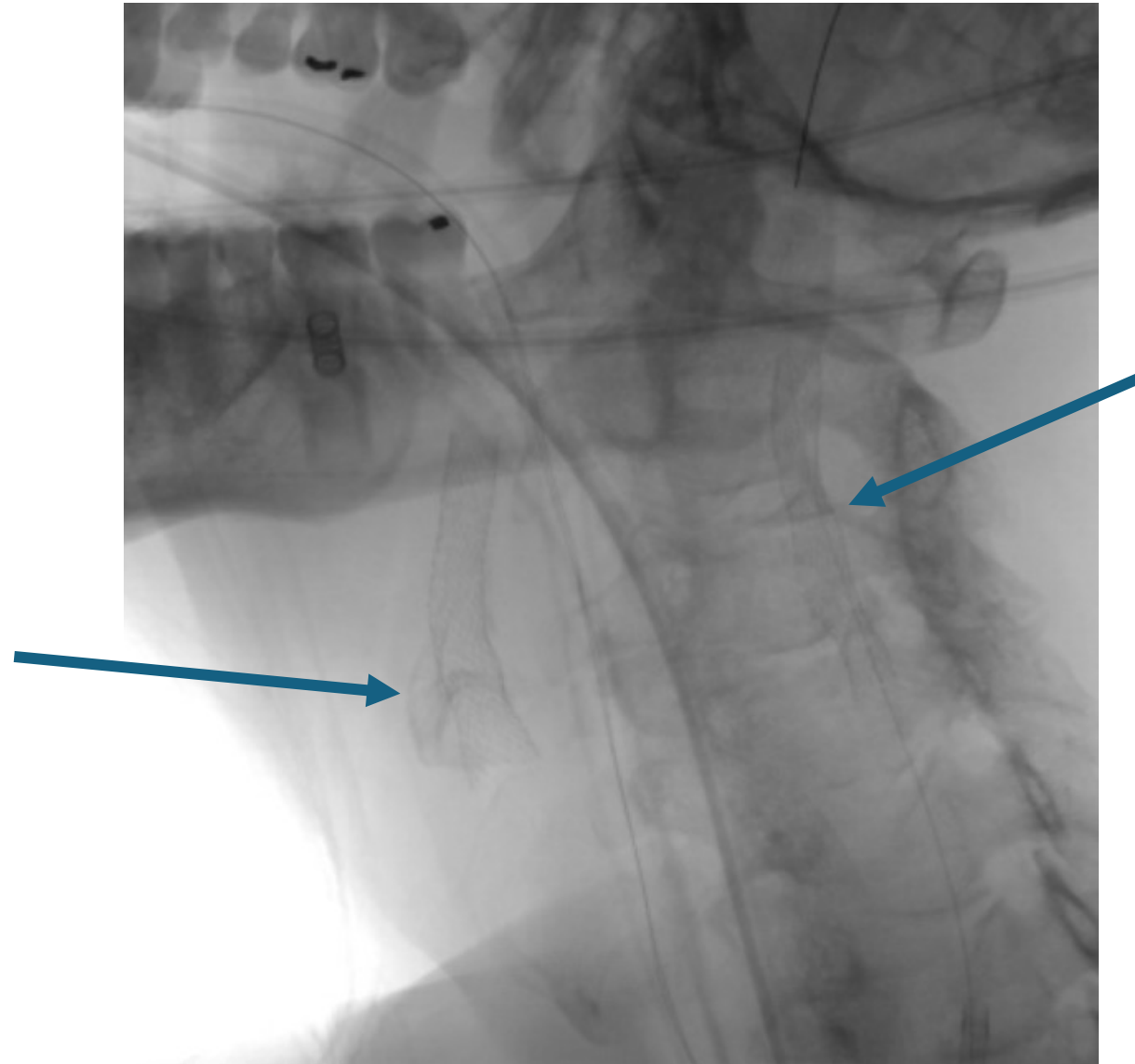
5mm pre-dilation  
10x40mm stent  
5.5mm post-dilation



## Completion



# Patient





Thank you