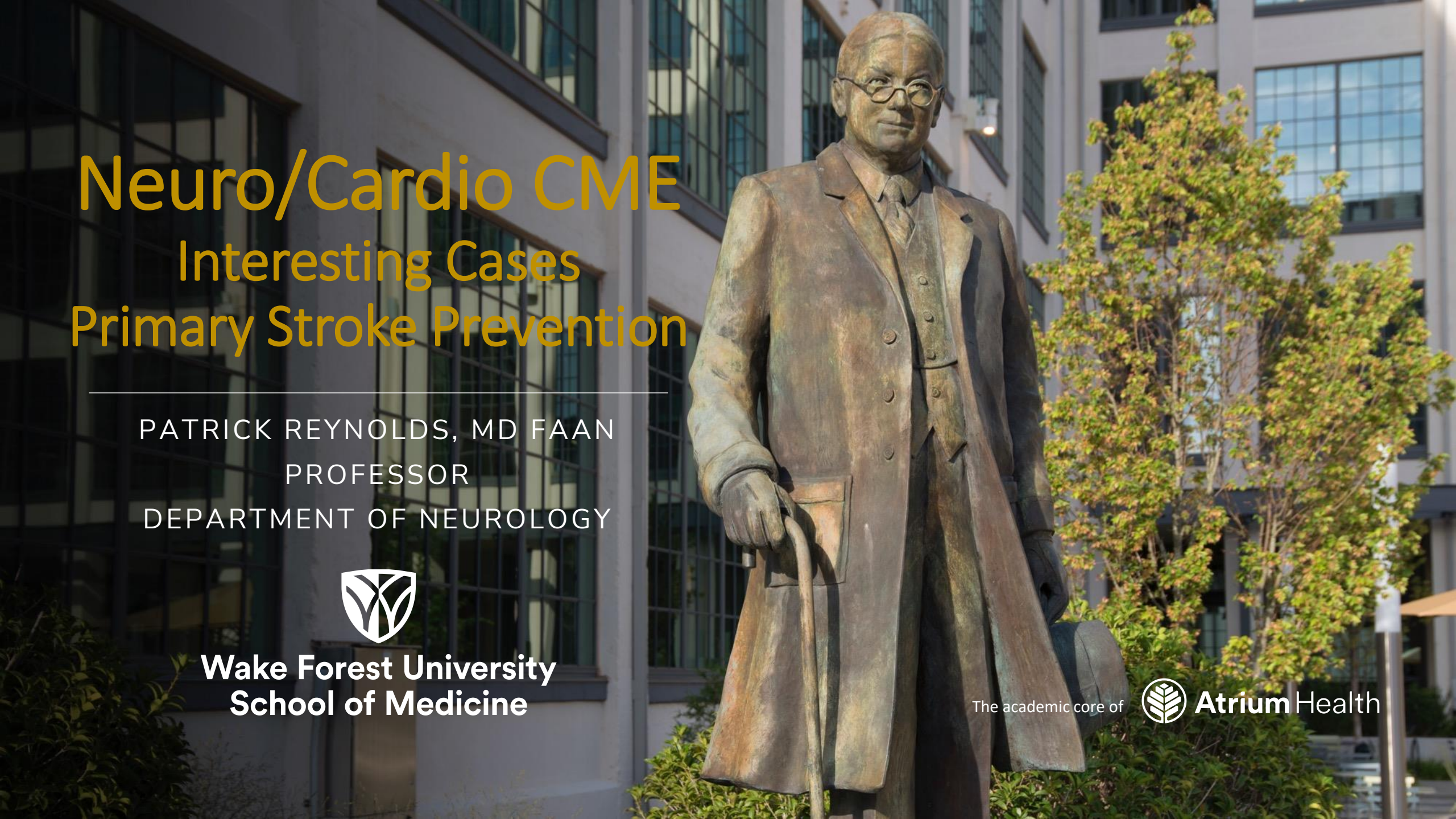

Neuro/Cardio CME

Interesting Cases
Primary Stroke Prevention

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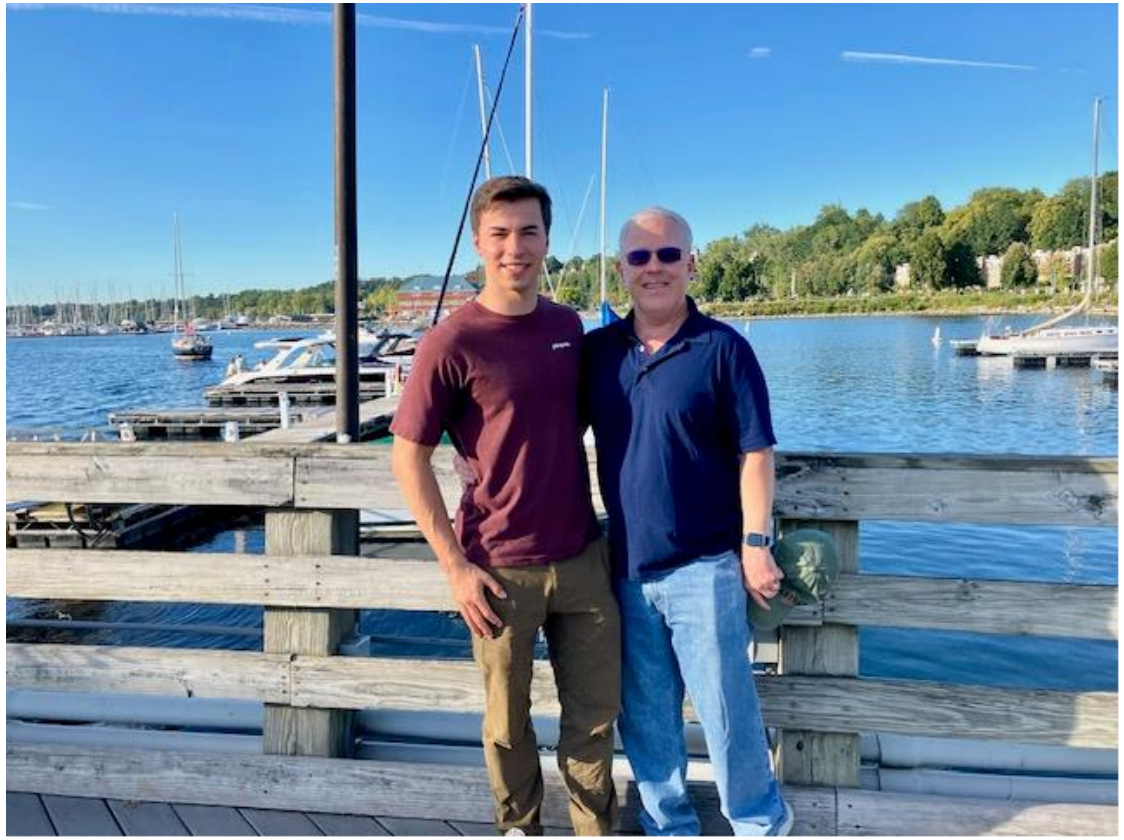
Wake Forest University
School of Medicine

The academic core of Atrium Health

Disclosures

- I have nothing to disclose



Outline

- Interesting Case discussions
  - Cryptogenic stroke management
  - Basilar thrombosis management conundrums
  - Is that carotid really occluded??
  - To intervene or not to intervene?
- Primary Prevention of Stroke – Overview of the new primary stroke prevention guidelines from the AHA

Case 1

- 80 y/o woman
- A-fib on apixaban, cardioversion 1 day PTA
- Presented to OSH with left-sided weakness and dysarthria and “altered LOC.”
- NIHSS ~ 8

80 y/o woman

Outside CTA
Distal Basilar thrombus

Case 1 (80 y/o woman)

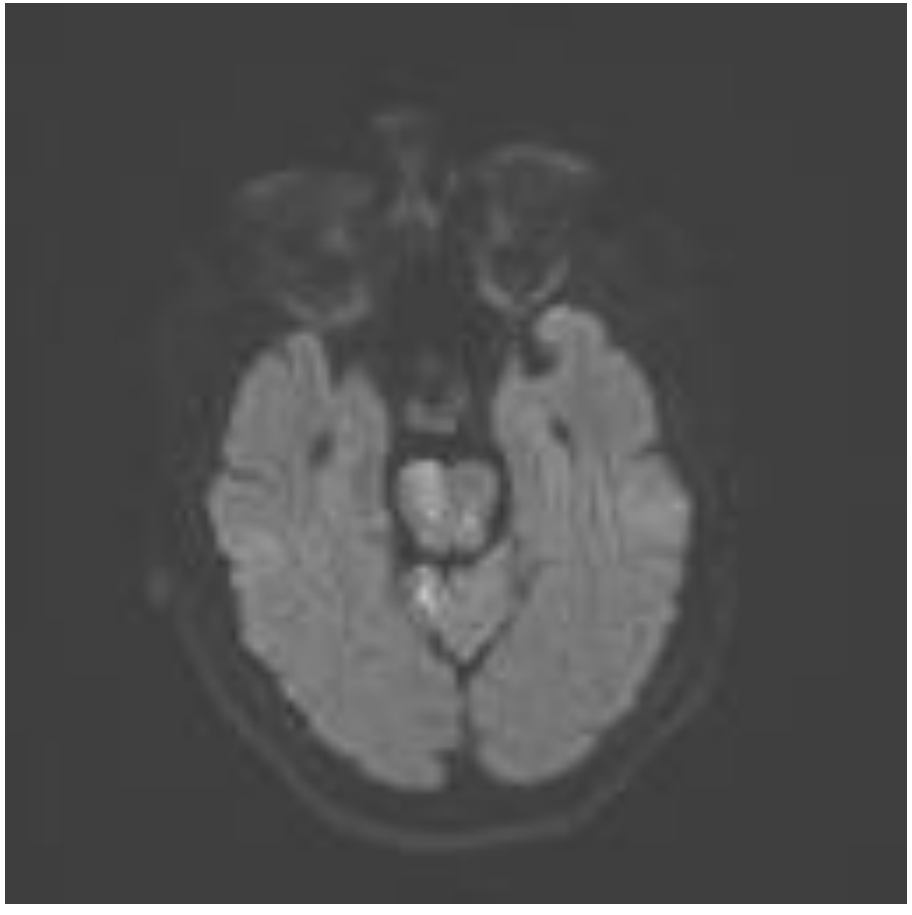
- Not a TNK candidate (on apixaban)
- Transferred to our hospital for possible thrombectomy
- Upon arrival her exam is much better with minimal dysarthria, mild left face droop and mild left arm drift.
  - NIHSS = 3

