

# The role of angioplasty and stenting in carotid revascularization

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## **Disclosures**

- Speaker fees - Cordis

## **Acknowledgements**

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- Vascular Neurology Colleagues

## **Abbreviations**

- CEA – carotid endarterectomy
- tf-CAS – trans-femoral  
carotid artery stenting
- TCAR – Trans-Carotid Artery  
Revascularization
- MMT – Maximal medical therapy
- ICA – Internal Carotid Artery
- CCA – Common Carotid Artery
- DAPT – Dual antiplatelet therapy

# My limited experience with CAS

- 59 elective stents
  - 76% Symptomatic
  - 24% Asymptomatic
- 29 stents during acute stroke thrombectomy

- 5-10 Covered / balloon mounted stents for carotid blow-out
- Numerous intracranial stents for cervical carotid dissection

Annual physician carotid stent procedures

Low (0-3)

Medium (4-24)

High (25-87)

Annual center carotid stent procedures

Low (0-14)

Medium (15-66)

High (67-210)

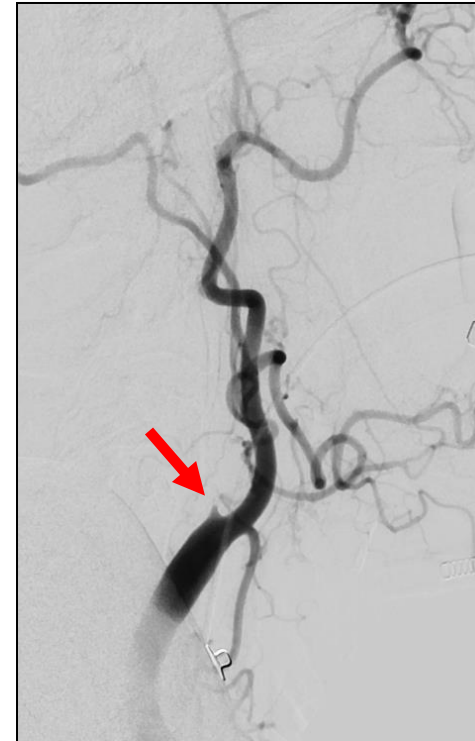
# What you do is critically important!

~41,000 strokes / year in USA



Carotid Stenosis

~18,000 strokes / year

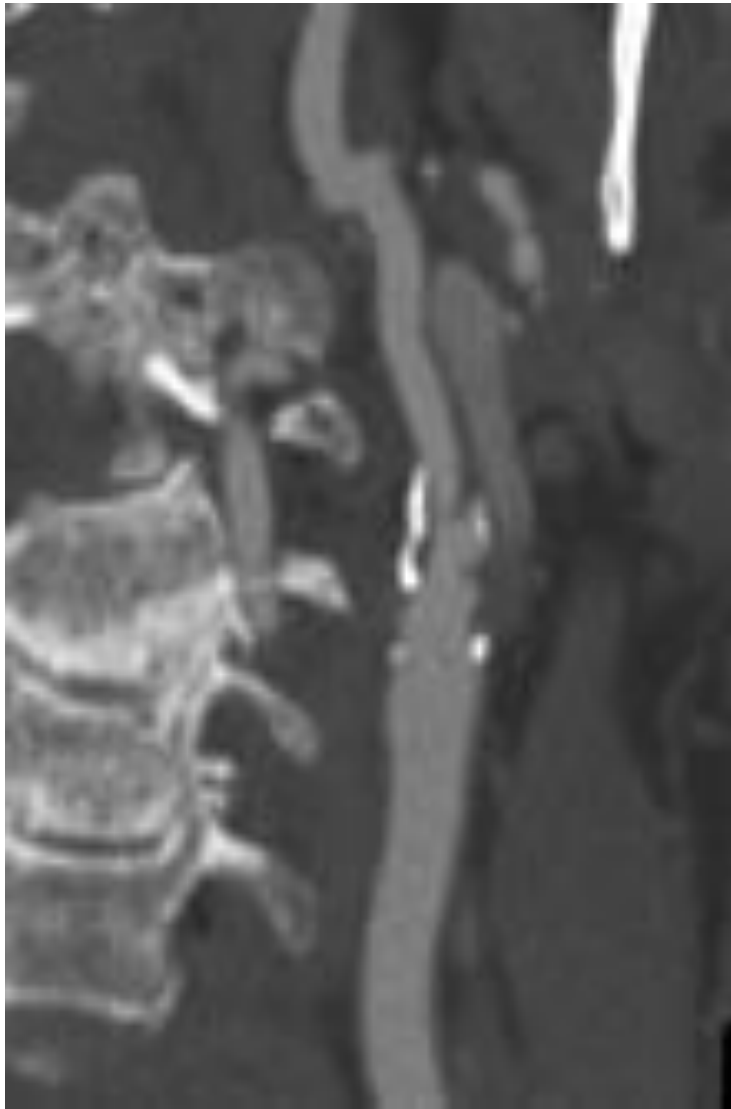


Carotid Occlusion

## Patient MC

- 77yo M with HTN, HL
- Presented to VA with mild right arm weakness
- MRI with watershed pattern of ischemia

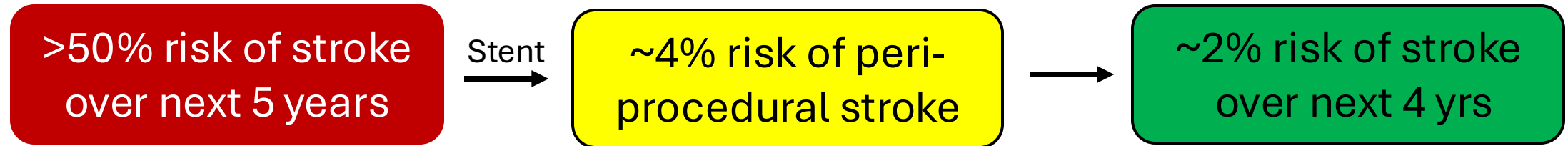




High Grade Left ICA Stenosis



# Stroke risk has been reduced



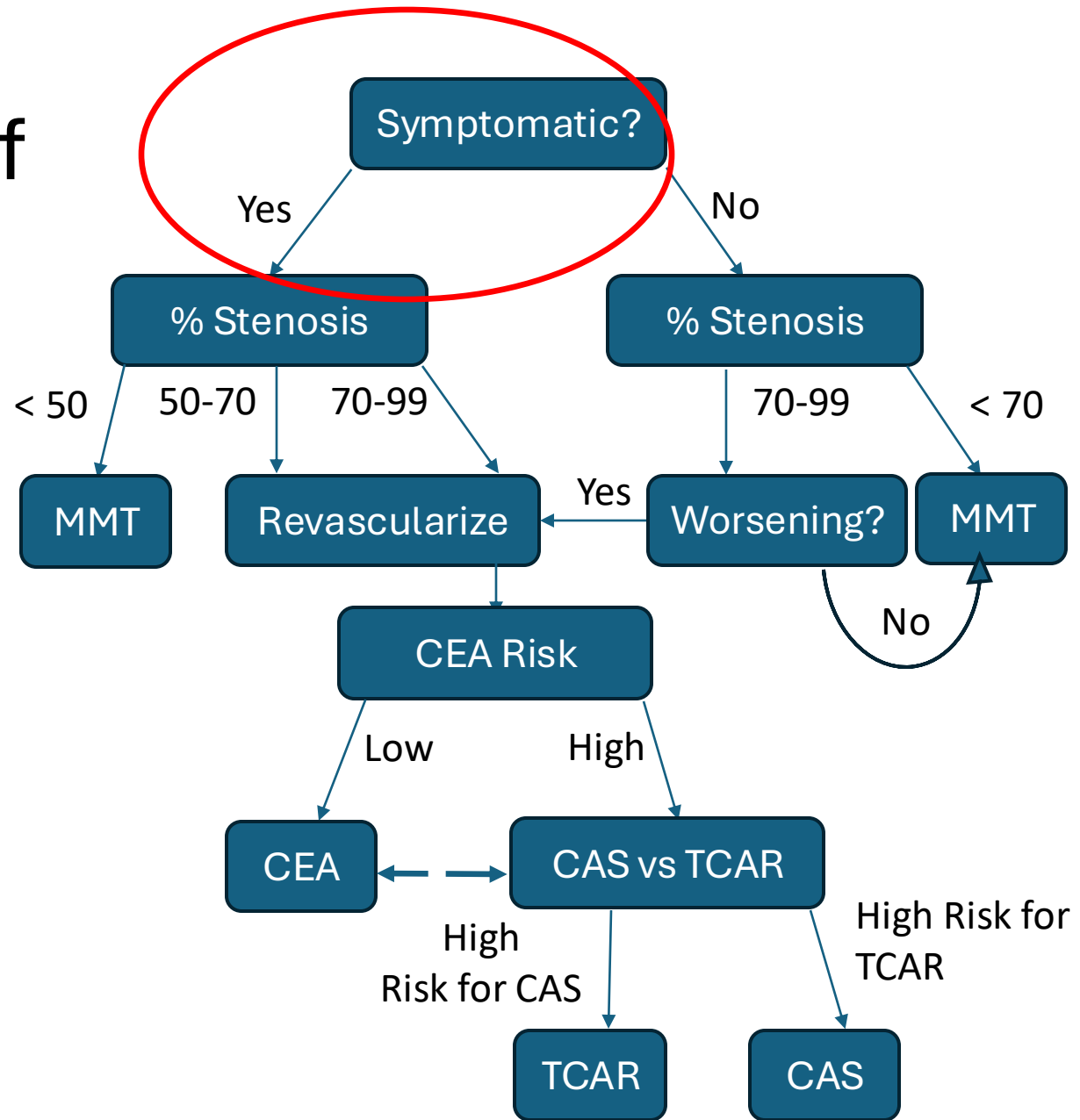
Continues to recover from his initial mild stroke

No bleeding on dual antiplatelet therapy

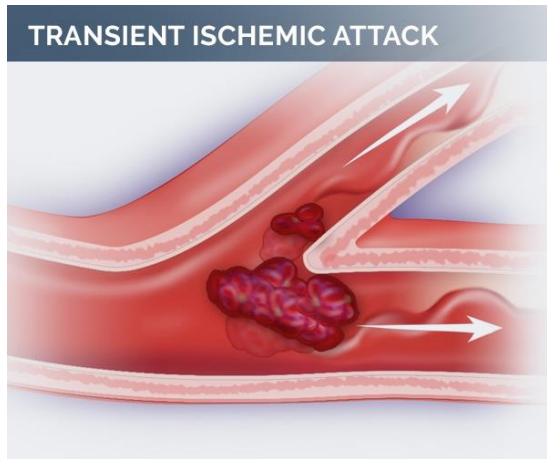
No strokes since his stent



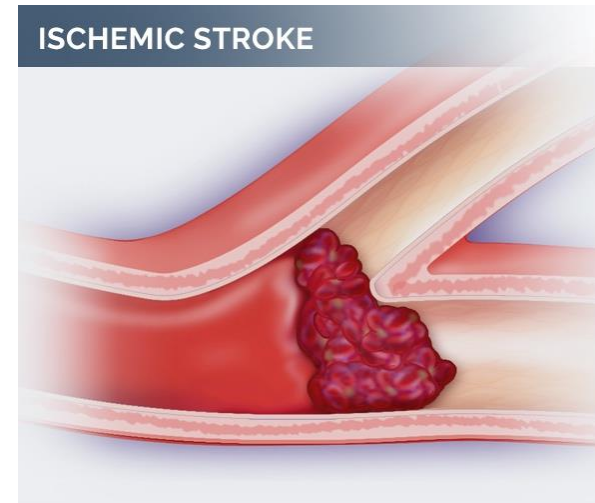
# An Algorithm for management of carotid stenosis



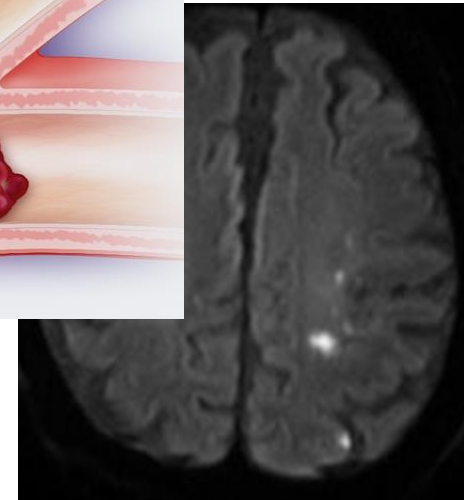
# What makes a stenotic carotid “symptomatic”?



TIA or  
“almost stroke”