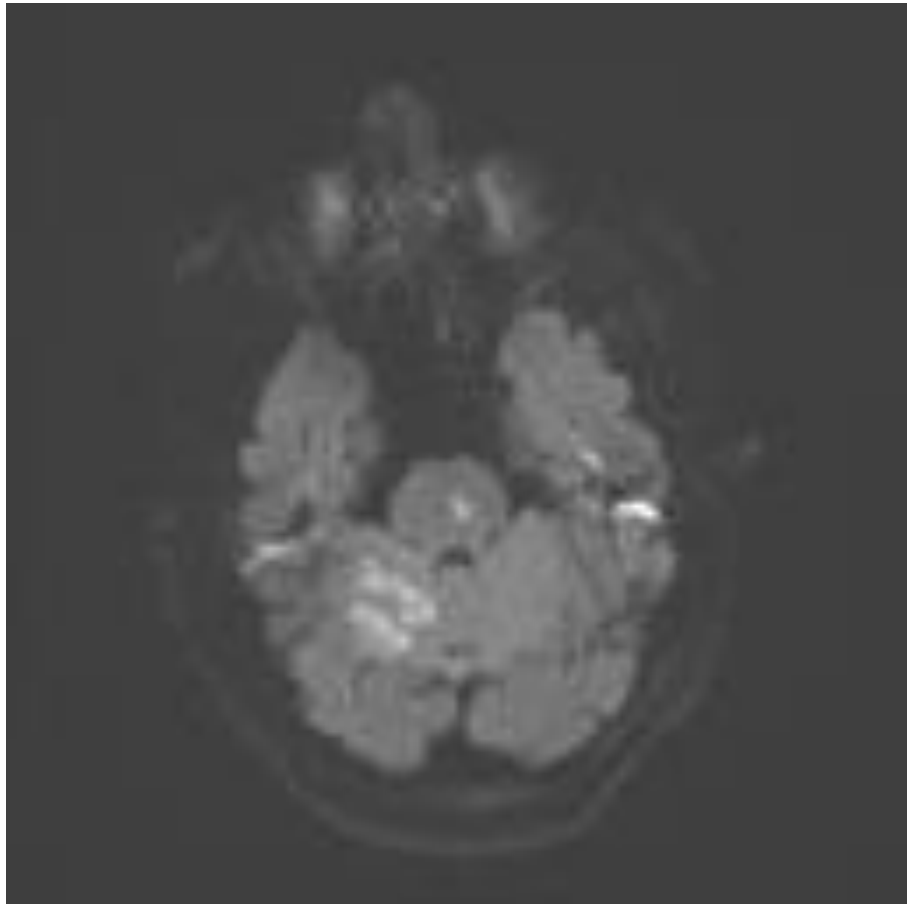
- What treatment would you recommend?

Case 1

- IR declined to intervene with low stroke scale and improving exam
- Patient admitted to the ICA on heparin gtt

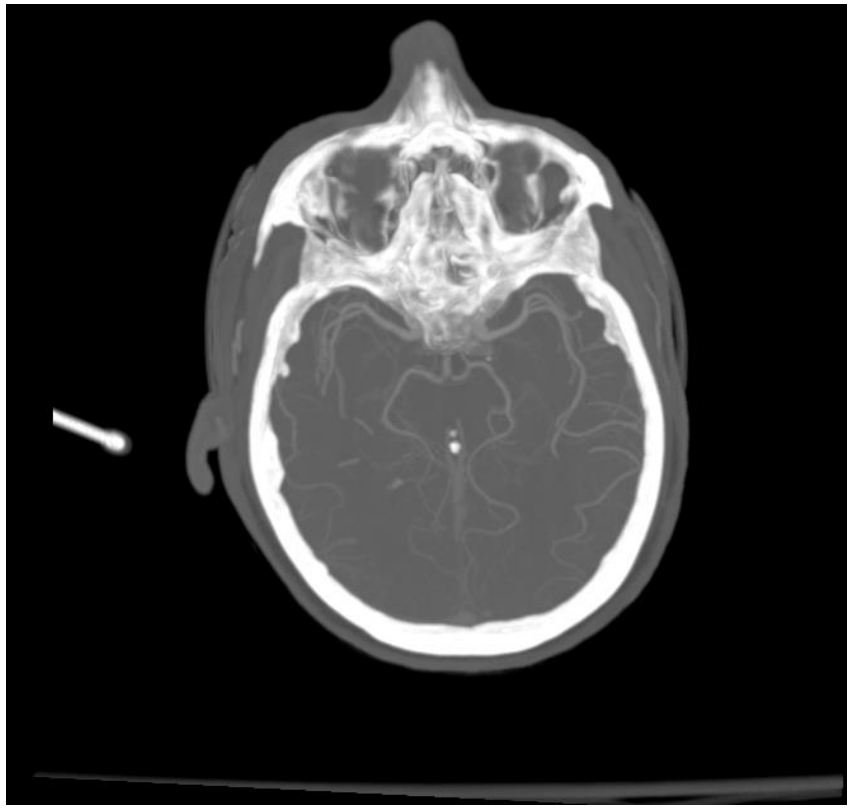
Case 1 MRI





Case 1

- About 12 hours into her hospitalization she develops worsening with left arm now plegic and worsened dysarthria. There were some issues about when this was noticed.



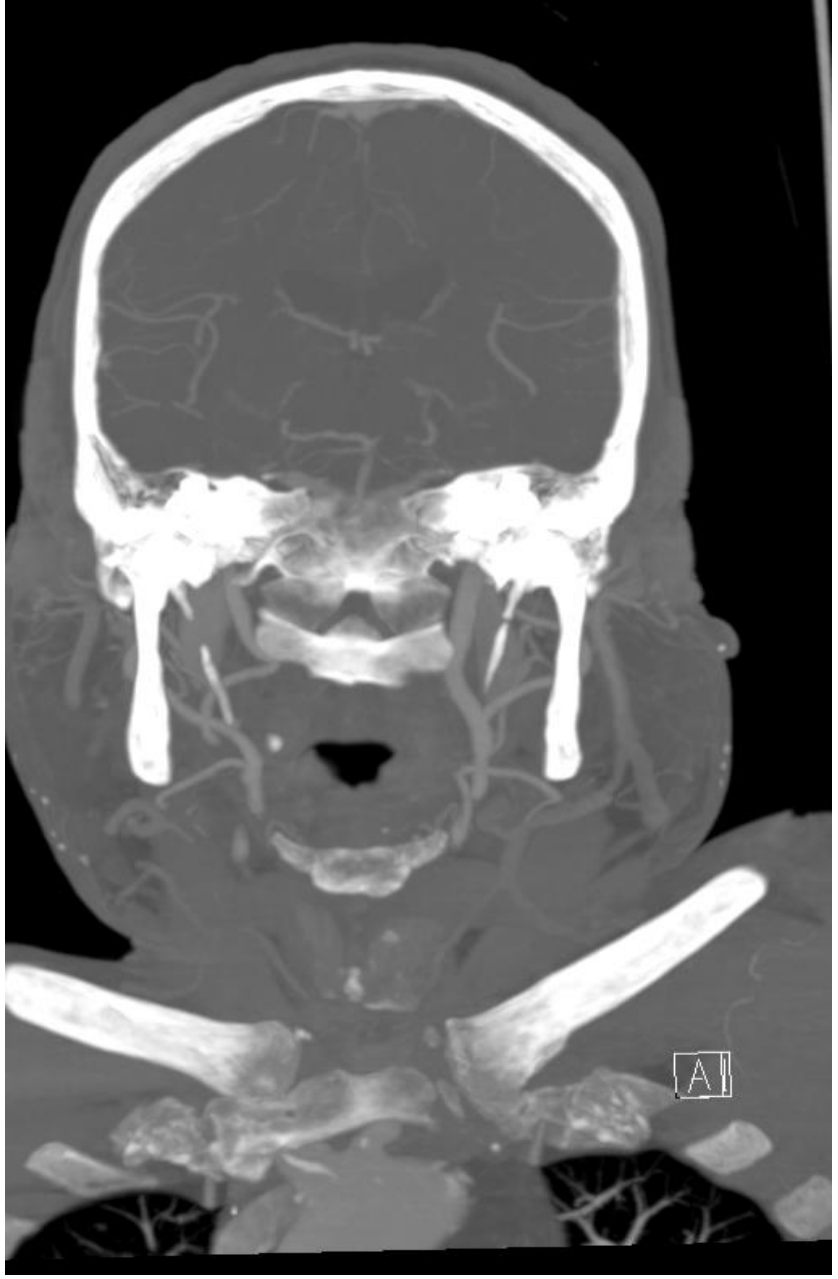
Looks like the clot has migrated a little bit and is now sitting at the top of the basilar. What do you do now?

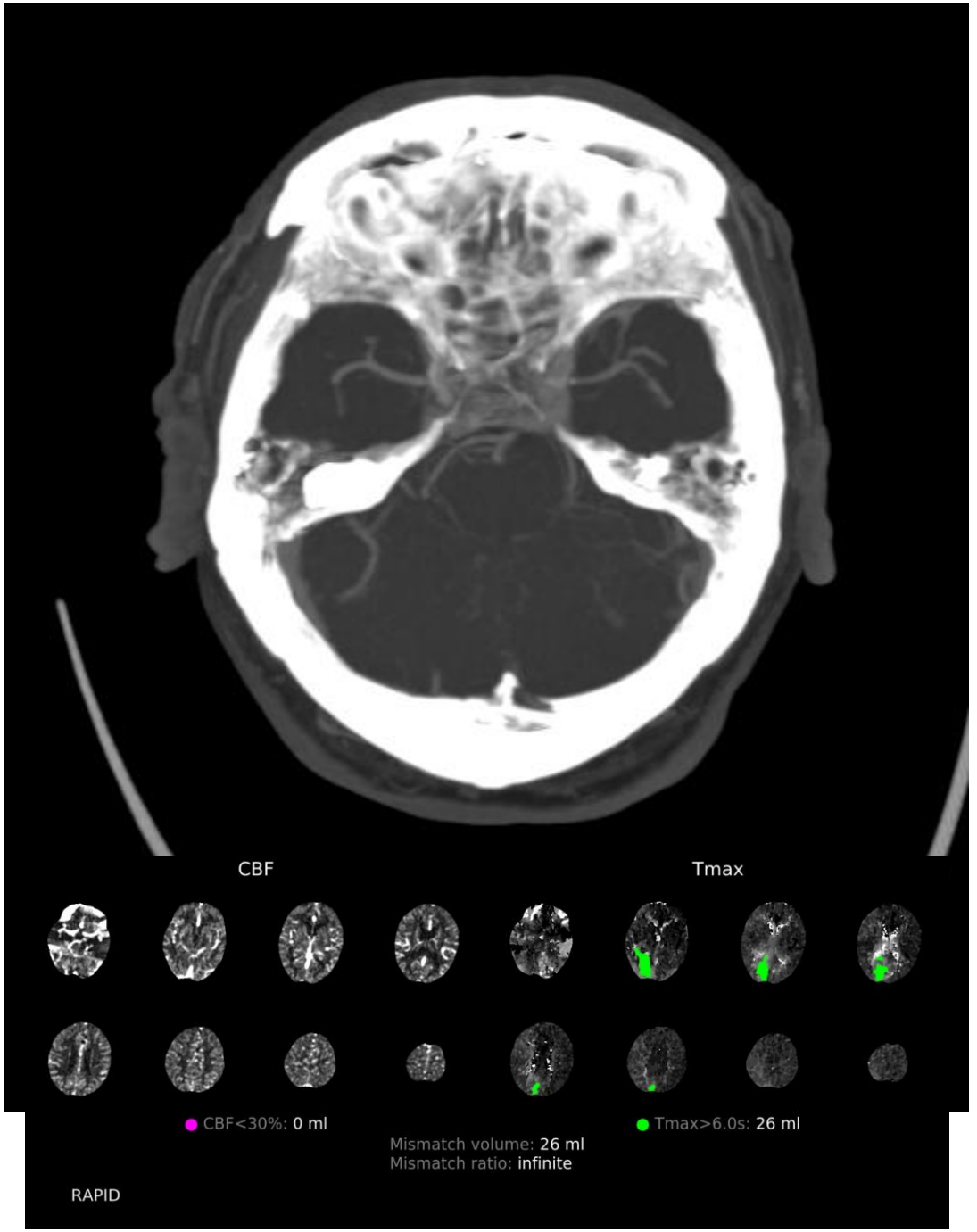
Case 1

- Again, IR consulted and again declined to intervene.
- Patient remained on heparin gtt.
- Ended up intubated due to pneumonia, had a retroperitoneal bleed, ended with trach and PEG and went to LTAC.
- Keep this patient in mind….

Case 2

- 81 y/o man
- H/O HTN, T2Dm, HLD
- Day PTA admission developed dizziness, N/V and trouble walking.
- The next afternoon, his friend took him to the ED because of his gait abnormality and he developed new left face droop, slurred speech, right gaze palsy while in the ED
- NIHSS ~ 10





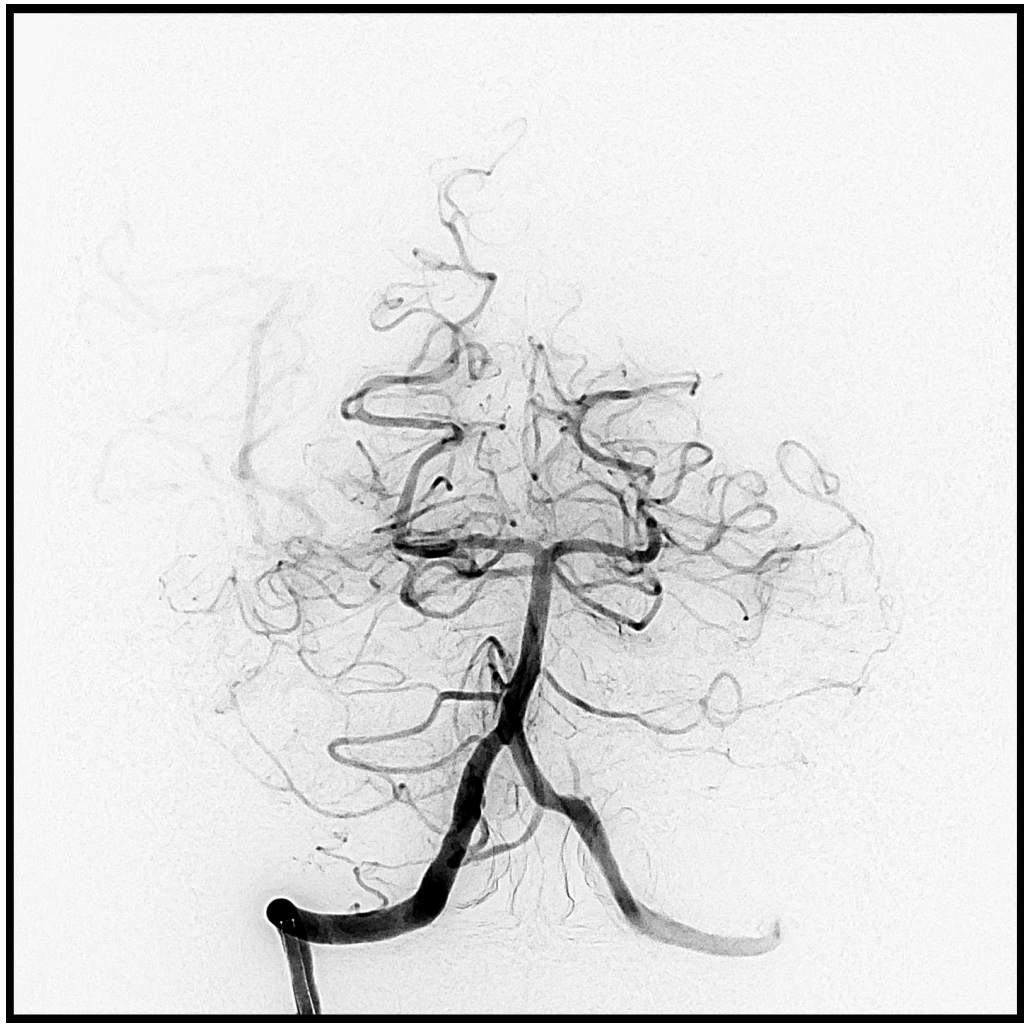
What treatment would you recommend?

Case 2

- Not a tPA candidate (symptoms started the night prior to admission)
- Consulted IR and patient taken to angio for thrombectomy

Case 2

Pre-thrombectomy

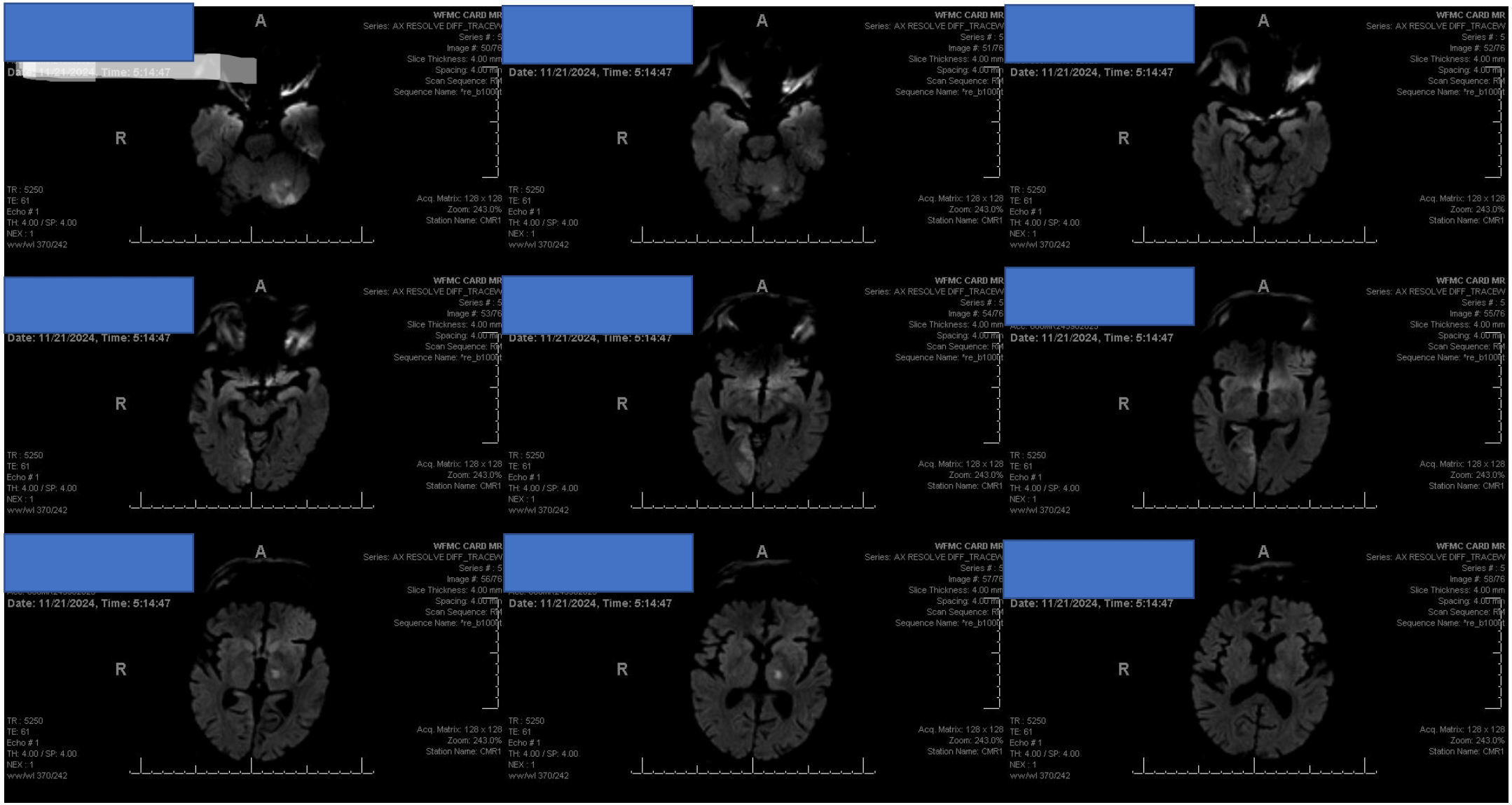


Post-thrombectomy

Case 2

- Patient is significantly improved the next day.
- He has left sided dysmetria, left VF cut
- Right sided face droop and right sided sensory change.
- No weakness

Case 2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Case 2

- Patient went to acute inpatient rehab, mainly for his dysmetria and learning how to deal with his VF cut

Basilar thrombosis

- Variable outcome data
- R Labauge, M Pages, C Marty-Double, JM Blard, M Boukobza, P. Salvaing[occlusion of the basilar artery. A review with 17 personal cases (author's transl)]Rev Neurol, 137 (1981), pp. 545-571Paris
  - This study reports an 86% mortality rate but there are lots of problems with this one
- Powers WJ. Strokelore: Outcome of Basilar Artery Occlusion. J Stroke Cerebrovasc Dis. 2022 Jun;31(6):106437. doi: 10.1016/j.jstrokecerebrovasdis.2022.106437. Epub 2022 Apr 6. PMID: 35397252.
  - This study is a review of multiple studies and case series
- Mortality rates range from 6-86%
- Favorable outcome rates from 14-63%
- So, as with everything, it’s all going to be patient-dependent but overall the prognosis is likely not good and we’ve all probably anecdotally felt that.
  - There is likely a big difference between an acute thrombosis like an a-fib embolus compared to a longstanding stenosis that occludes.