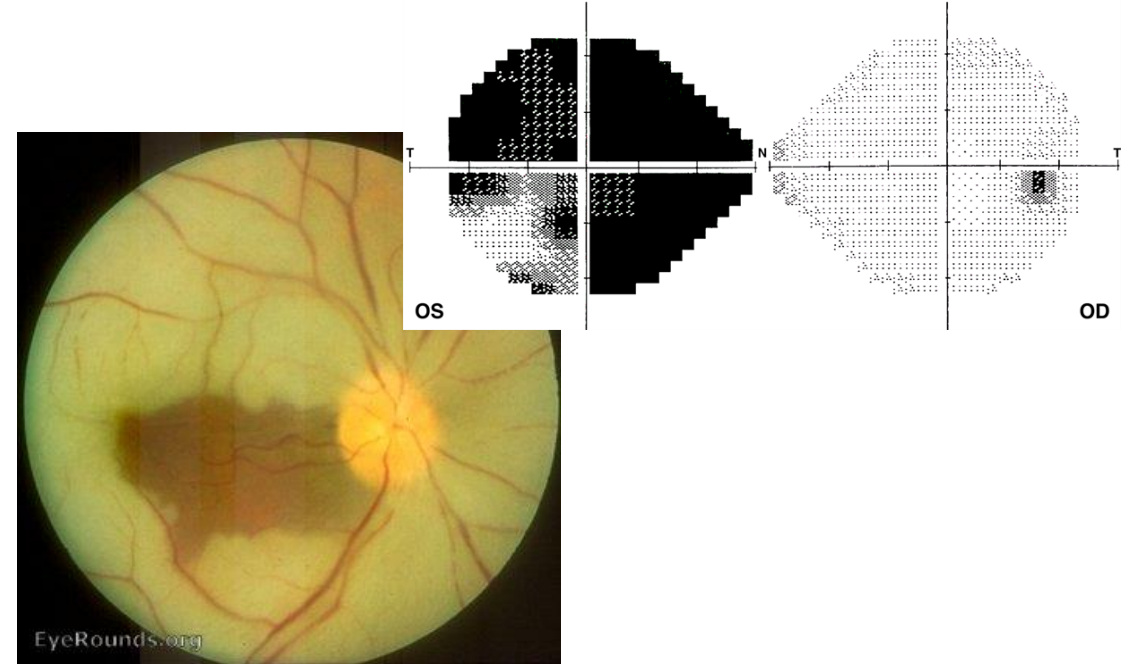
Ischemic  
stroke



# What makes a stenotic carotid “symptomatic”?

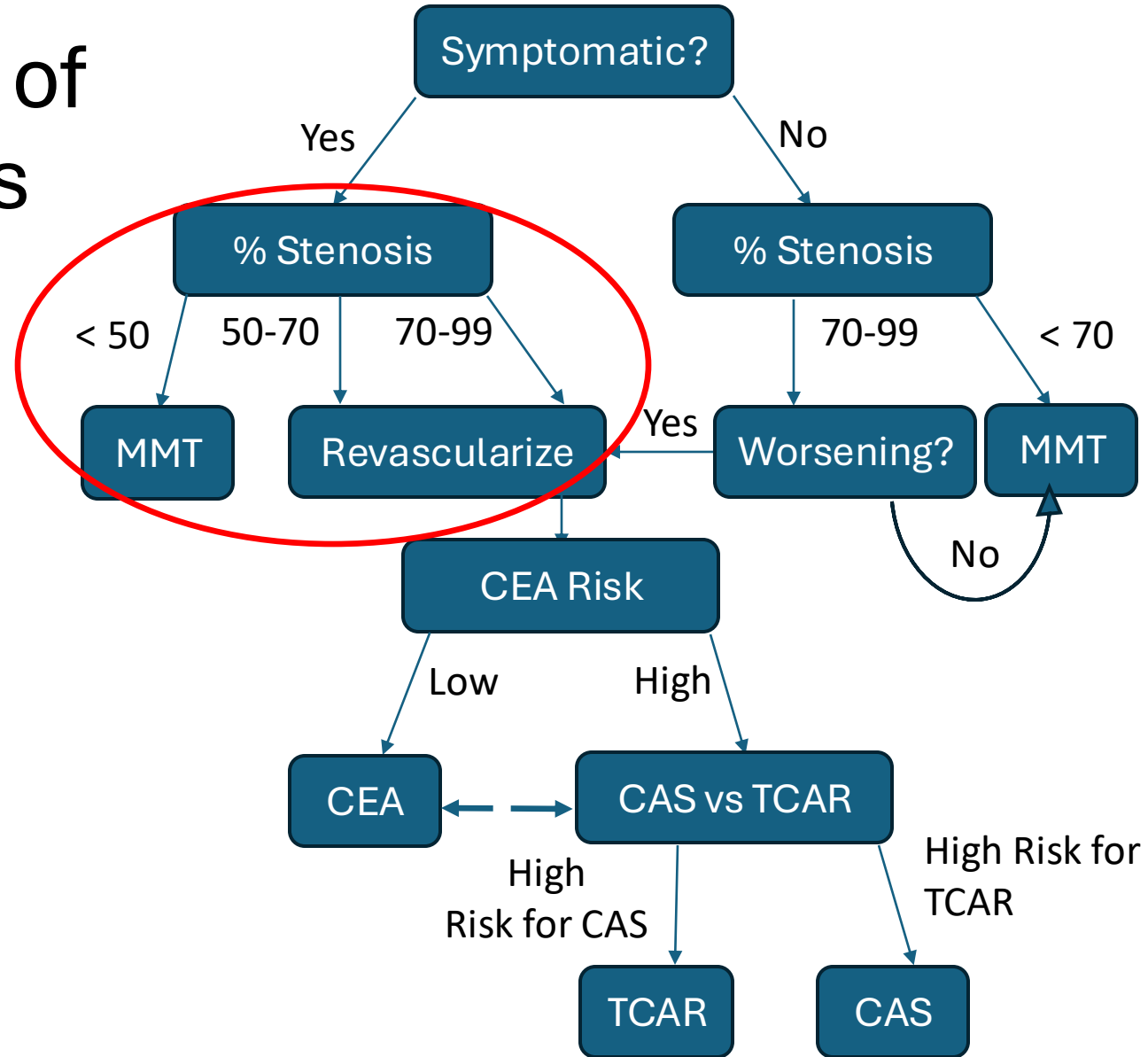


Amaurosis Fugax  
“TIA of the eye”

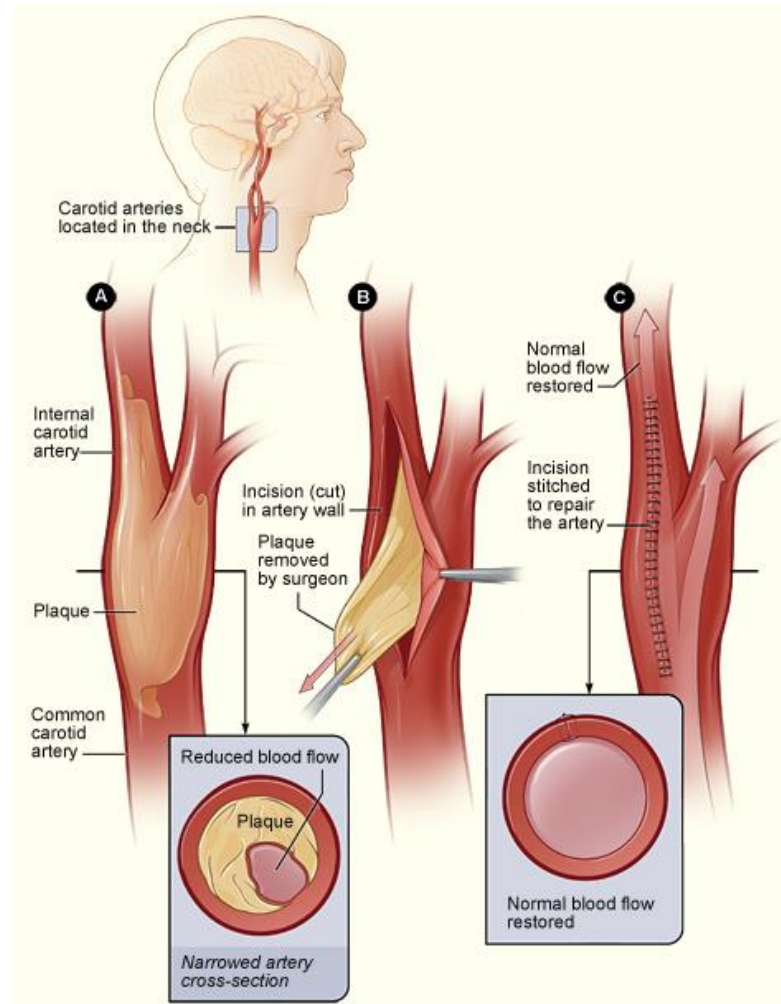


Central Retinal Artery Occlusion  
“Stroke of the eye”

# An Algorithm for management of carotid stenosis

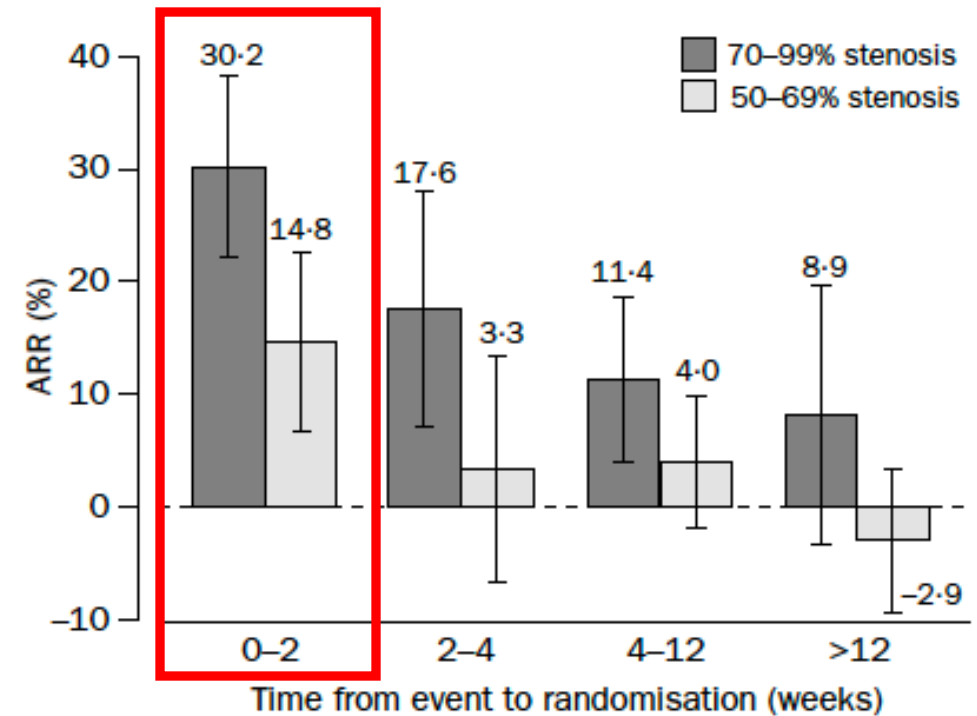


# CEA versus MMT in symptomatic patients (ECST, NASCET, VA 309)



# CEA versus MMT in symptomatic patients (ECST, NASCET, VA 309)

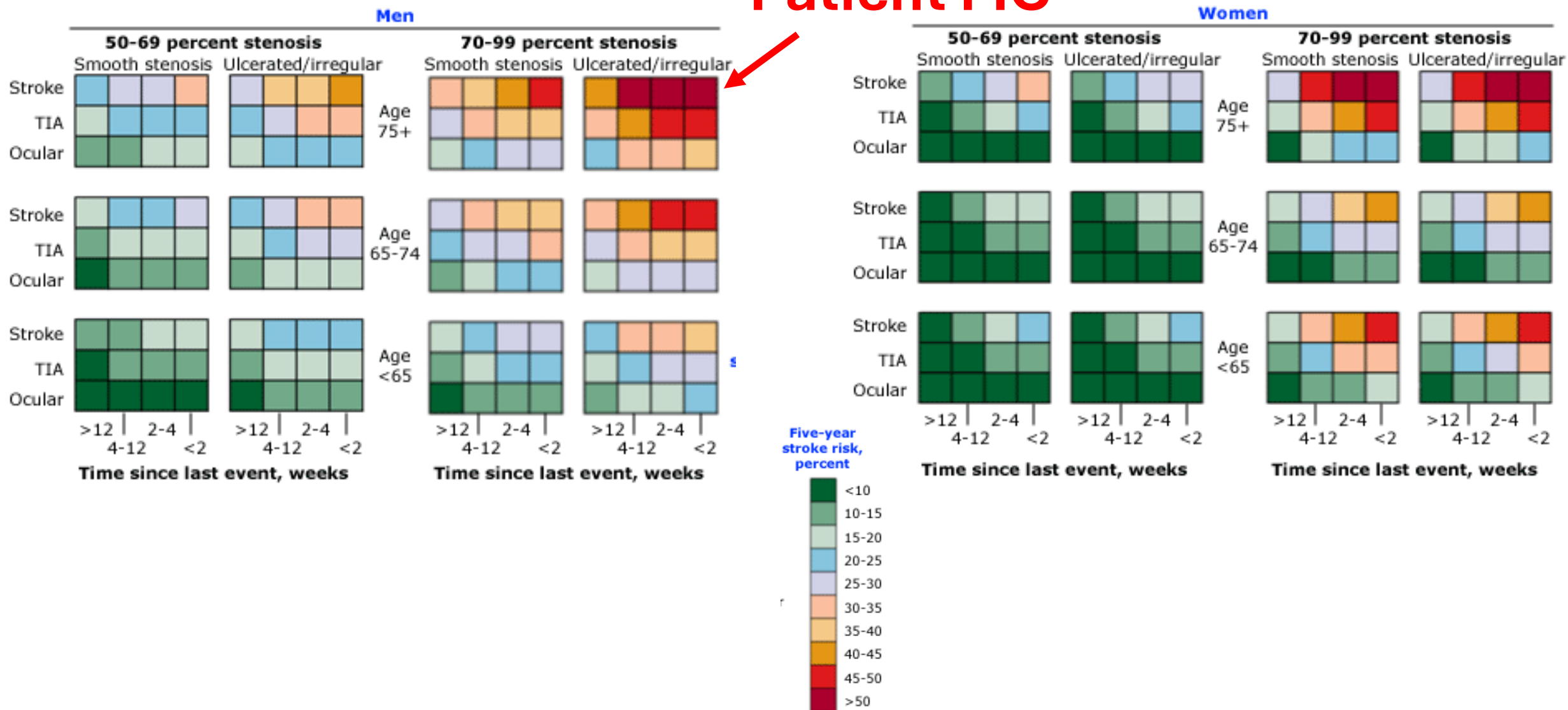
- Benefit of CEA depends on degree of stenosis
  - < 30% = Harmful
  - 30-49% = No benefit
  - 50-69% = Some Benefit
  - 70-99% = Significant Benefit



- Interesting Subgroups:
  - Greater benefit if >75yo
  - Less benefit in women with 50-69% stenosis
  - More benefit if performed early

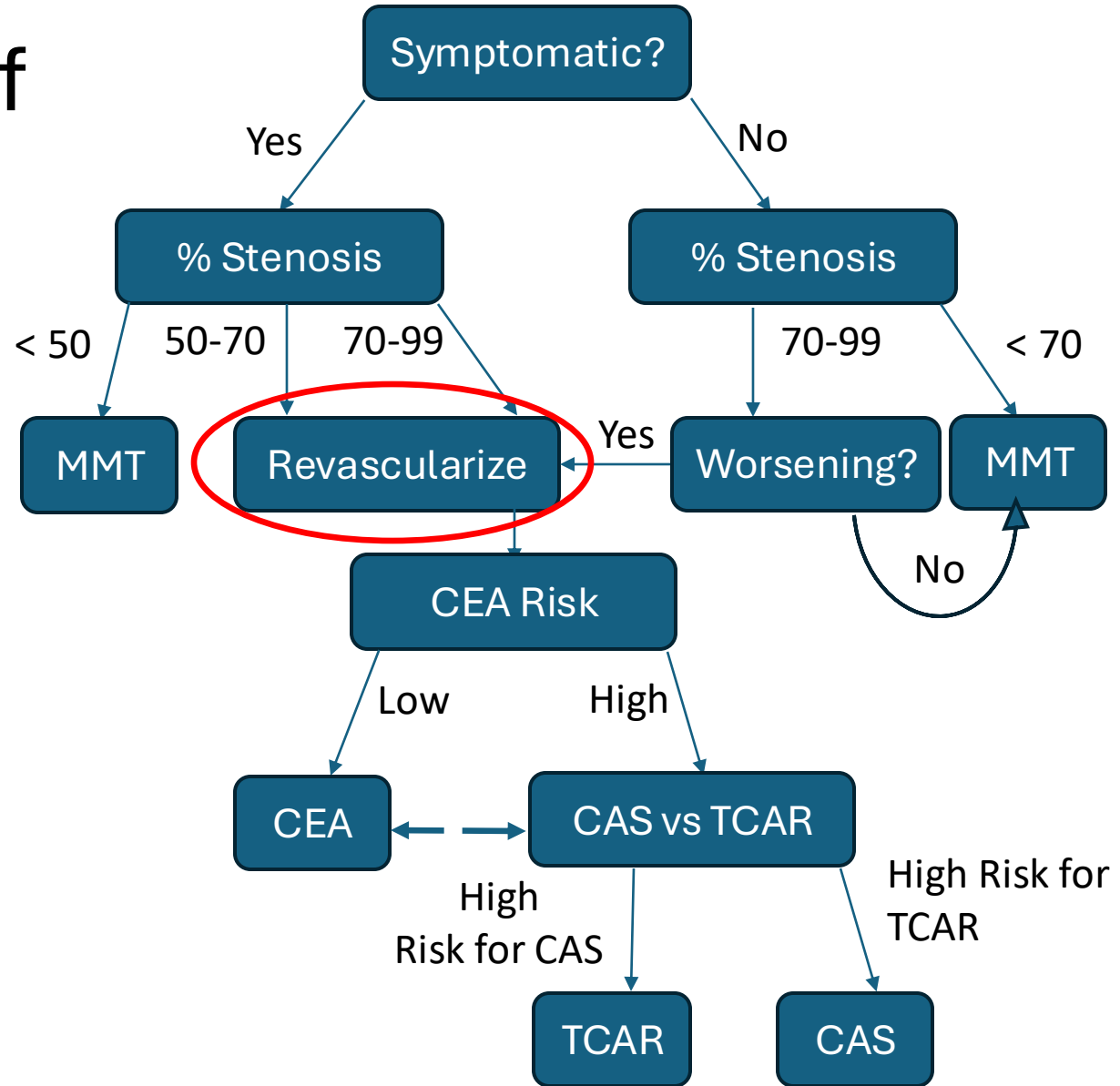
# Even more granular / personalized risk assessment