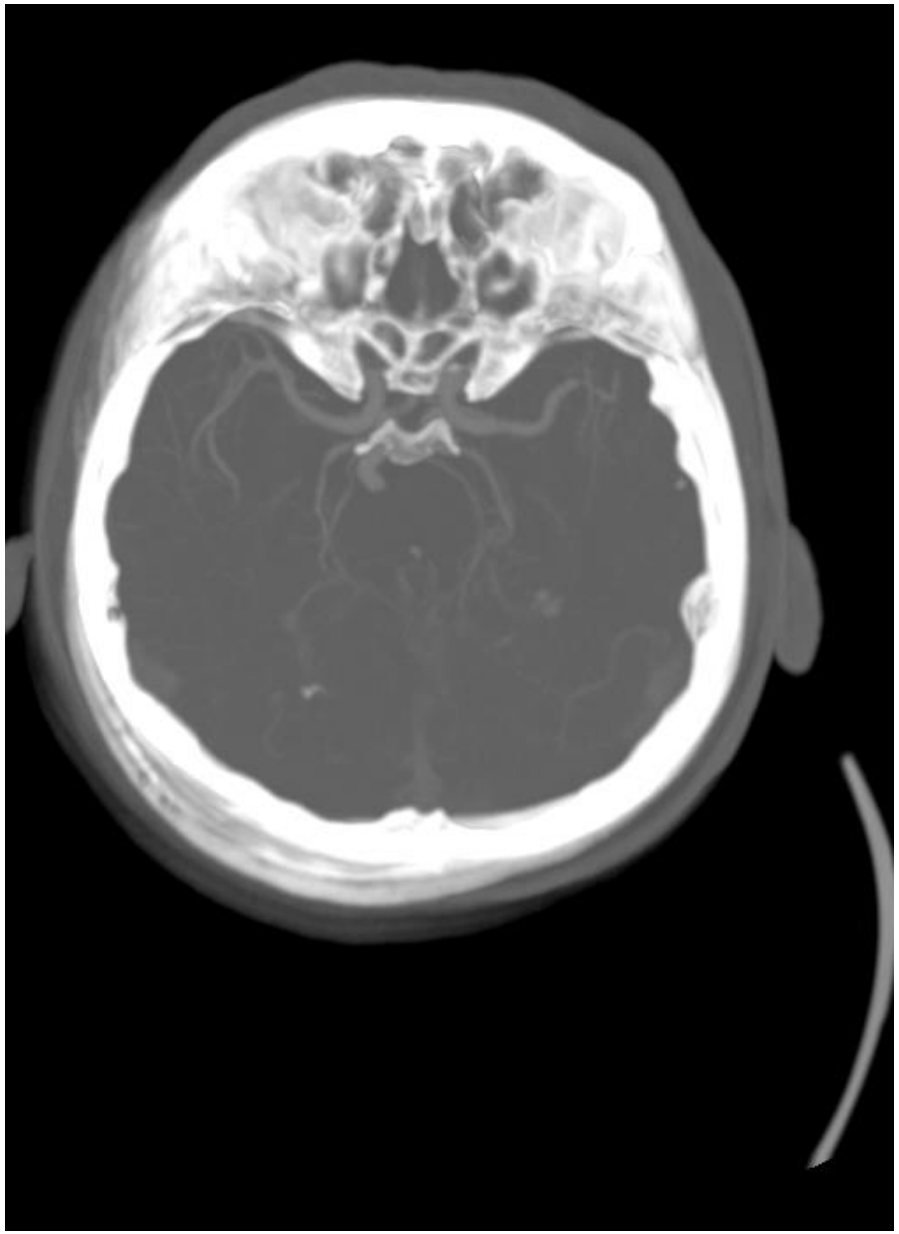
Basilar Thrombosis - Treatment

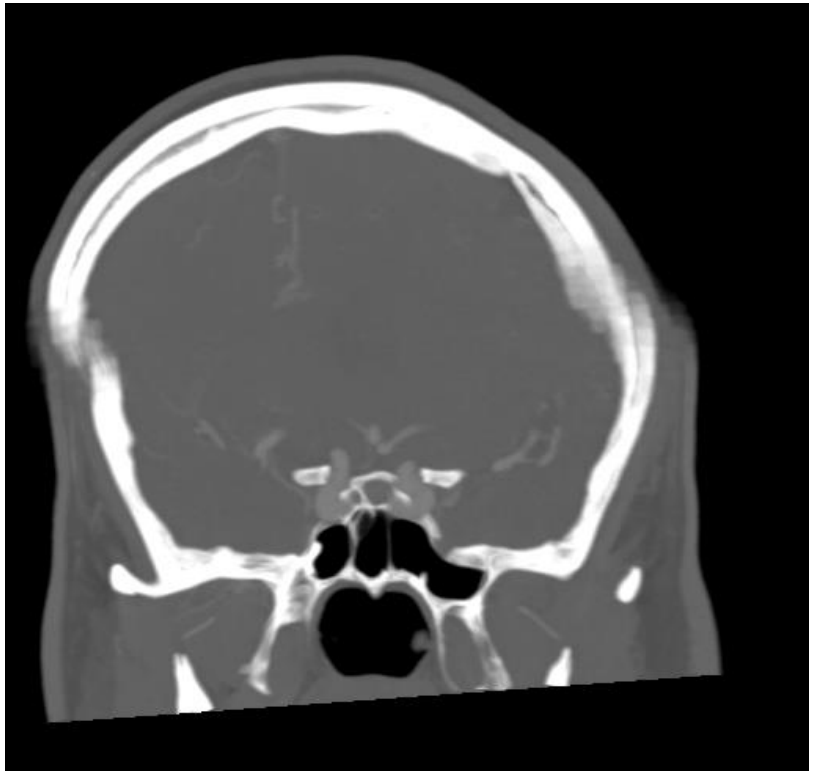
- Both IV thrombolysis and mechanical thrombectomy are effective.
- Thrombectomy in 6-24 hours led to better functional outcomes and lower mortality. Did not enroll NIHSS < 10
  - Jovin TG, Li C, Wu L, Wu C, Chen J, Jiang C, Shi Z, Gao Z, Song C, Chen W, Peng Y, Yao C, Wei M, Li T, Wei L, Xiao G, Yang H, Ren M, Duan J, Liu X, Yang Q, Liu Y, Zhu Q, Shi W, Zhu Q, Li X, Guo Z, Yang Q, Hou C, Zhao W, Ma Q, Zhang Y, Jiao L, Zhang H, Liebeskind DS, Liang H, Jadhav AP, Wen C, Brown S, Zhu L, Ye H, Ribo M, Chang M, Song H, Chen J, Ji X; BAOCHE Investigators. Trial of Thrombectomy 6 to 24 Hours after Stroke Due to Basilar-Artery Occlusion. N Engl J Med. 2022 Oct 13;387(15):1373-1384. doi: 10.1056/NEJMoa2207576. PMID: 36239645
- Thrombectomy for basilar artery strokes with mild symptoms with NIHSS < 7 had better outcomes than thrombectomy for more severe stroke scales. Factors associated with better outcomes were younger age, fewer passes, cardiac cause and no stenting.
  - Guenego A, Dargazanli C, Weisenburger-Lile D, Gory B, Richard S, Ducroux C, Piotin M, Blanc R, Labreuche J, Lucas L, Aubertin M, Benali A, Bourcier R, Detraz L, Vannier S, Guillen M, Eugene F, Walker G, Lun R, Consoli A, Lapergue B, Fahed R; ETIS Investigators. Thrombectomy for Basilar Artery Occlusion with Mild Symptoms. World Neurosurg. 2021 May;149:e400-e414. doi: 10.1016/j.wneu.2021.02.010. Epub 2021 Feb 9. PMID: 33578025.
- This new study from 2024 shows that IV thrombolysis results in a 3 month favorable outcome in about ½ of patients and these are moderate to severe stroke scales.
  - Räty S, Virtanen P, Ritvonen J, Georgiopoulos G, Sairanen T, Lindsberg PJ, Strbian D. IV Thrombolysis in Basilar Artery Occlusion: Outcomes and Comparison With Endovascular Thrombectomy. Neurology. 2024 Apr 23;102(8):e209249. doi: 10.1212/WNL.0000000000209249. Epub 2024 Mar 26. PMID: 38531004.

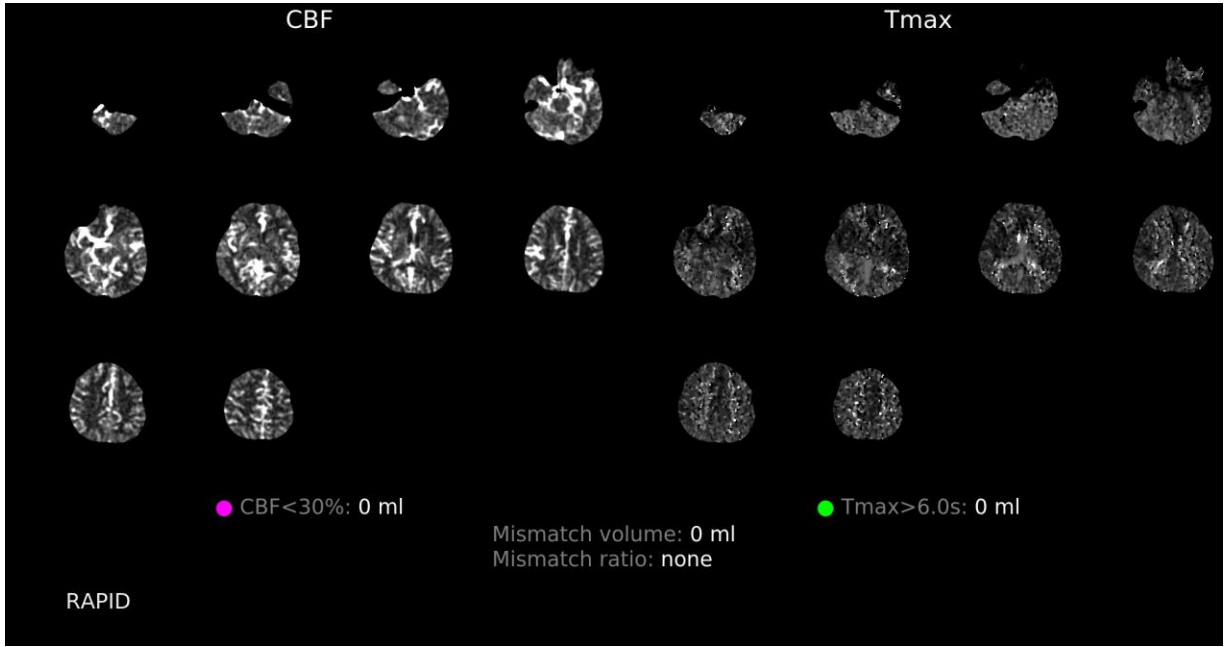
Case 3

- 52 y/o man with HTN, HLD, OSA awakened with right sided weakness. LKN was about 14 hour prior to when he went to bed.
- ED exam: No face droop, mild dysarthria
- RUE drift and mild weakness
- No sensory loss

Case 3






CBF
Tmax
CBF<30%: 0 ml
Tmax>6.0s: 0 ml
Mismatch volume: 0 ml
Mismatch ratio: none
RAPID