## Patient MC





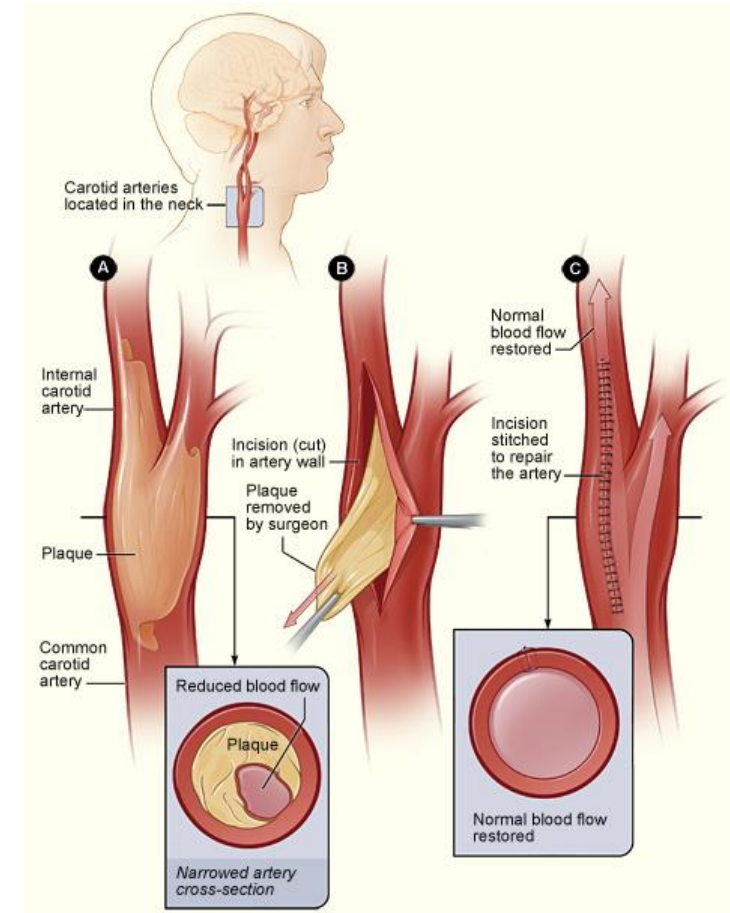
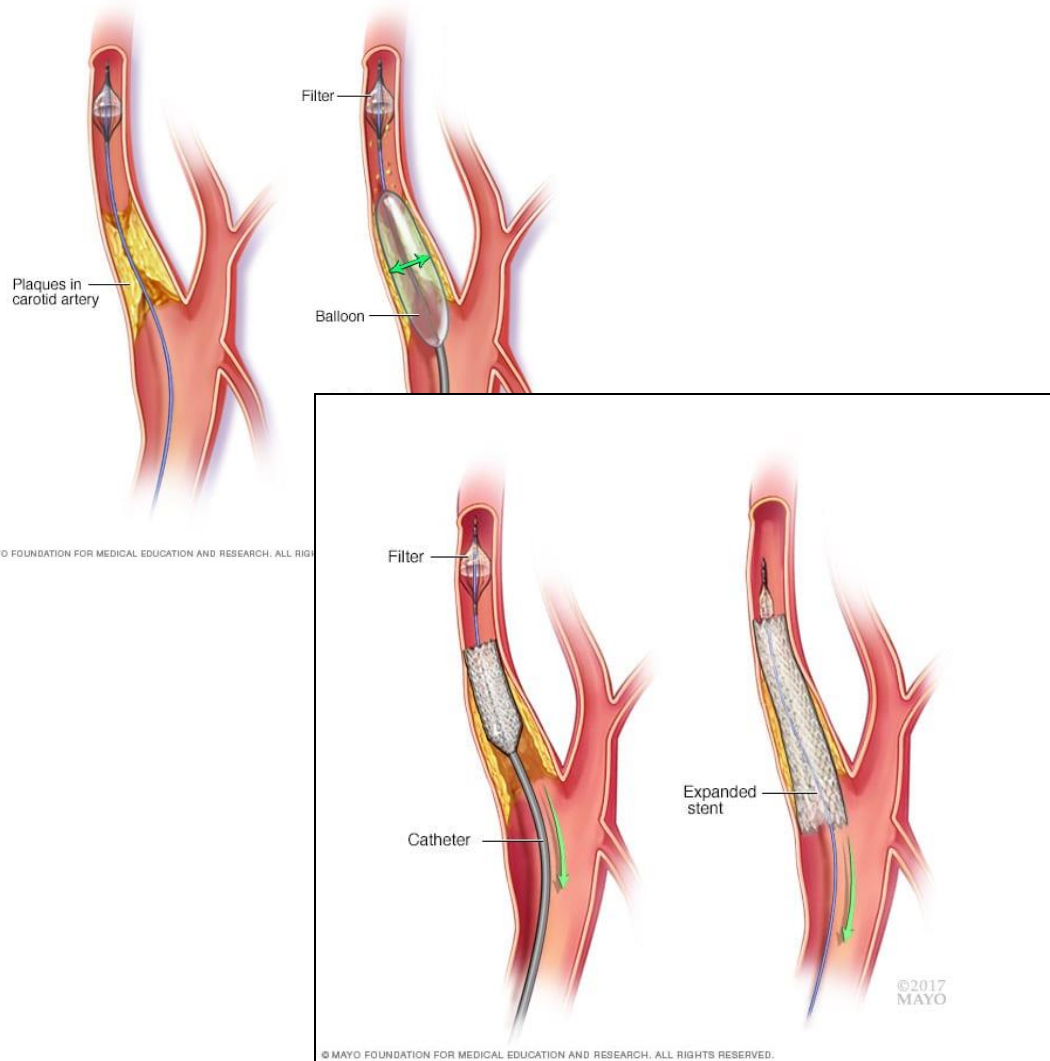
# An Algorithm for management of carotid stenosis





# So you've decided to revascularize...

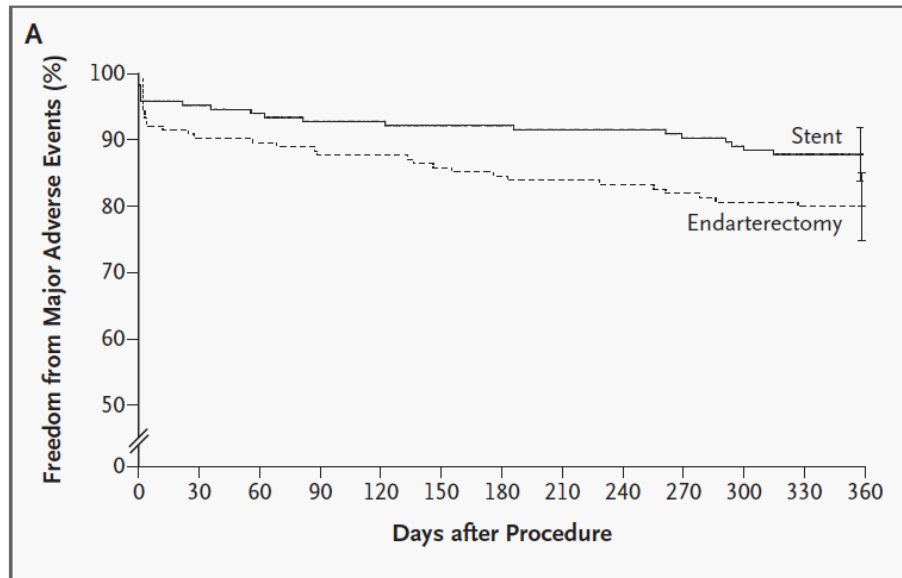
## Carotid Angioplasty & Stenting versus CEA



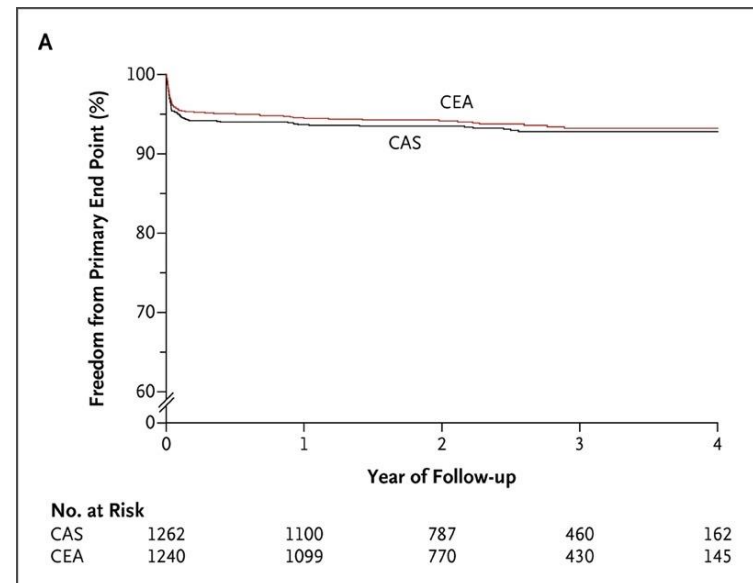
# So you've decided to revascularize...

## Carotid Angioplasty & Stenting versus CEA

### SAPPHIRE (2004)



### CREST (2010)



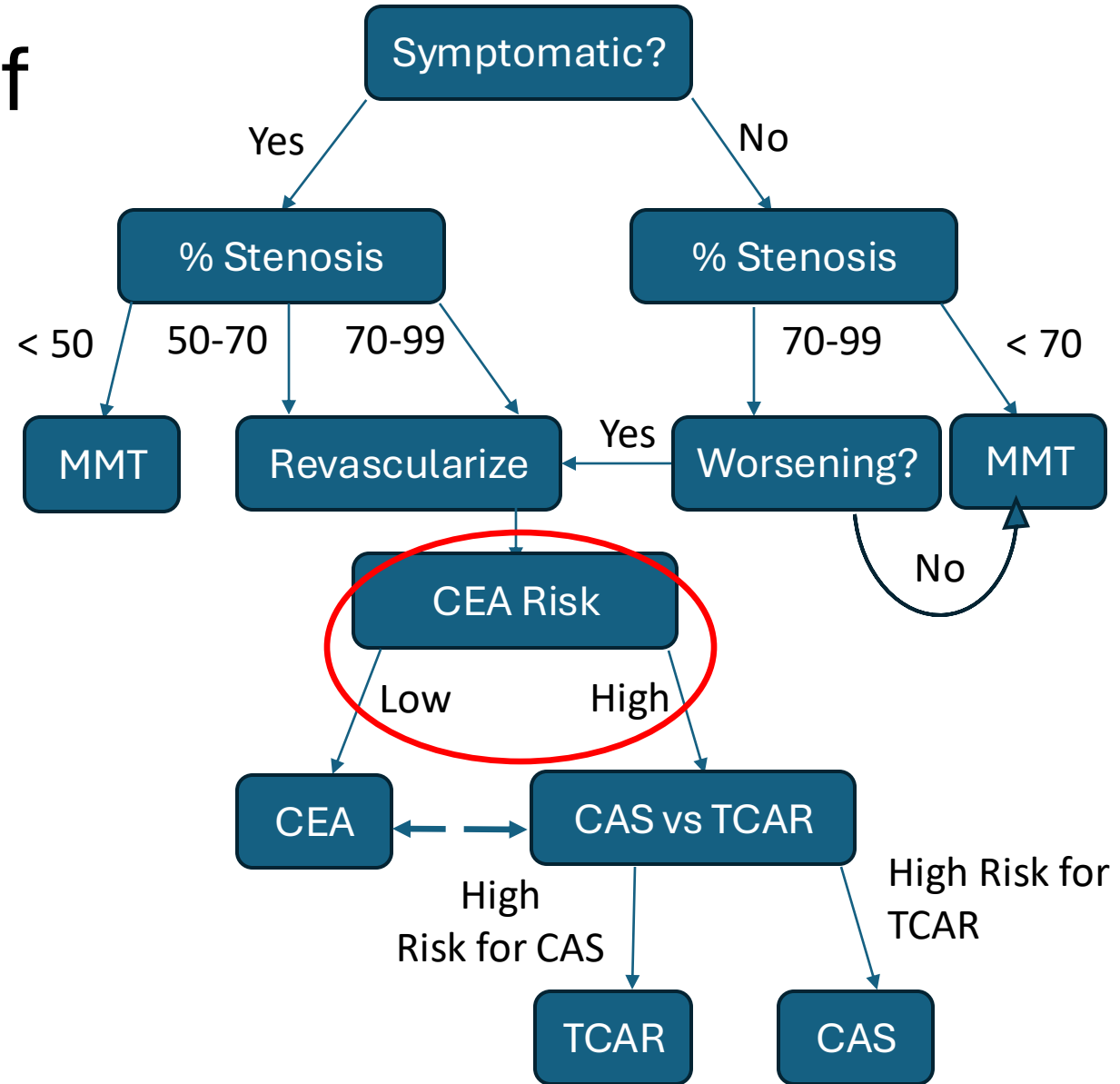
- Low rates of recurrent stroke after intervention
- No statistical difference between CAS and CEA (risk of stroke, death or myocardial infarction)

# Adverse event rates in CREST

- More heart attacks after CEA (2.3%) than after CAS (1.1%)
- More strokes after CAS (2.9%) than after CEA (1.4%)

CAS only approved (initially)  
for patients too high risk for CEA

# An Algorithm for management of carotid stenosis

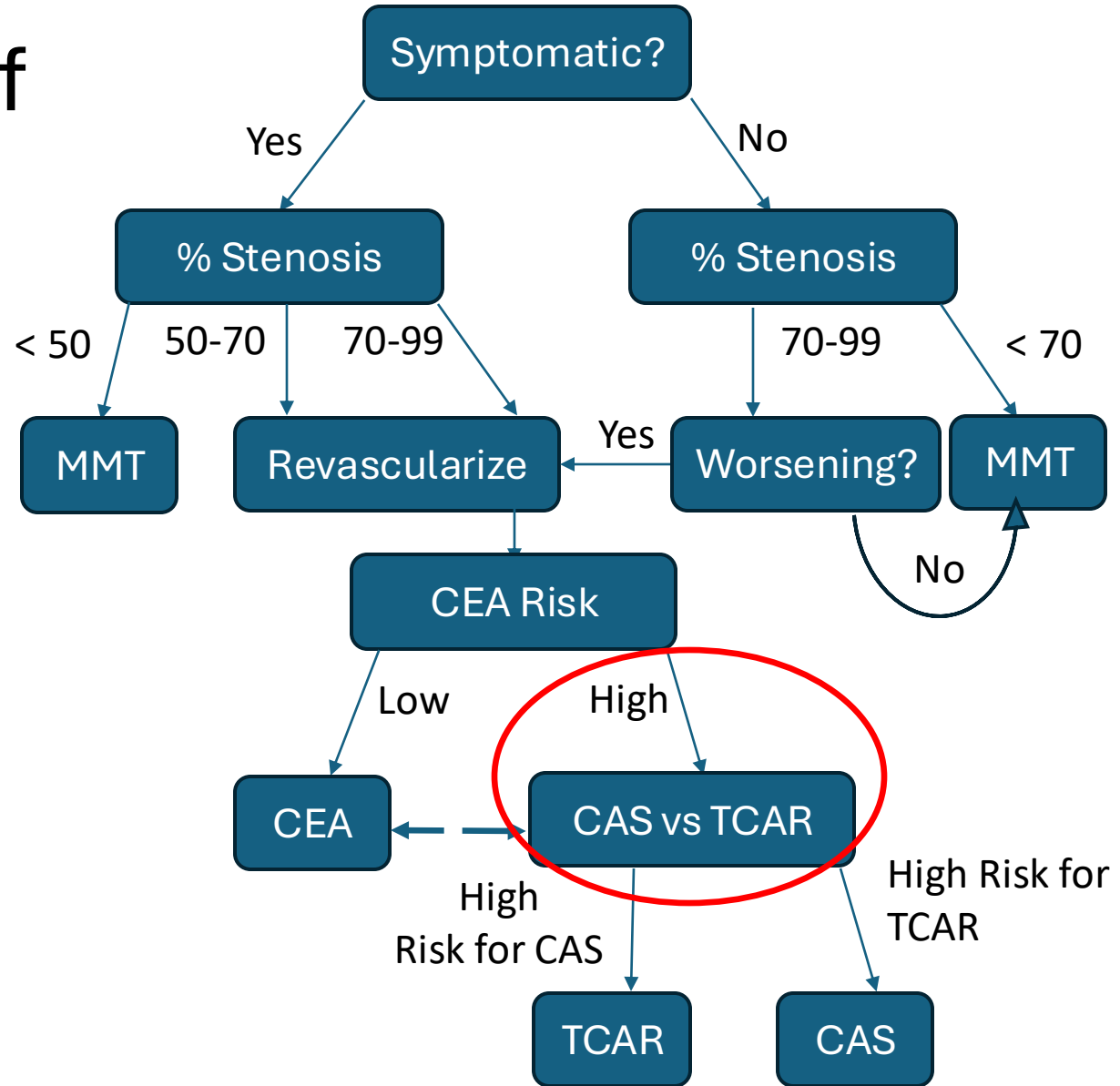


# What makes a patient too high risk for CEA?

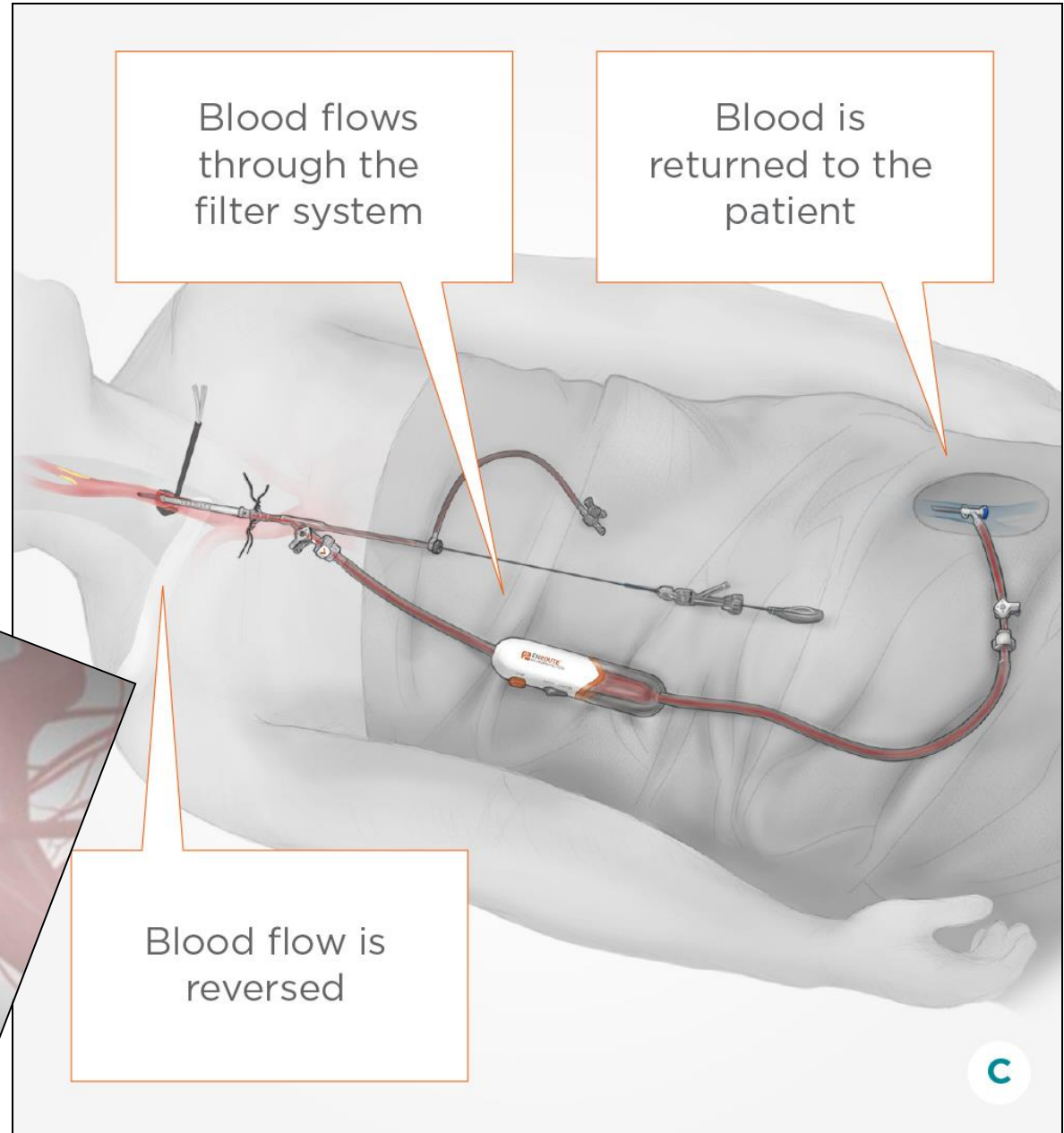
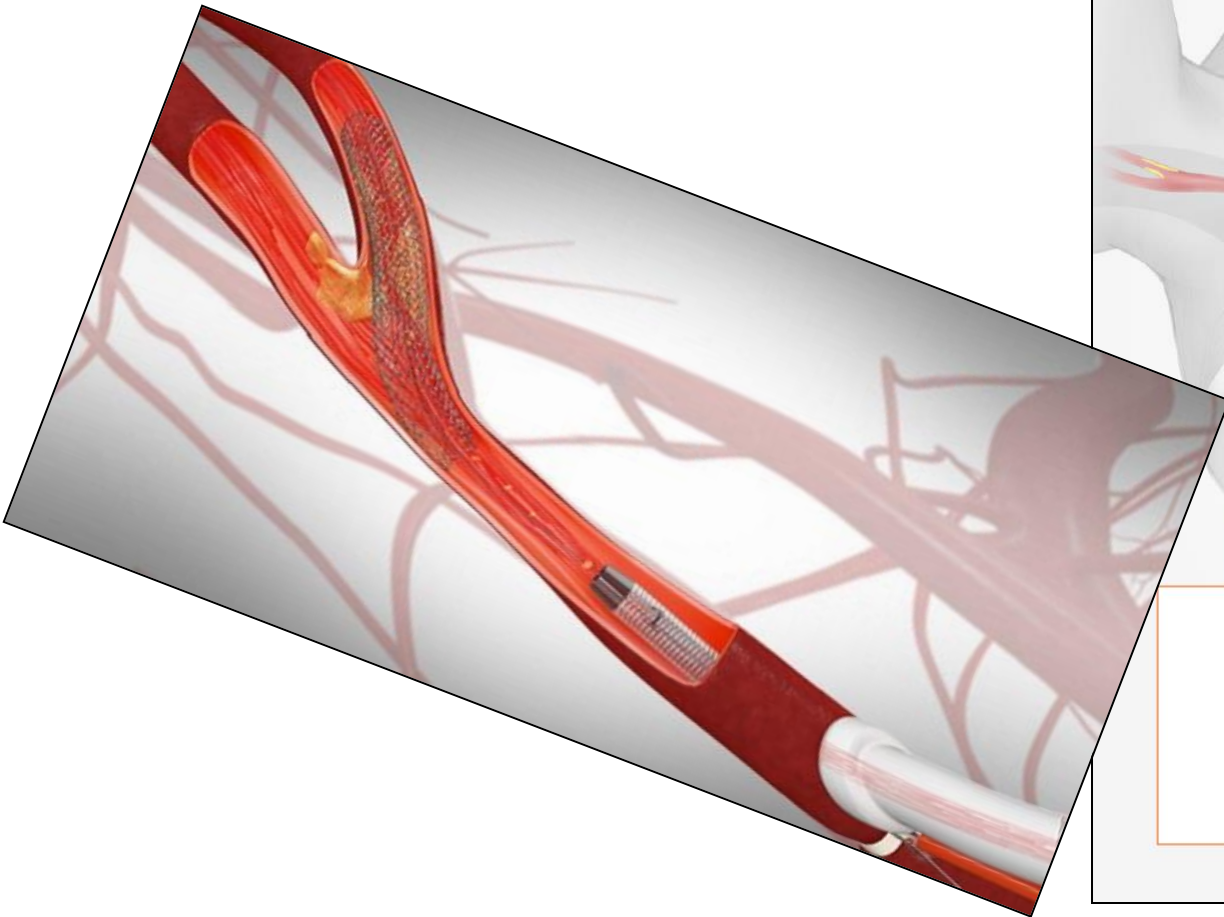
- Medical comorbidities with high anesthesia risk  
(i.e. heart failure, unstable angina, recent MI, COPD, advanced age)
- Contralateral occlusion (+/- critical stenosis, incomplete Circle of Willis)
- Anatomically unfavorable  
(i.e. high or low bifurcation, “kissing” retropharyngeal carotids, tortuosity)
- Prior CEA with re-stenosis
- Prior neck radiation
- Contra-lateral vocal cord paralysis

*Time for a  
stent!*

# An Algorithm for management of carotid stenosis

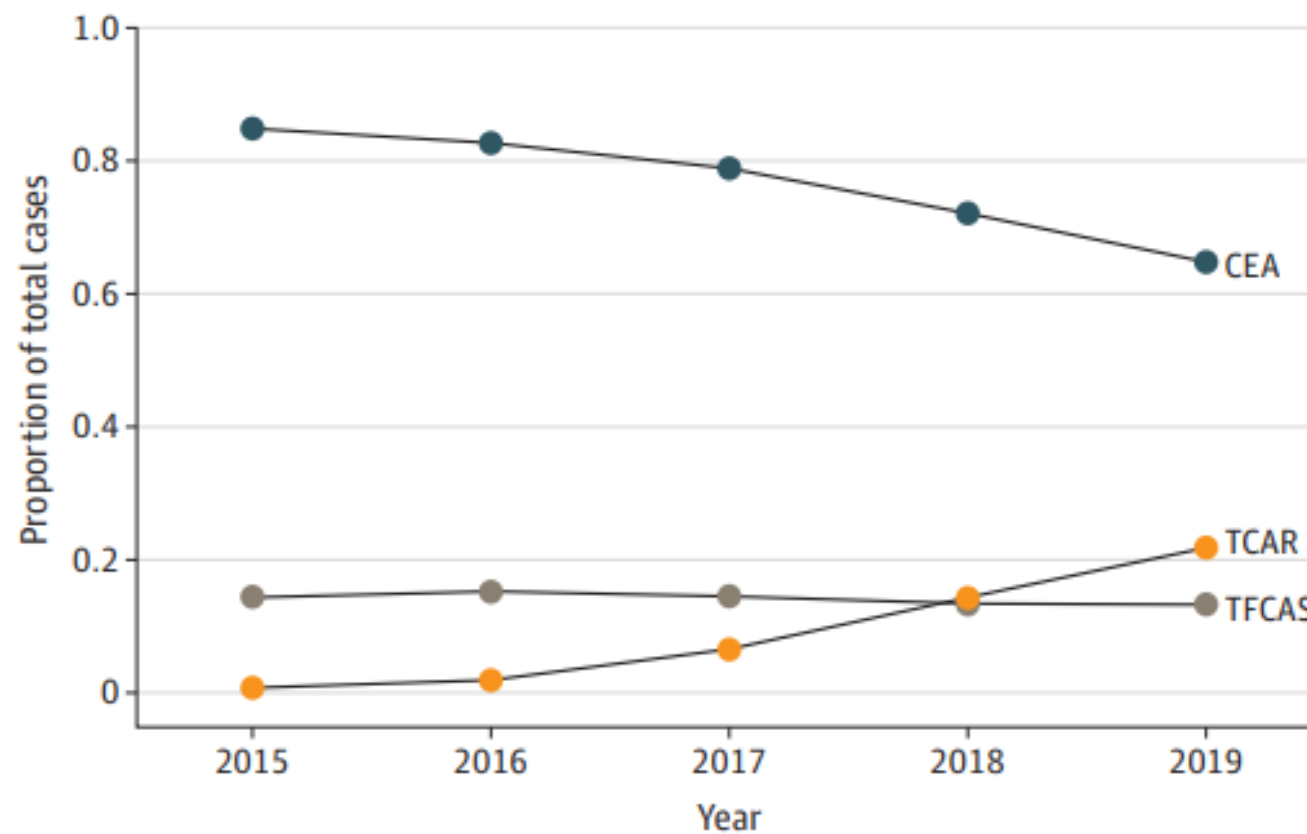


# Trans-Carotid Revascularization



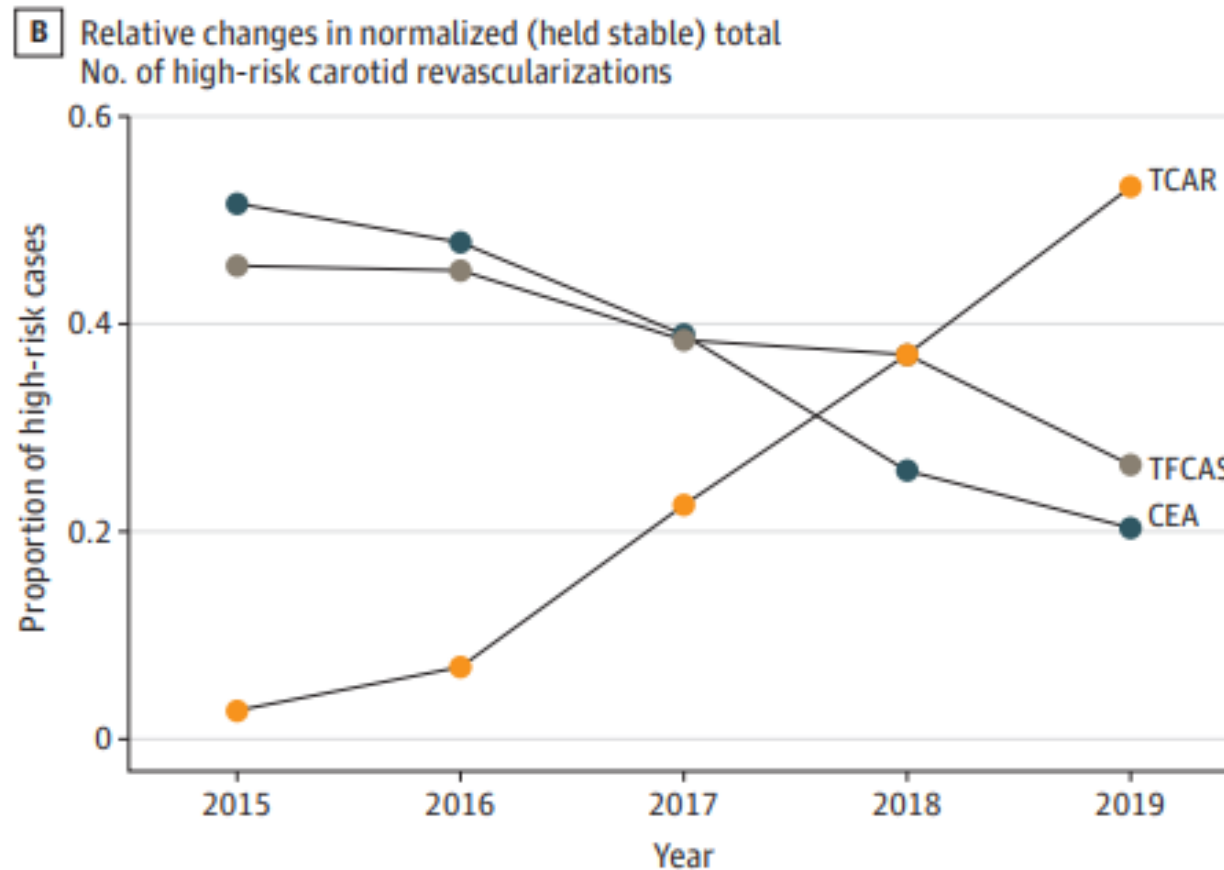
# Trends in Carotid Revascularization (Total cases up to 2019)