Case 3

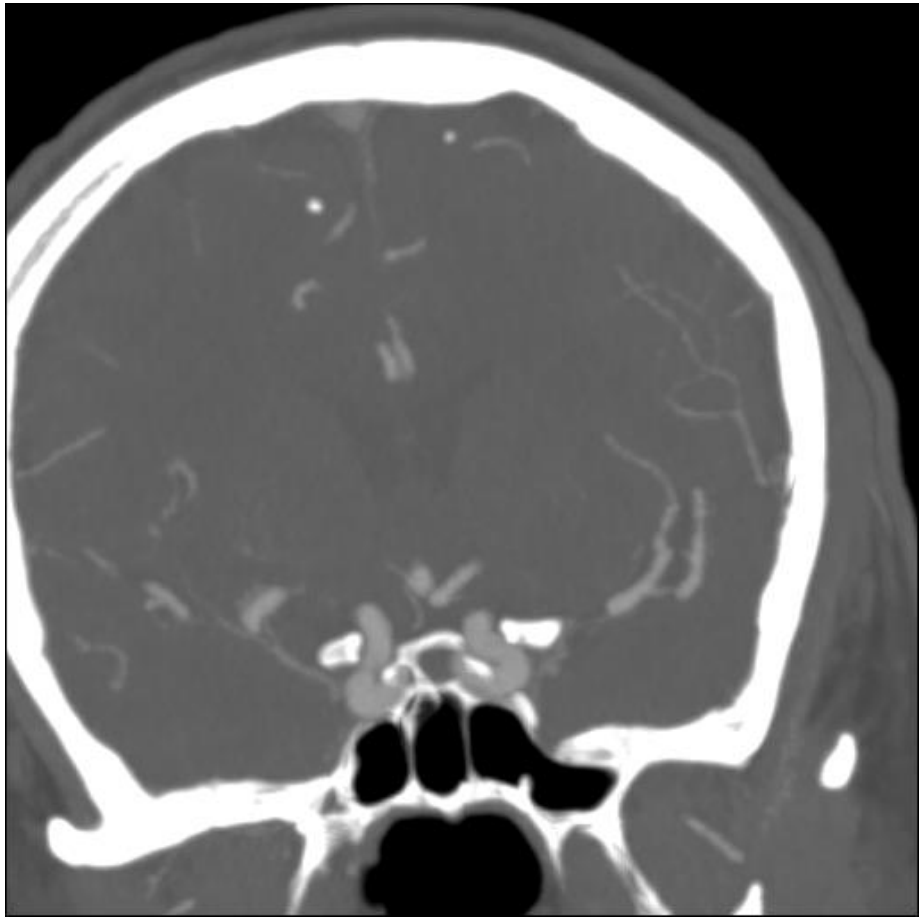
- Left MCA stenosis but no perfusion defect on RAPID
- Fairly mild symptoms with stroke scale of 4
- Out of TNK window
- How do you treat him?

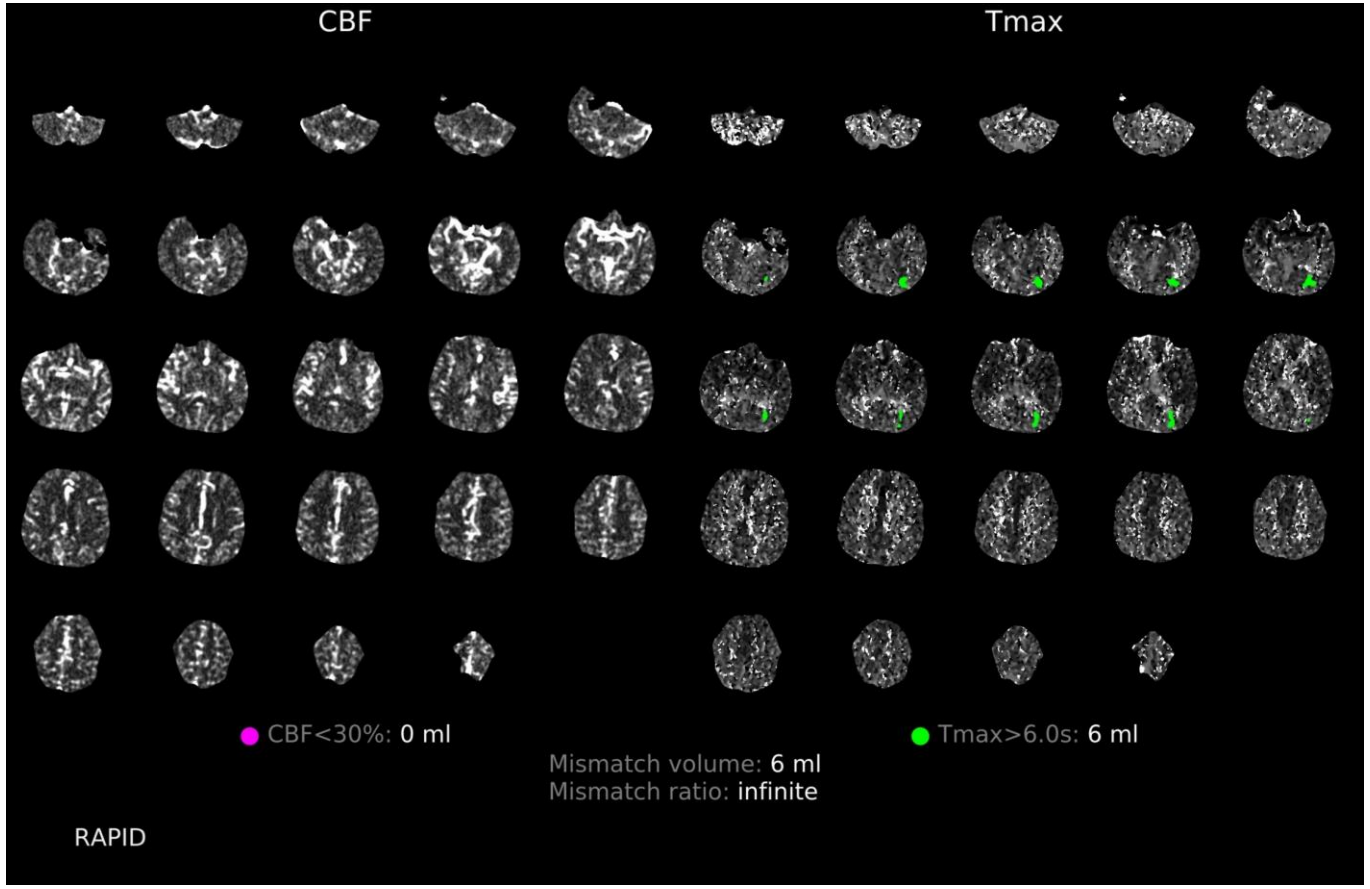
- Plan was to load with DAPT per POINT/CHANCE trial protocols and admit

Case 3

- Patient arrives to the floor about 2 hours later and suddenly worsens
- He is very dysarthric and now plegic in his right arm and minimal movement in the right leg
- He follows commands well and does not seem to be aphasic
- He denies sensory loss
- Goes back for repeat CTA – did that MCA occlude??

Case 3

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Mismatch volume: 6 ml
Mismatch ratio: infinite
RAPID

Case 3

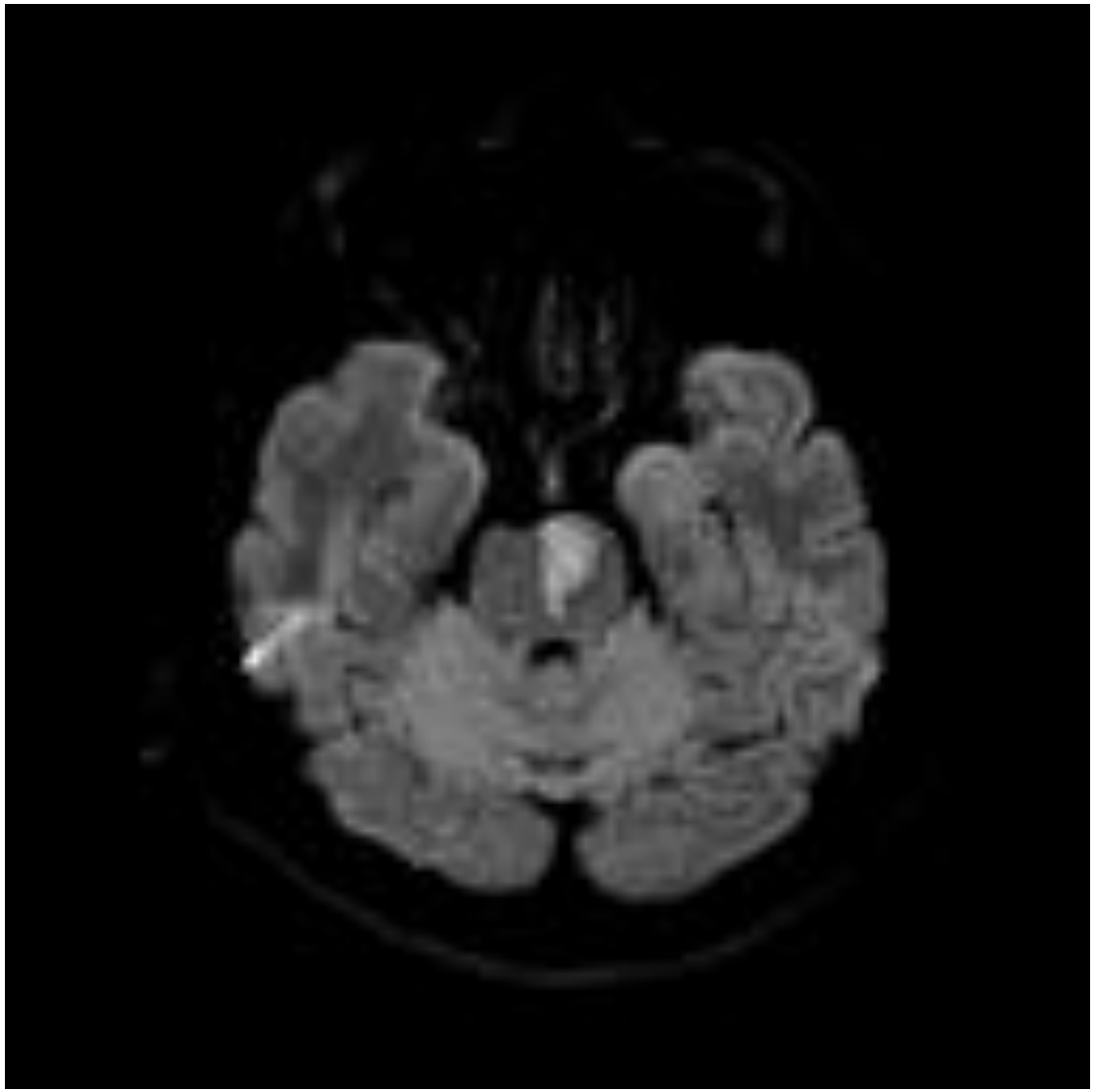
- The MCA stenosis looks the same. There is no perfusion defect in the territory of the MCA stenosis and no new lesion
- What do you do?