**B** Relative changes in normalized (held stable) total No. of carotid revascularizations

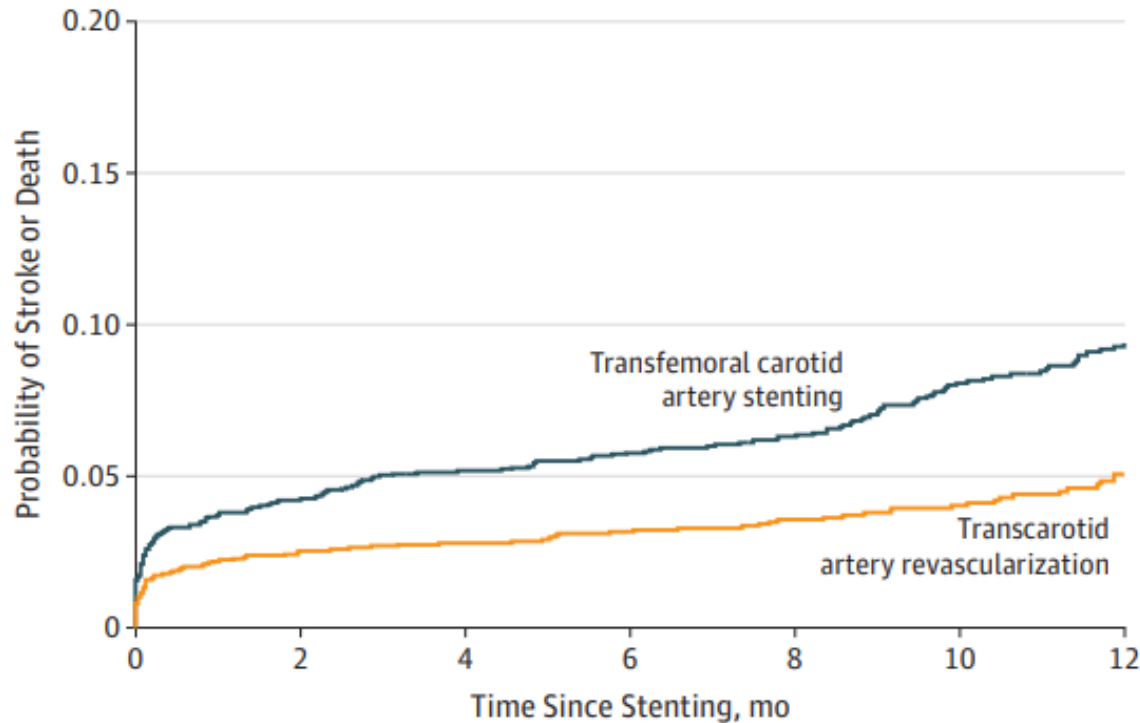




# Trends in Carotid Revascularization (High Risk cases up to 2019)



# But is TCAR really better than CEA or CAS?



- All TCAR data is collected in Vascular Quality Initiative – TCAR Surveillance Project (VQI-TSP).

## Schermerhorn et al (2019) JAMA

- Compared well-matched patients with TCAR (n = 3285) to patients with tf-CAS (n = 3285)
- In-hospital stroke or death
- Stroke or Death at 1 month and 1 year
- Stroke ... Death ... MI ... TIA

# But is TCAR really better than CEA or CAS?

Outcome (1y)	TCAR (%)	tf-CAS (%)
Stroke or Death	1.6	3.1
Stroke	1.3	2.4
Death	0.4	1.0

- Differences significant only for symptomatic patients.
- No difference in Stroke / Death for asymptomatic patients.

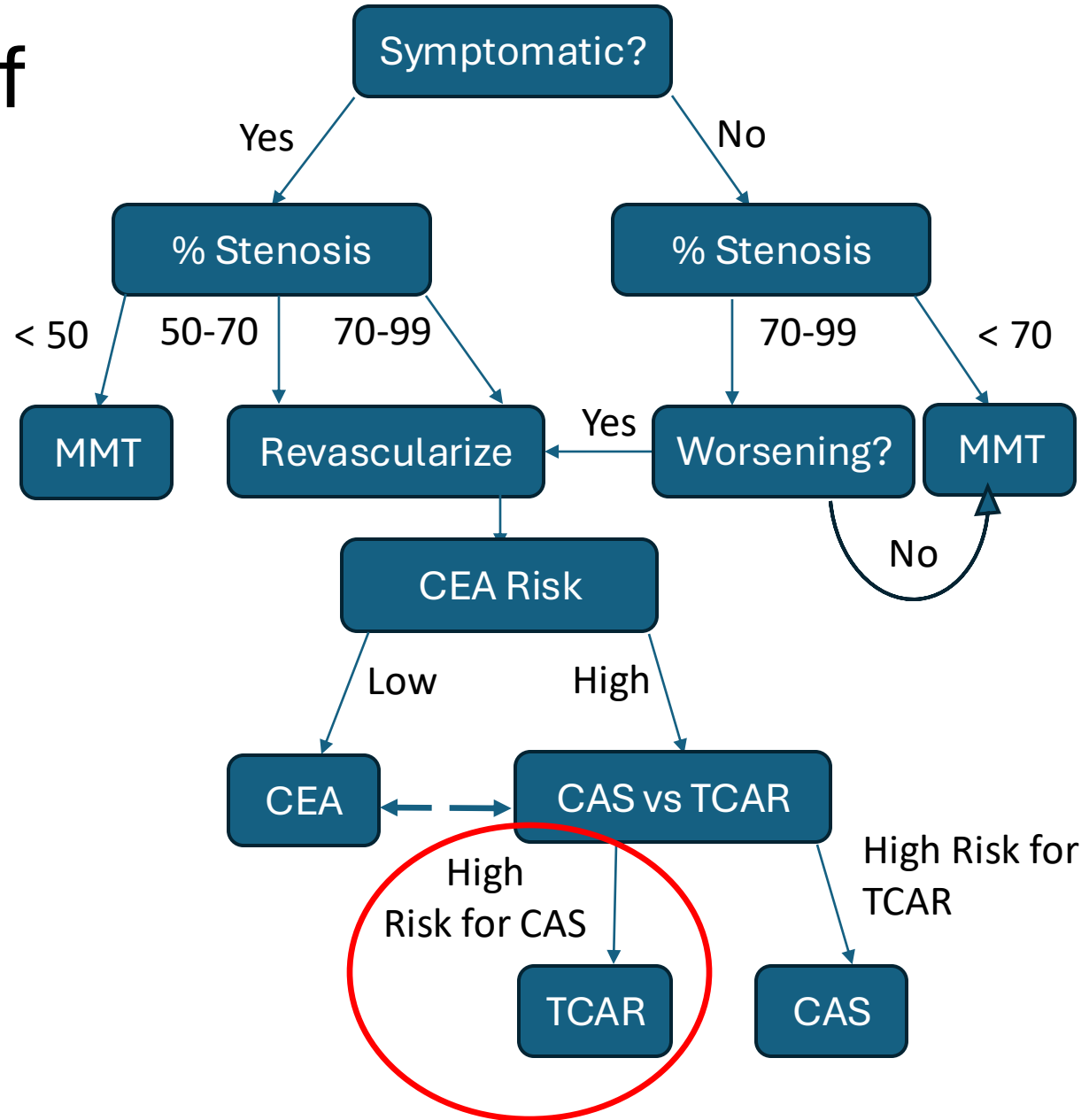
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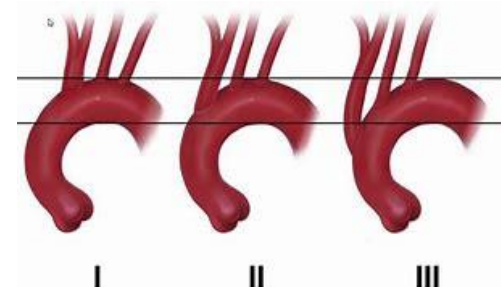
Still no randomized trials of TCAR vs tf-CAS

# An Algorithm for management of carotid stenosis

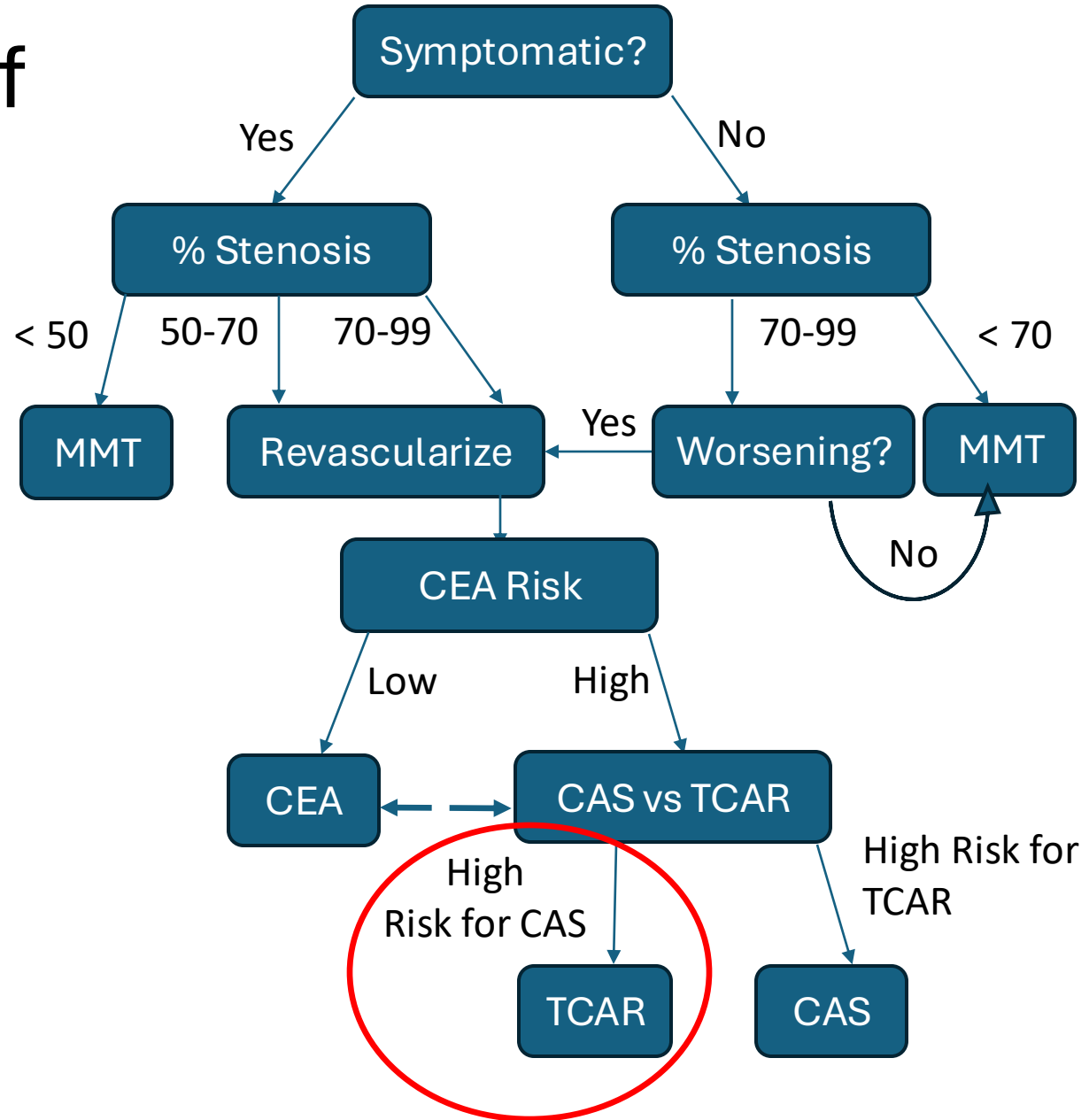


# High risk features for tf-CAS

- Poor vascular access
- Heavily calcified or Type III aortic arch
- Circumferential calcification – incr. thrombotic risk / can't widen lumen
- Bleeding disorder (may not tolerate DAPT)
- Intraluminal thrombus along lesion (high risk for CEA and TCAR as well)



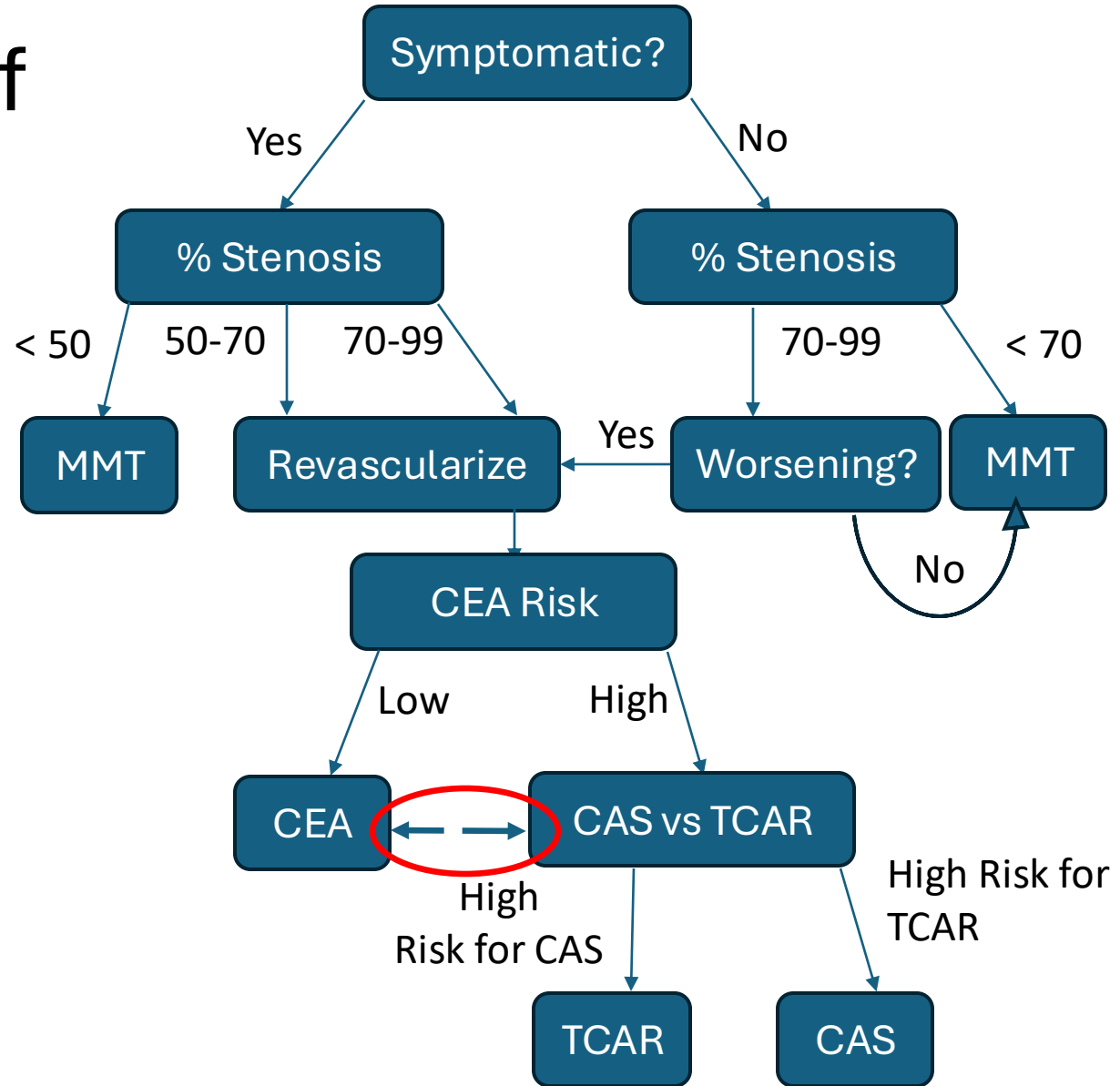
# An Algorithm for management of carotid stenosis