- Discussed with IR and we decided not to take him to IR
- Presentation is really pure motor and is behaving like a stuttering lacune.
- We loaded him with clopidogrel and aspirin. (he had NOT gotten the load in the ED yet) and moved him to the ICU

Case 3

- Next morning his exam is much better
- Dysarthria and face droop have improved.
- Leg and arm are now only mildly weak.

Case 3



Pontine perforator infarct.
NOT an MCA infarct

Patient continued to improve and got so much
Better that he actually went home before we
Could get rehab approved.

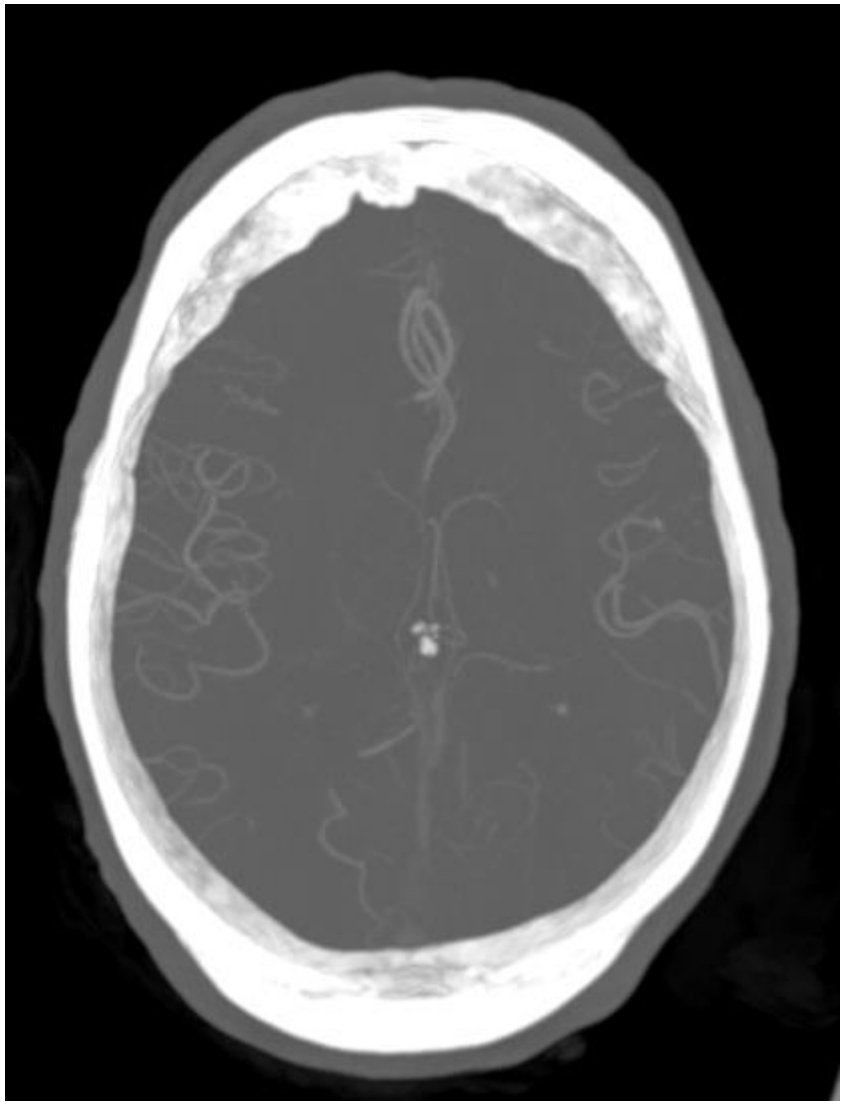
Treatment of Stuttering Lacunar Syndrome

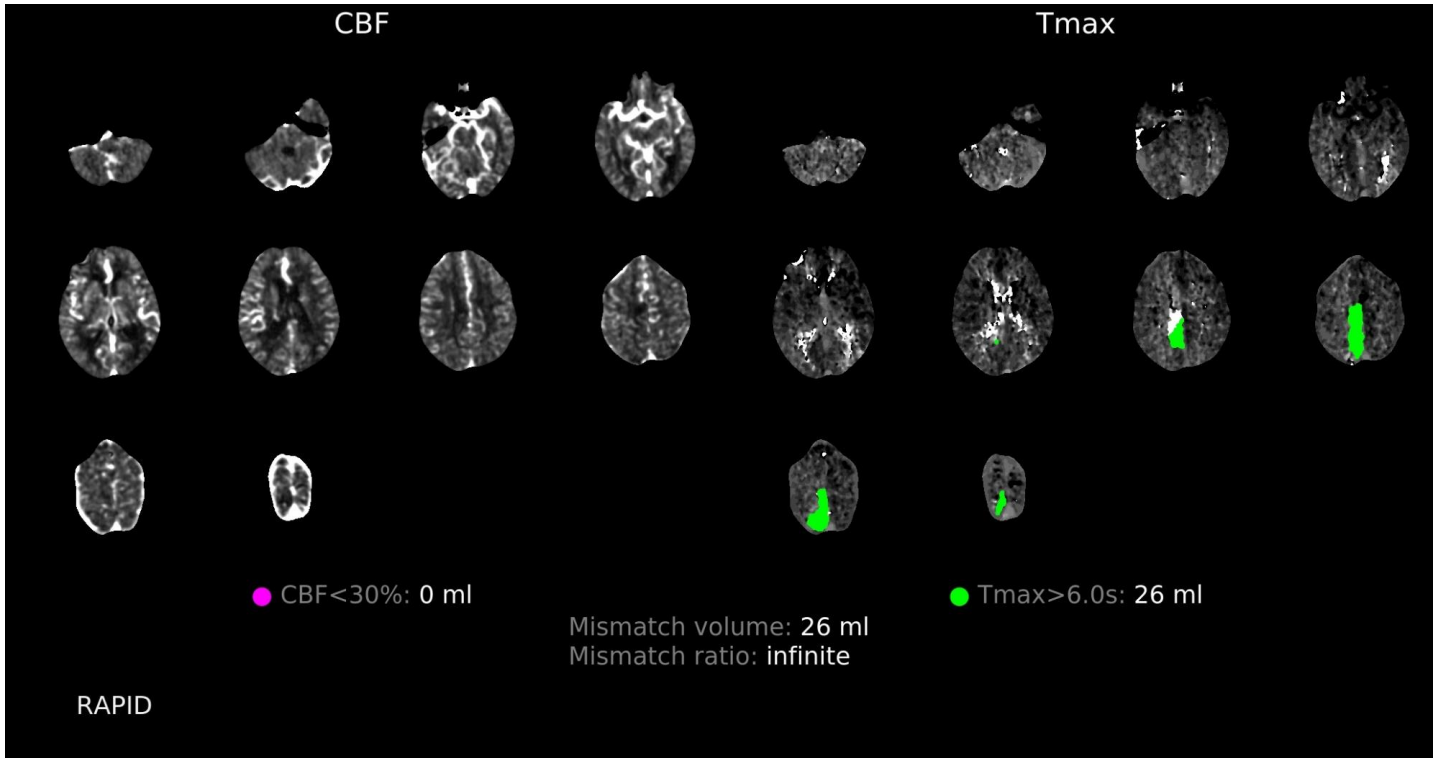
- When this happens the patient is usually out of the IV thrombolysis window.
- DAPT loading has been my treatment of choice for many years.
  - Hawkes MA, Braksick SA, Zhang W, Wijdicks EFM, Rabinstein AA. Can we stop the stuttering in stroke? Interventions in 40 patients with acute lacunes. J Neurol Sci. 2019 Jun 15;401:1-4. doi: 10.1016/j.jns.2019.04.009. Epub 2019 Apr 6. PMID: 30986702.
  - GP IIb-IIIa inhibitors were shown last year to be helpful in progressing strokes which provides more evidence for aggressive antiplatelet therapy in these patients as well

Case 4

- 79 y/o with cardiac amyloid, HTN, lives independently, had recent fall and SDH one month ago.
- She began feeling unwell around 10am and then fell due to leg weakness. She lives independently.
- She called 911 and arrived at the ED around 2:00 pm
- On exam she is awake and alert with no aphasia or dysarthria and no face droop.
- Minimal LUE drift, left leg is plegic.

Case 4

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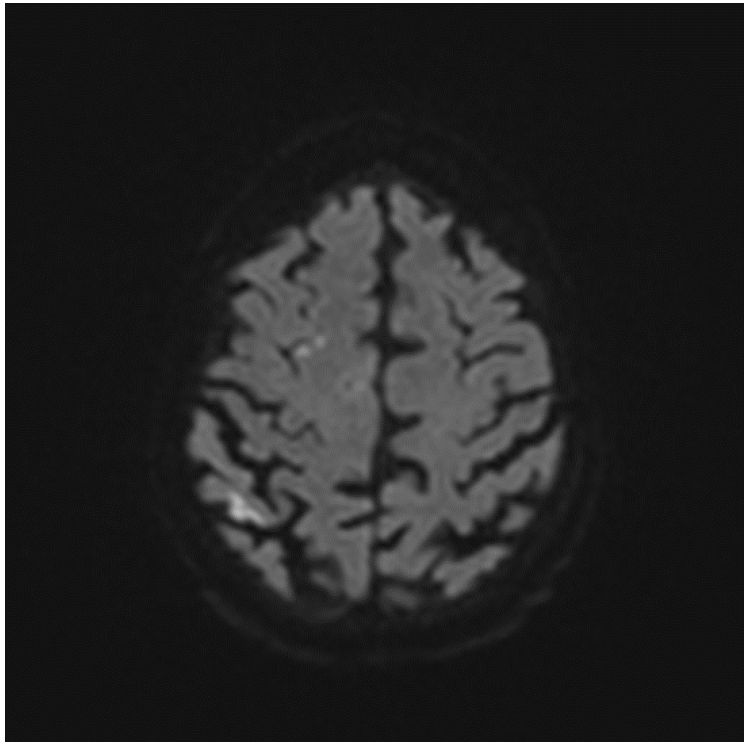
CBF<30%: 0 ml
Tmax>6.0s: 26 ml
Mismatch volume: 26 ml
Mismatch ratio: infinite
RAPID

Case 4

- How do you treat her?
- It is really hard to determine if she is within the TNK window but she just had a subdural a few weeks ago. If you go by when she started feeling badly then she's > 4.5 hours out by the time she gets imaged.
- The ACA lesion is clearly symptomatic but way too distal for a stent retriever.
- Patient was independent and now is clearly disabled with a plegic leg. She is < 6 hours from symptom onset.
- I called nsgy to see if they might go in and try to drip some IA tPA or something like that.
- NSGY took her to angio

Case 4

- So, nsgy was able to reach the clot and aspirate it out with some kind of new, small, flexible catheter
- In the ICU after procedure patient is much better with 4/5 strength in the left leg and arm is normal.