# Too High risk for TCAR??

- Previously radiated neck (still need to do a cut down)
- Short distance between clavicle and carotid bifurcation
- Bleeding disorder (may not tolerate DAPT)

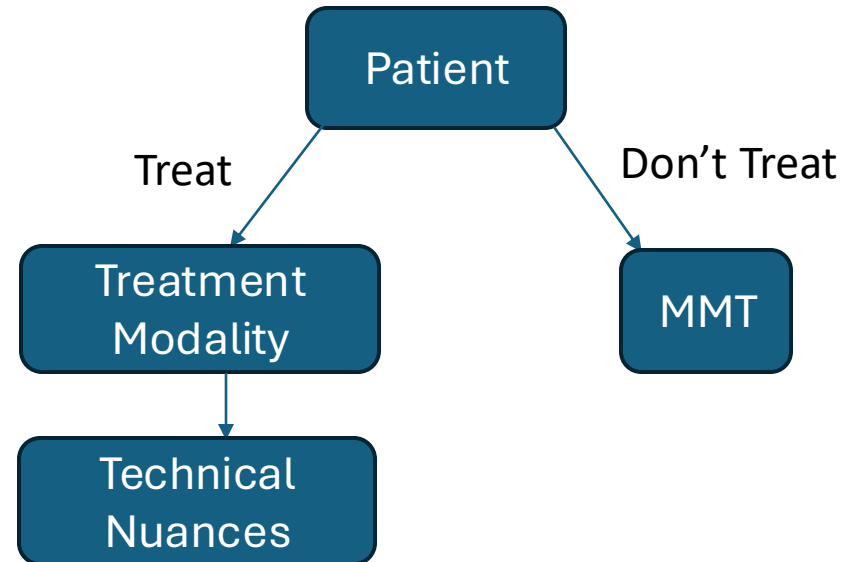
# An Algorithm for management of carotid stenosis



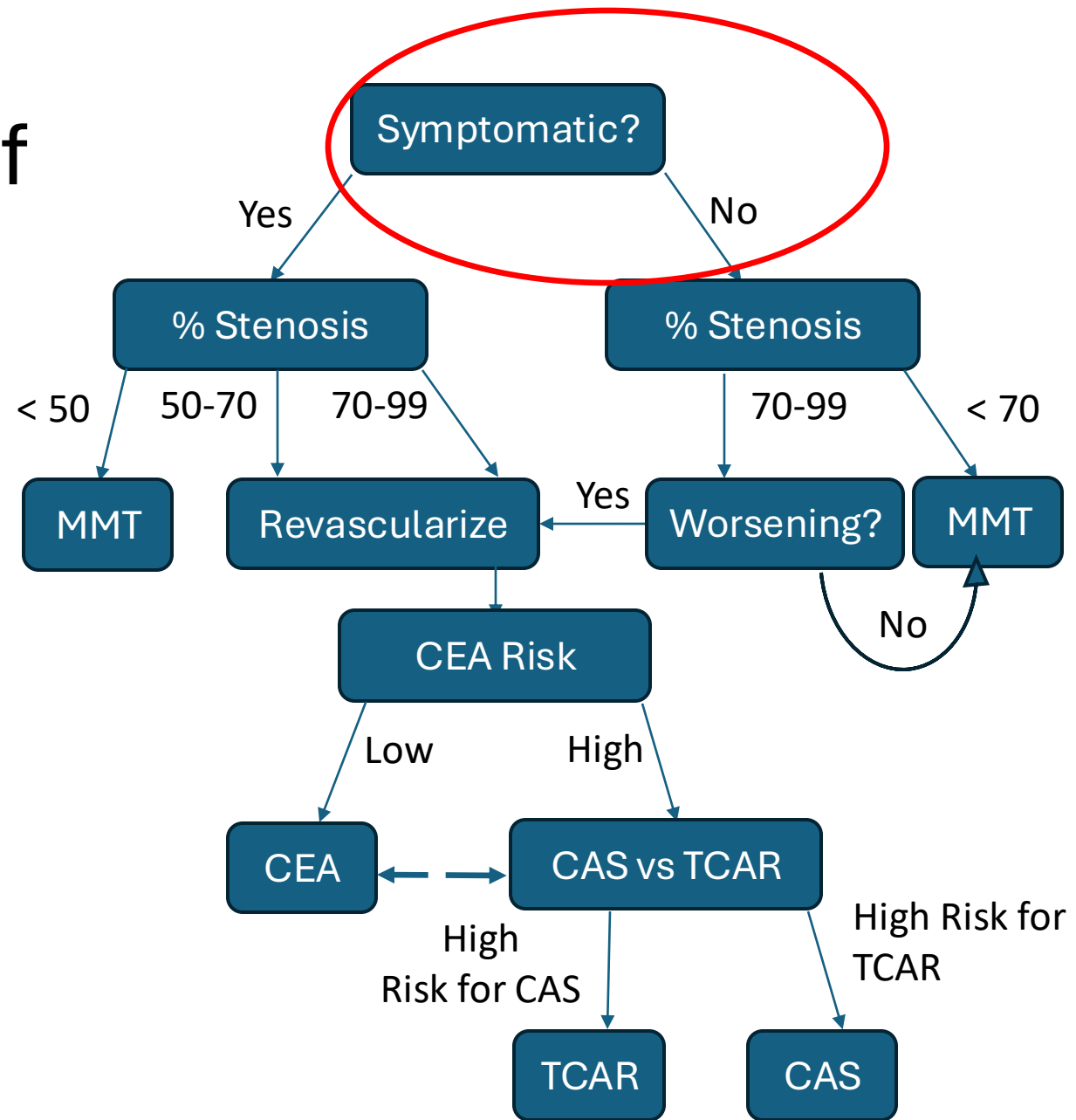


# Multidisciplinary approach is best

- Weekly Multidisciplinary Cerebrovascular Case Conference
- Virtually every elective case is discussed (carotid, aneurysm, AVM)
- Interventional Neurology
- Endovascular Neurosurgery
- Open vascular Neurosurgery
- Vascular Neurology
- Fellows, Residents, APPs



# An Algorithm for management of carotid stenosis



# Patient MB

- 78yo F with HTN
- Completely asymptomatic
  - No Stroke / TIA, no Amaurosis
- Severe focal sub-occlusive stenosis up to 90% by CTA
- Short distance btw clavicle and bifurcation (No TCAR)