Case 4

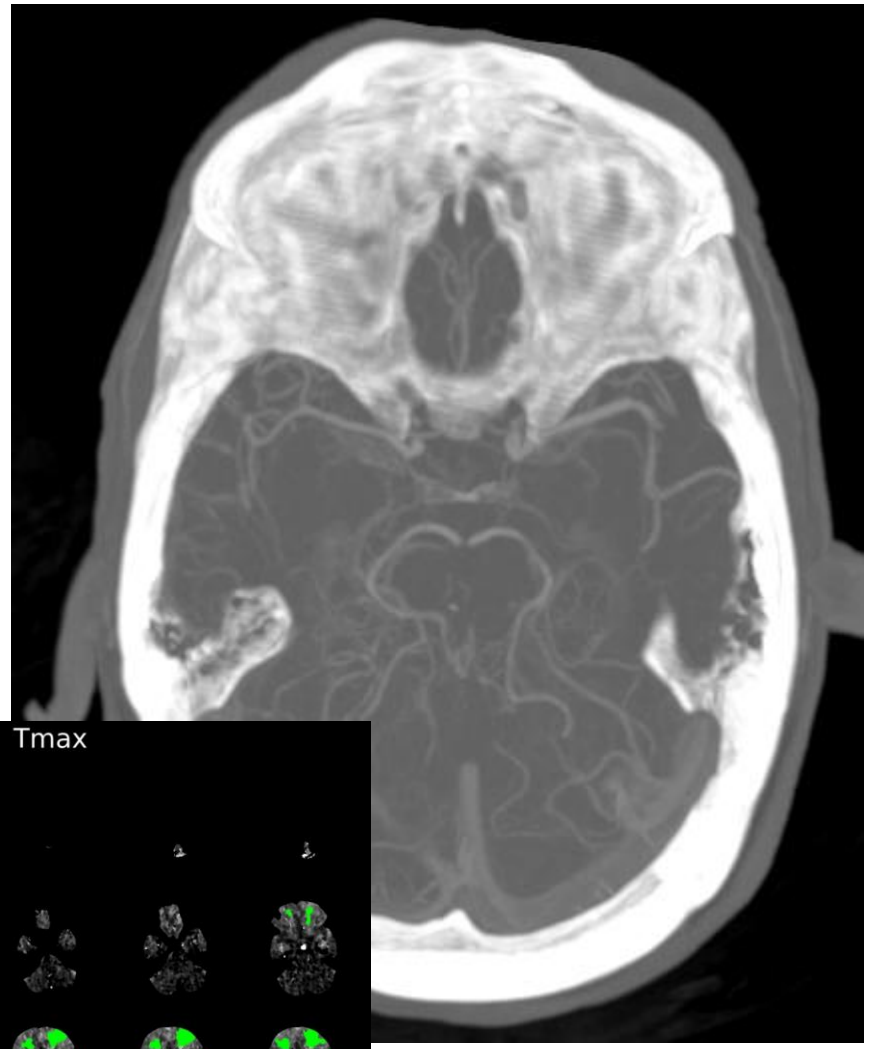
- Patient ended up going to a short stay for IPR and then went home.

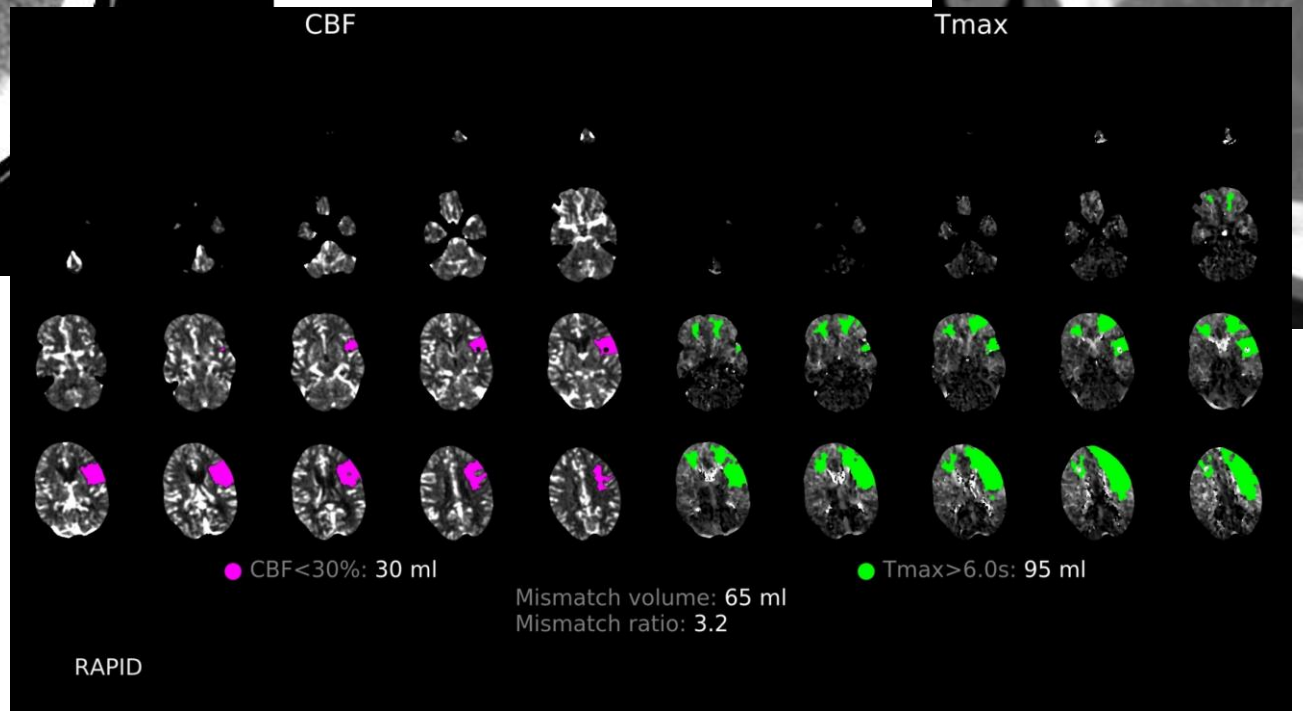
Case 5

- 64 y/o with h/o HTN, HLD, smoking, prior left CEA in 2018 who presented to OSH after witnessed onset at work of aphasia, left gaze preference, right VF cut and right sided weakness – large left MCA syndrome. NIHSS 15.
- CTA showed bilateral ICA occlusions.
- Received tNK 2 hours after symptom onset and transferred to our hospital.
- Upon arrival no change after TNK. Exam consistent with large left MCA syndrome.