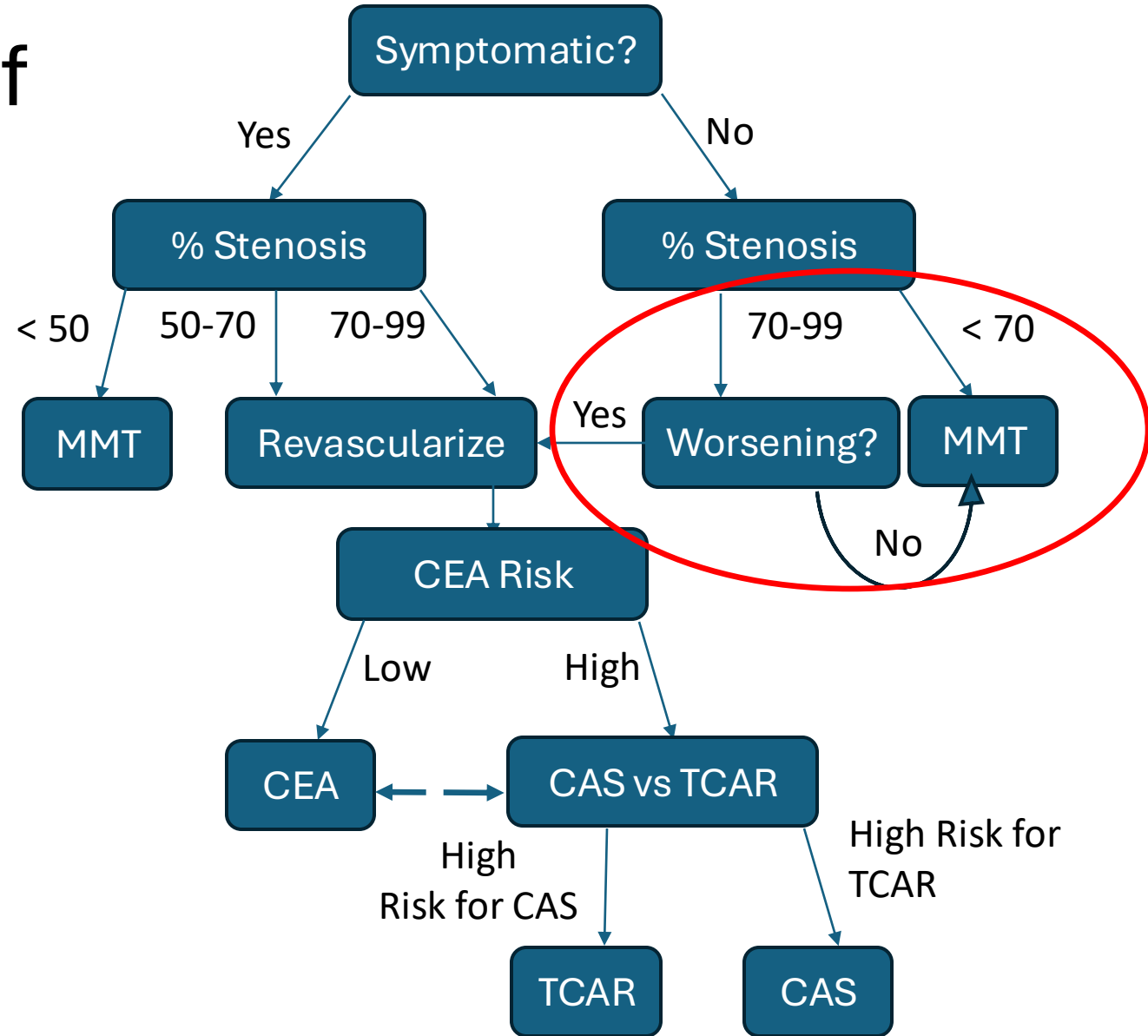


Before



After

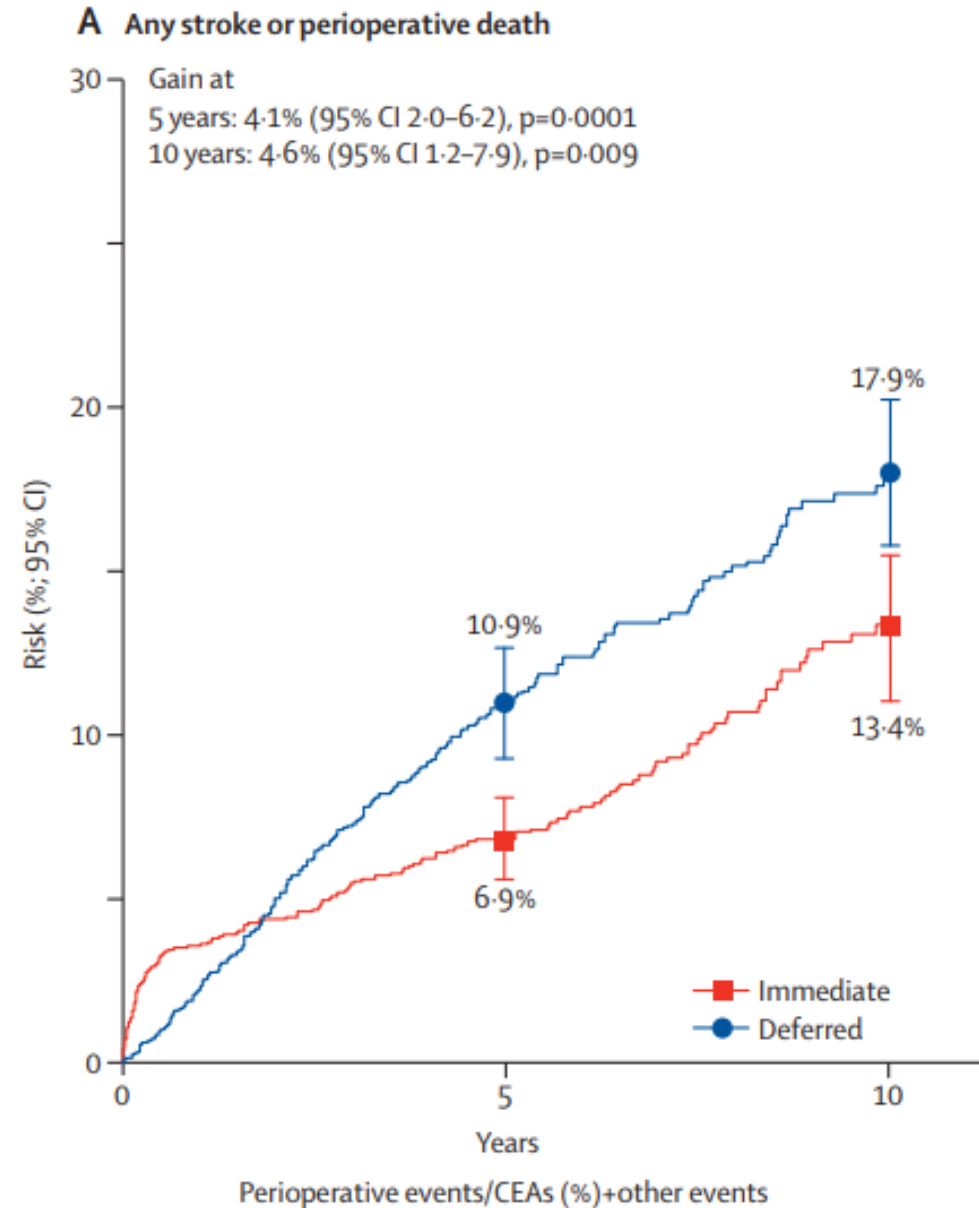
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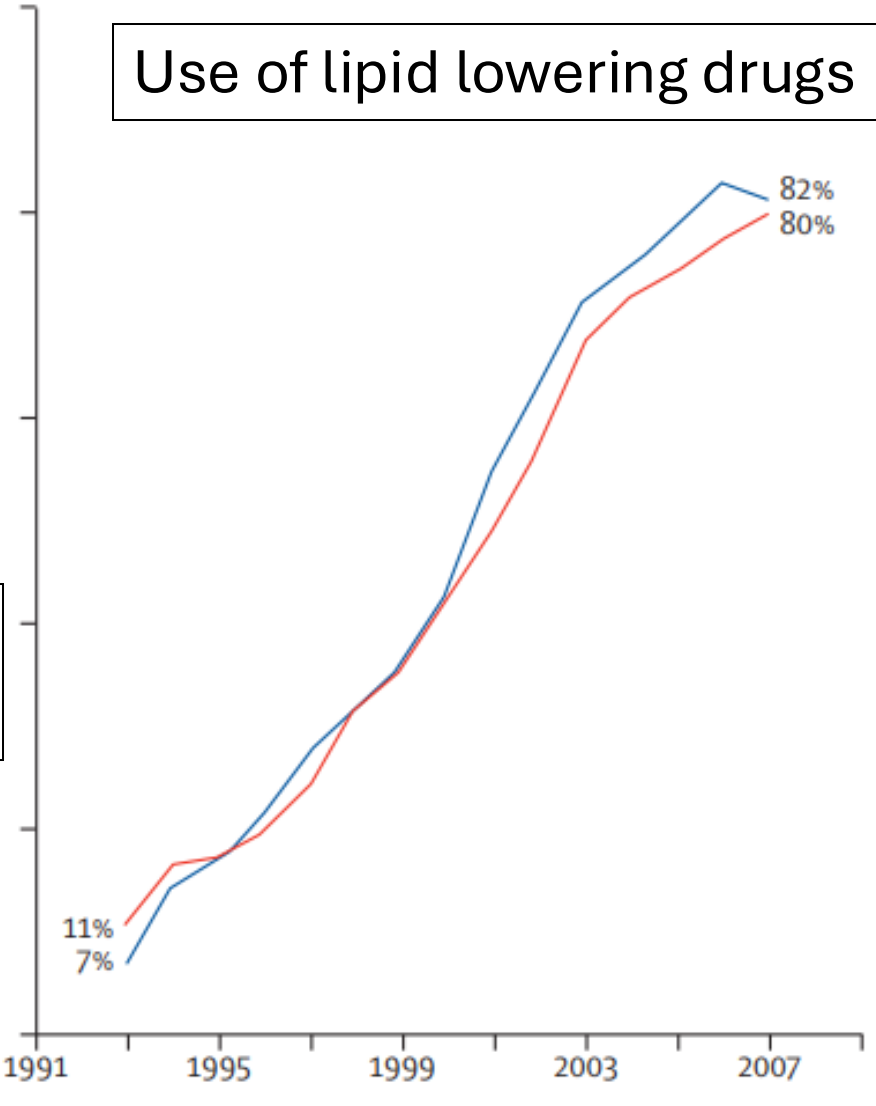
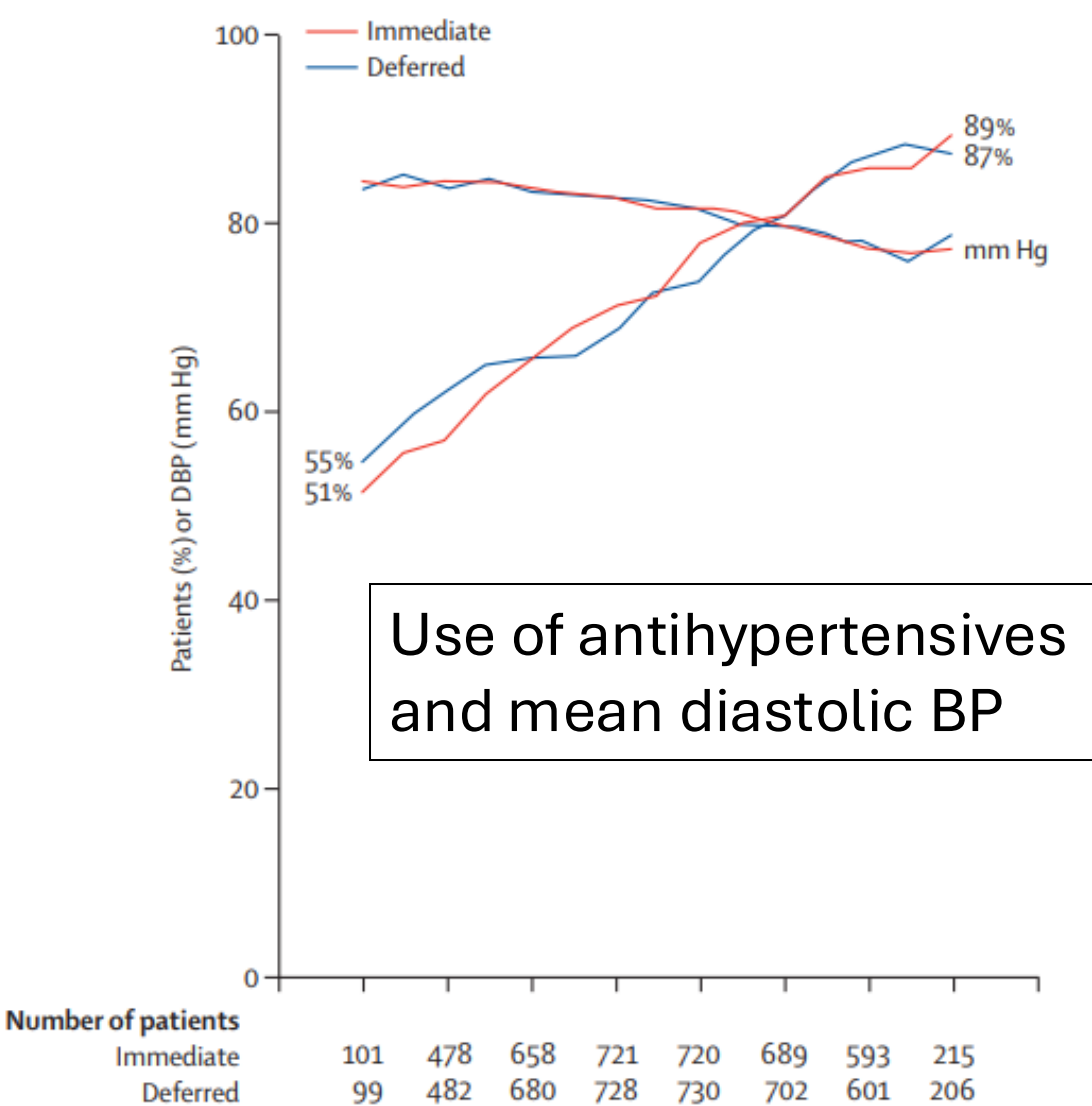
# ACST – 1 Trial

- 3120 asymptomatic pts (years 1993-2003)
- “Generally >60% stenosis”
- Randomized to ‘immediate CEA’ versus ‘deferred CEA’ until symptoms developed or patient / MD changed their mind
- Patients followed for 10y for “any stroke / perioperative death”

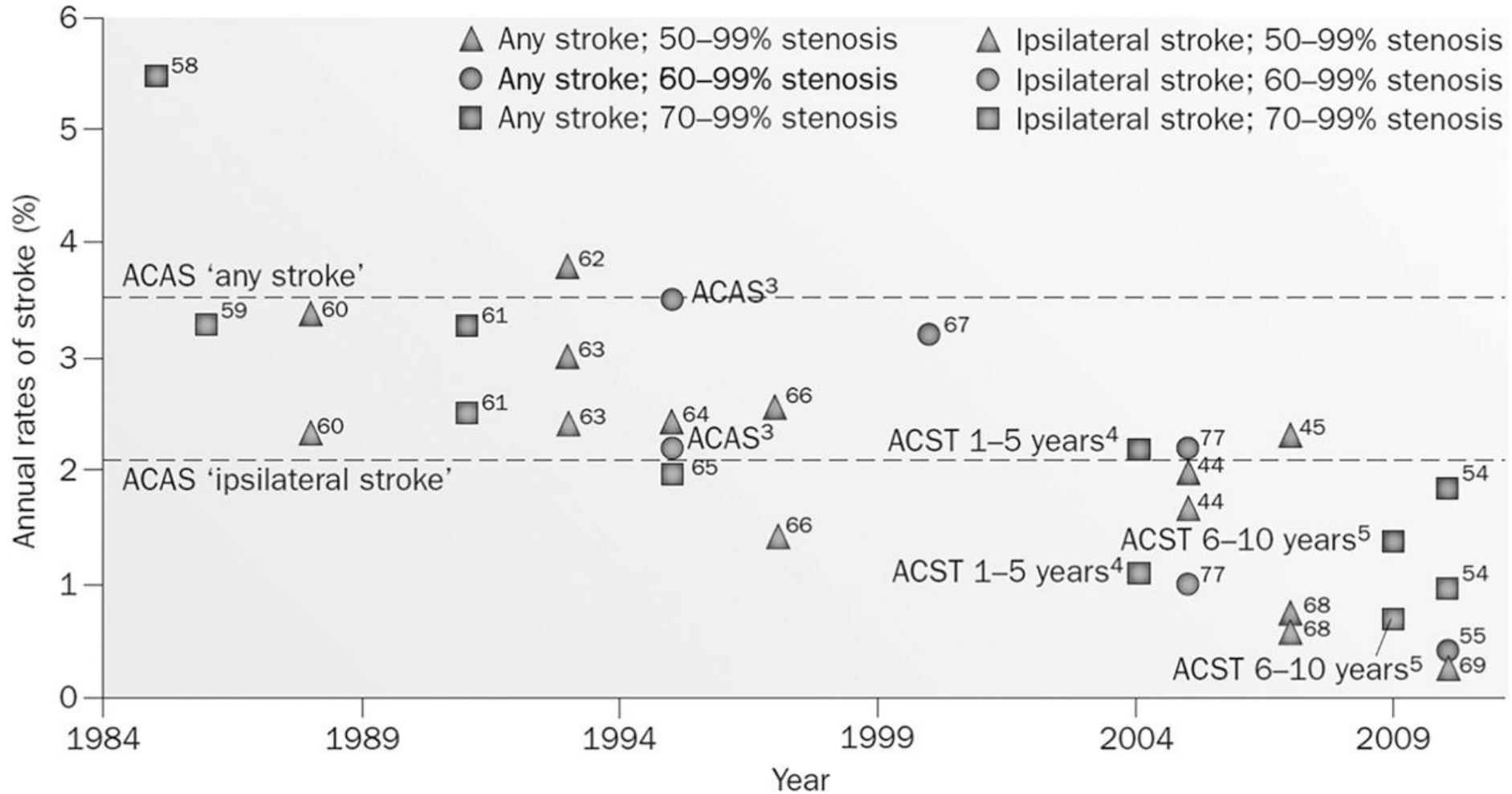
Lancet 2010; 376: 1074-84



# Medical stroke risk reduction improved



# Improvements in medical therapy continue to reduce stroke risk



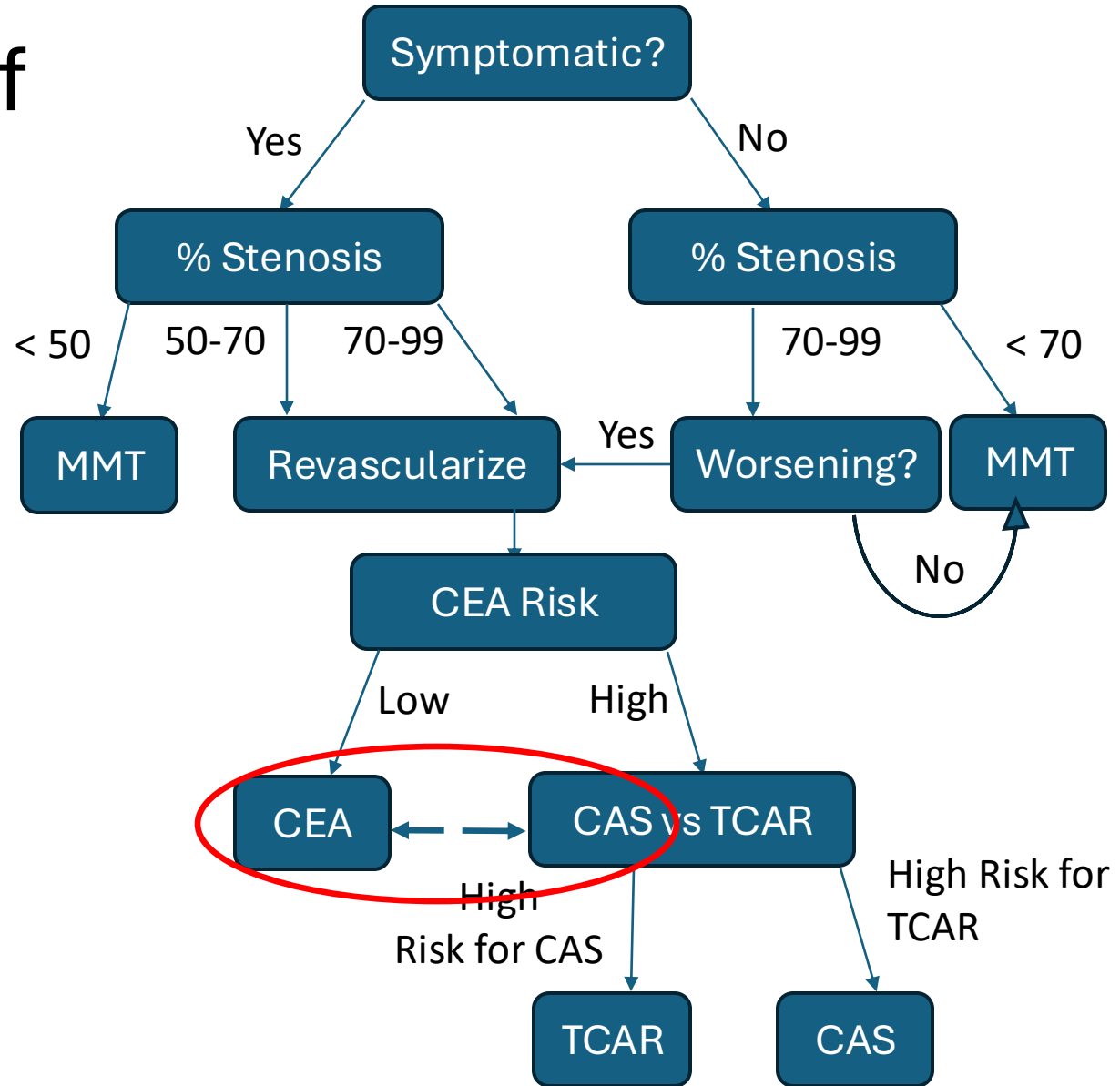


# I don't rush into treating asymptomatic patients

- Medical treatments for stroke are quite effective
- Risk / Benefit ratio in asymptomatic patients is less favorable
- Monitor for worsening with serial imaging
- MRI Brain to look for asymmetric sub-clinical ischemia

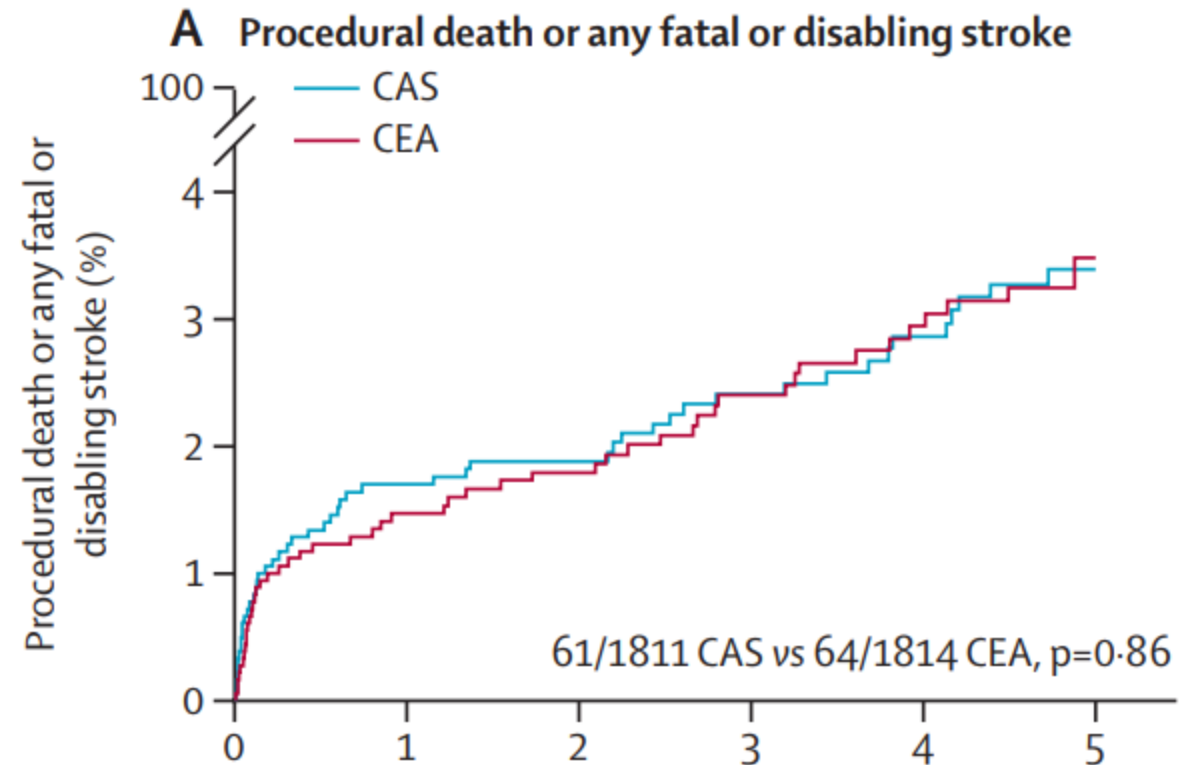
**EXCEPTION: Post-radiation vasculopathy – poor natural history**

# An Algorithm for management of carotid stenosis



# ACST-2 Clinical Trial

- 3625 asymptomatic patients, “severe unilateral or bilateral carotid stenosis (generally 60% or higher)”
- Randomized to CAS vs CEA
- No significant difference between CEA and CAS





National Coverage Analysis (NCA)

Decision Memo

## Percutaneous Transluminal Angioplasty (PTA) of the Carotid Artery Concurrent with Stenting

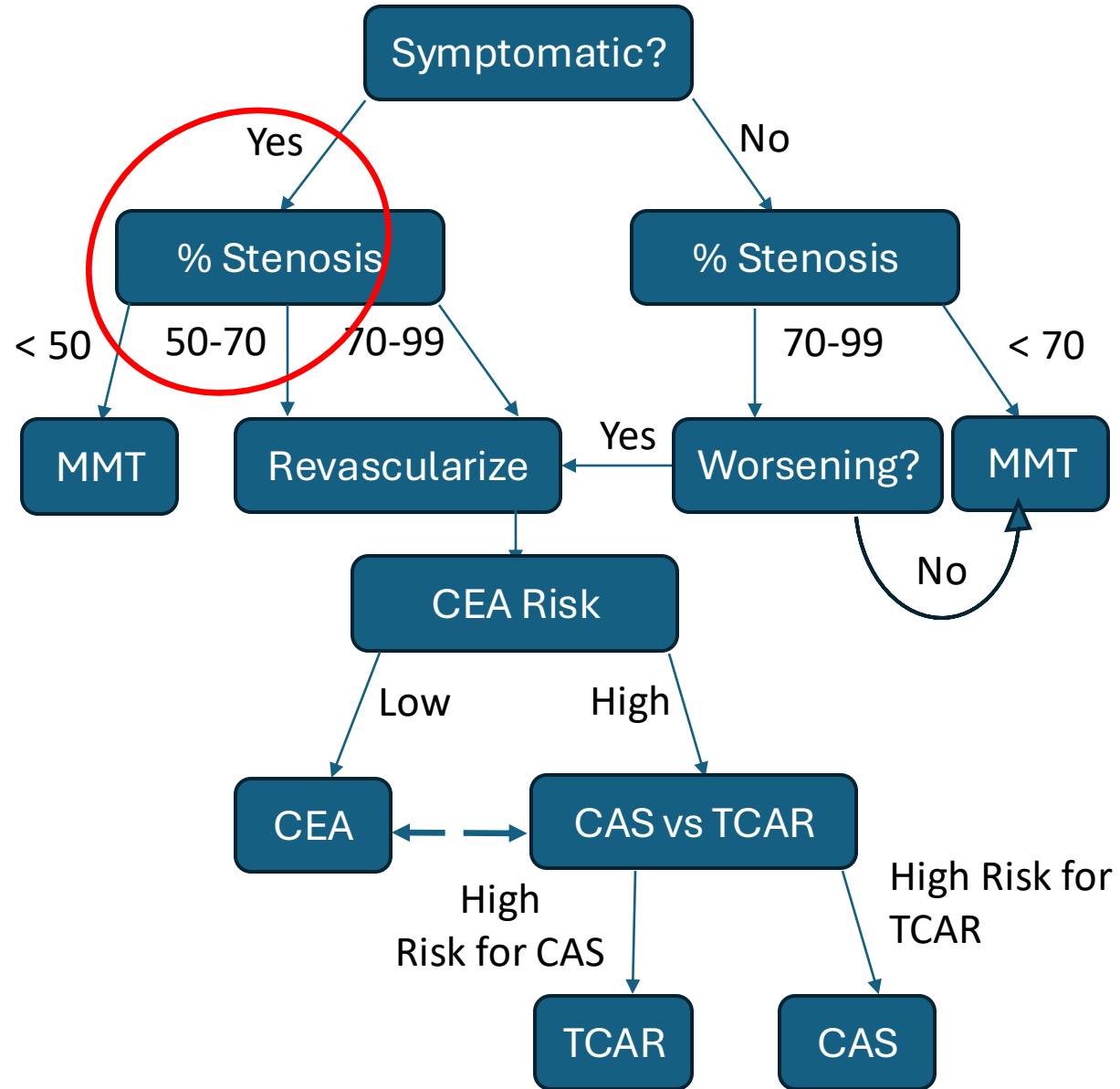
Previously only >70%

- A. Patients with symptomatic carotid artery stenosis  $\geq 50\%$ ; and
- B. Patients with asymptomatic carotid artery stenosis  $\geq 70\%$ .

Previously only if part of a trial

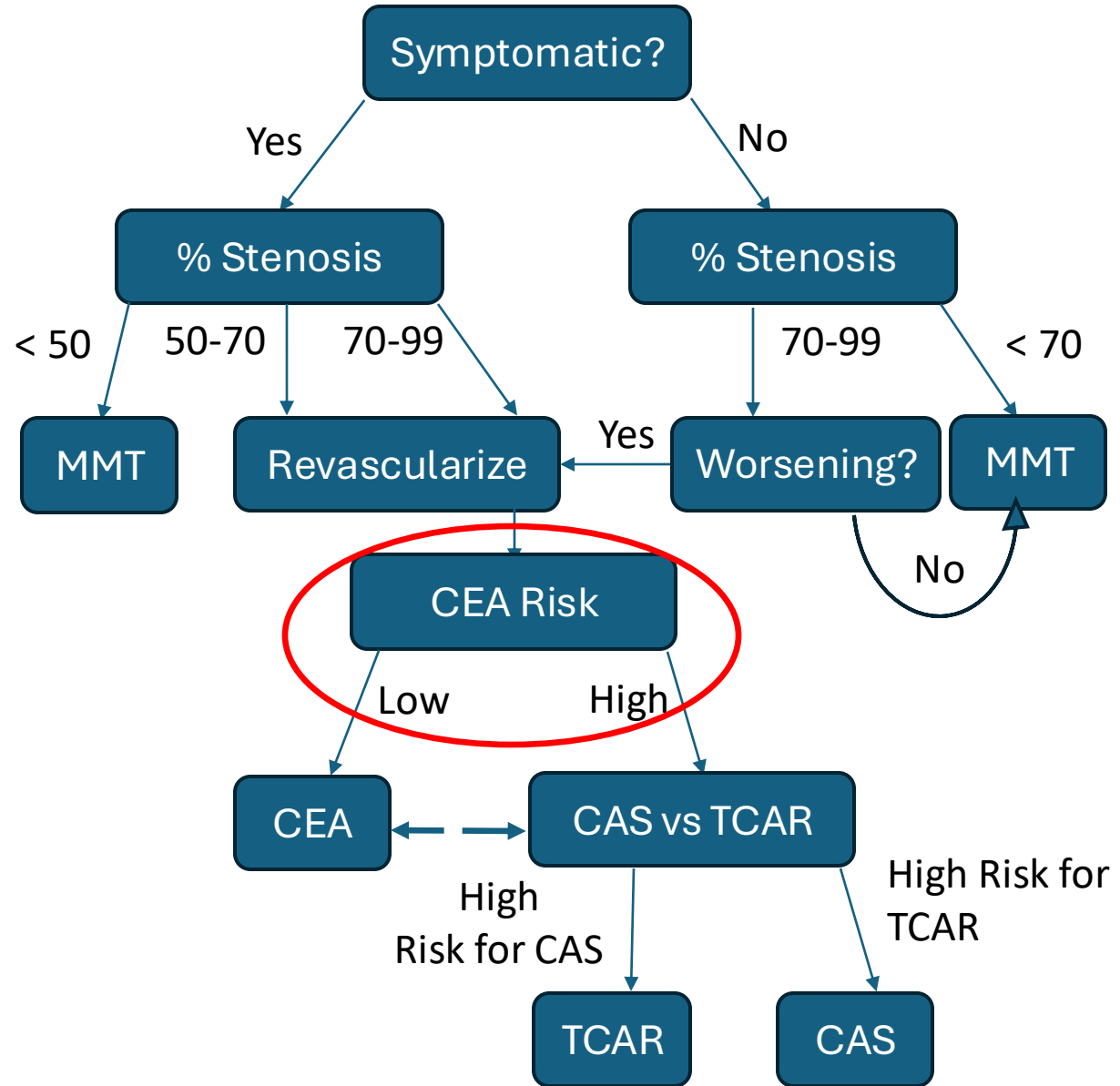
1. Expanding coverage to individuals previously only eligible for coverage in clinical trials;
2. Expanding coverage to standard surgical risk individuals by removing the limitation of coverage to only high surgical risk individuals;

# Changes to Algorithm after CMS National Decision Memo





# Changes to Algorithm after CMS National Decision Memo

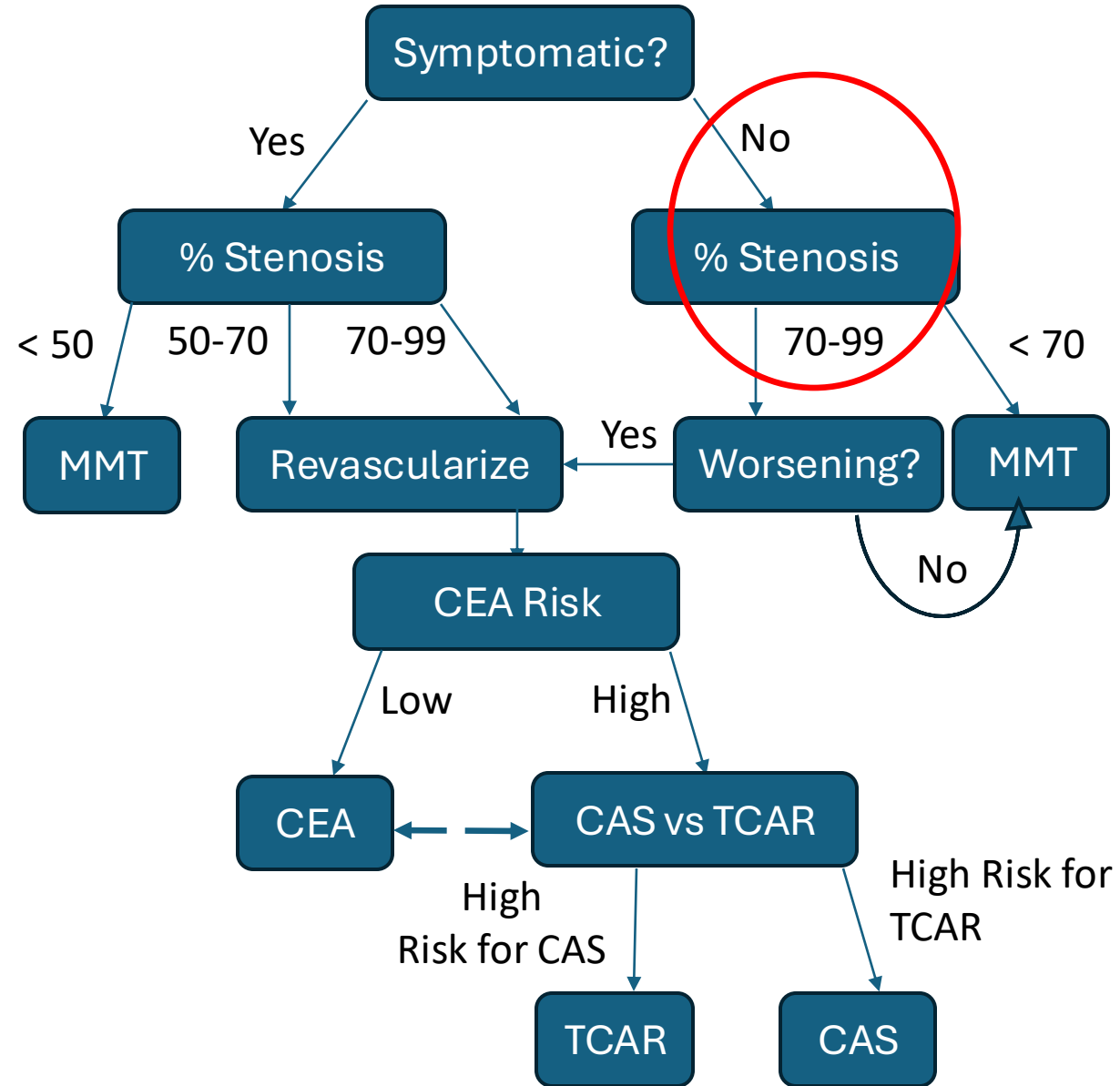


# We can now offer CAS for standard risk patients


- What CMS covers  $\neq$  what's right for every patient.
- Our preference for CEA > CAS for standard risk patients has NOT changed. **Multidisciplinary approach is best**
- CAS volume may increase but significant portion of that will be TCAR



# Changes to Algorithm after CMS National Decision Memo



# Now able to offer CAS for asymptomatic >70% stenosis without enrollment in clinical trial

- No CAS-clinical trial available to us. CREST-2 registry difficult to access.
  - Before: Cleared each non-coverage case with hospital administration. Always 
  - Now, OK to stent
- But is it the right thing to do? (what CMS covers ≠ what's right for patient)



Thank you!

Can't wait for our case discussions  
during breakout sessions