Case 5

Initial head CT upon arrival

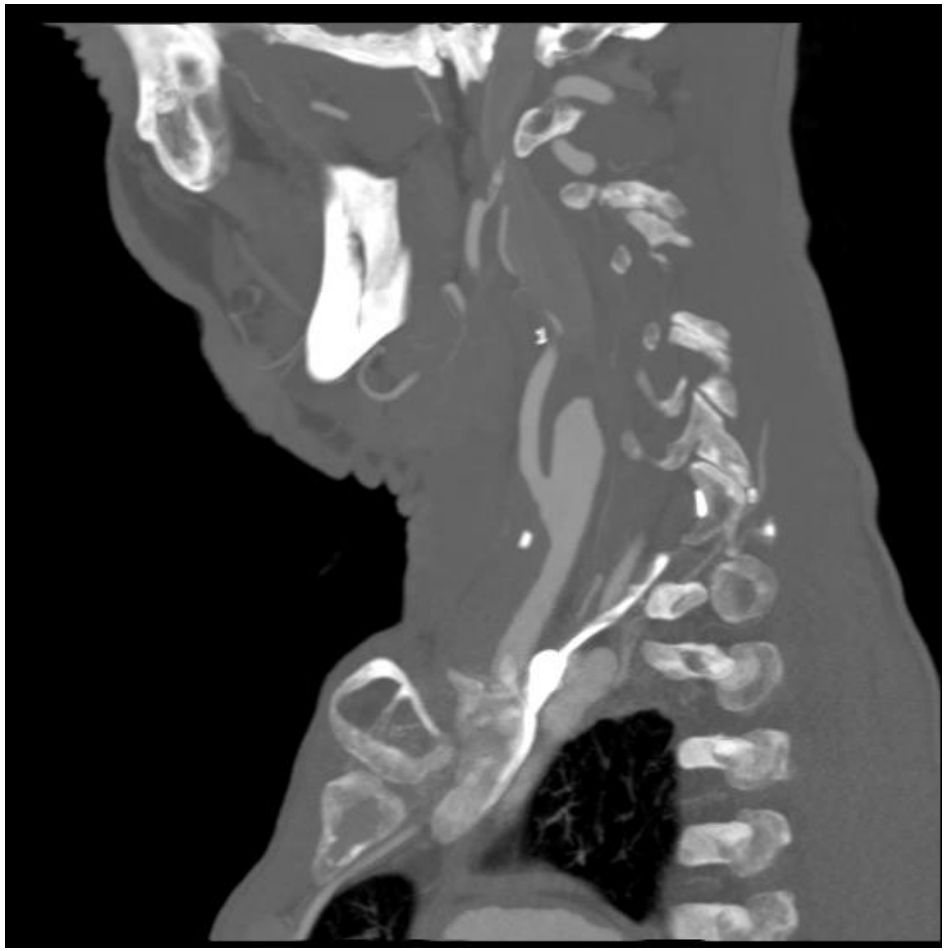




Proximal left M2 cutoff

Case 5

Right ICA



Left ICA

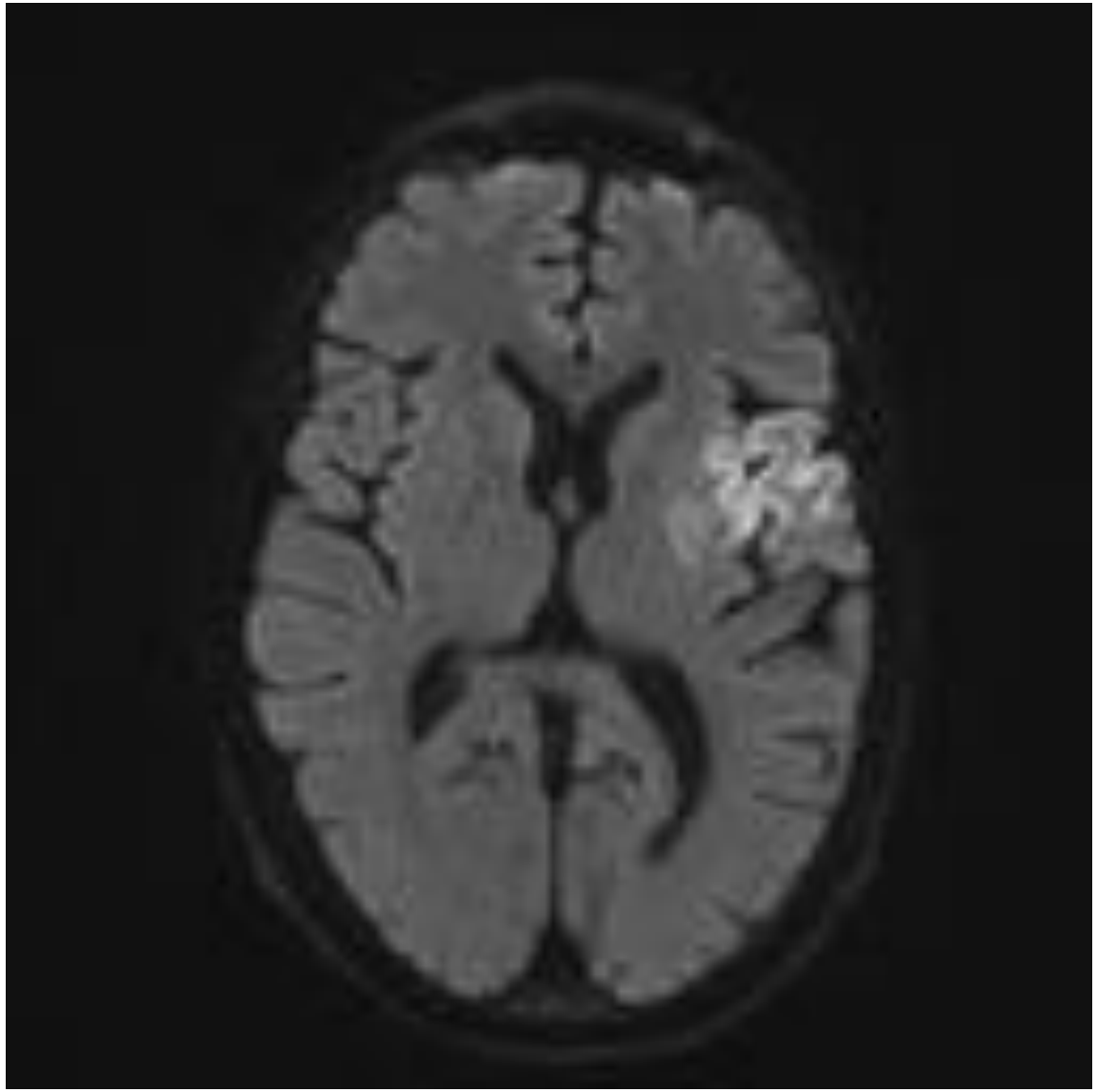
Case 5

- So, what do you do?
- I called our interventionalist who declined to intervene on the left ICA
- Admitted to the ICU

Case 5

- Next morning his aphasia was somewhat better. He had minimal speech output but could name some things and follow one-step commands.
- Could cross midline.
- Motor strength was much improved with only drift in the RUE and no weakness in the leg.

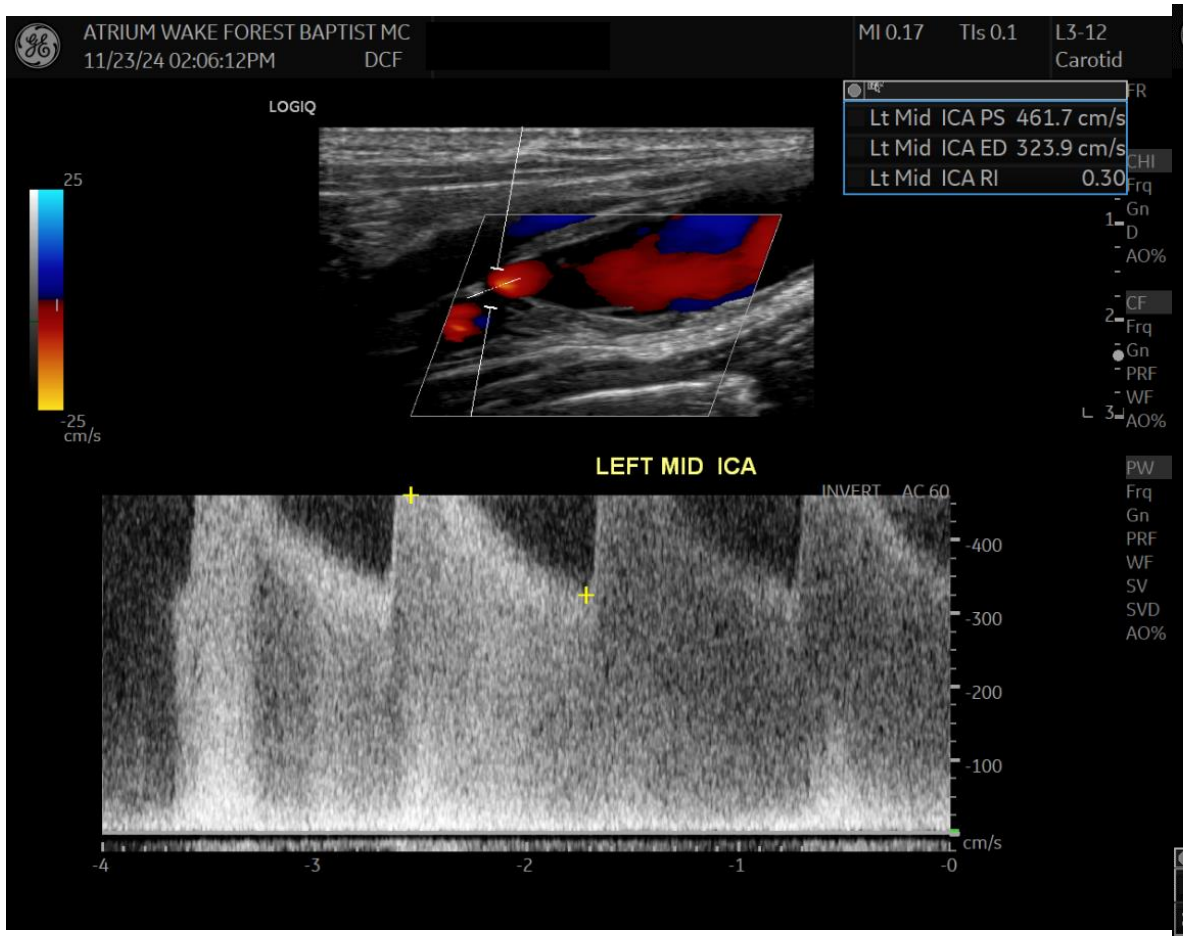
Case 5

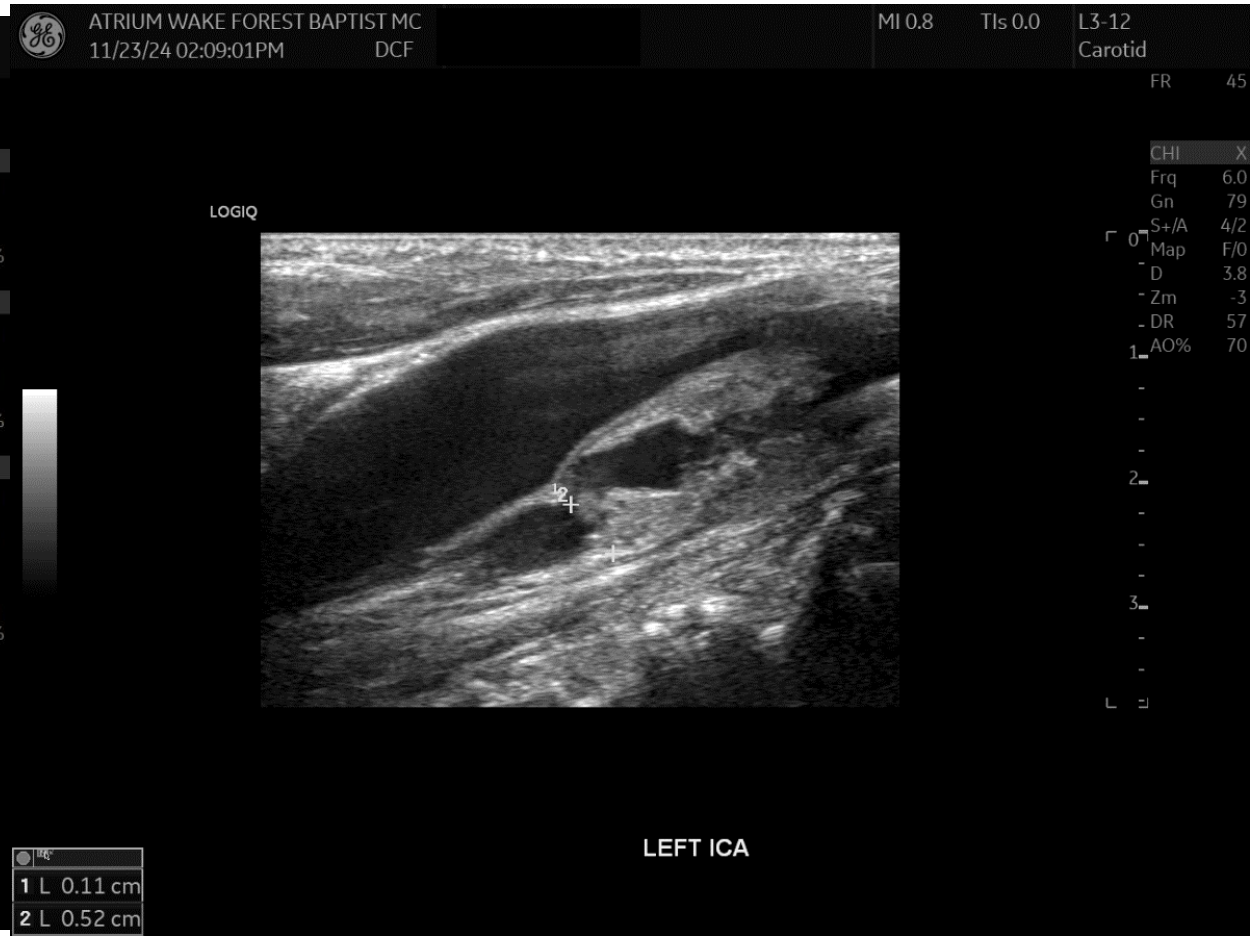


Case 5

- So, is there anything to do now other than risk factor treatment and rehab?
- Well, I was suspicious about whether the left ICA is truly occluded.
  - Why would a chronic occlusion embolize?
- So, I ordered some ultrasounds

Case 5: Carotid Duplex





Very high-grade, focal stenosis, > 90% by Doppler criteria

Distal to the stenosis the artery is wide open and we got a good Doppler signal as far as we could go…

Case 5

- I called our new neurosurgeon back and told him the ICA was open.
- He was skeptical. He did not train where they use ultrasound like we do.
- I showed him the pictures…
- I finally convinced him to do a DSA…

Case 5

Case 5

Case 5

- Patient discharged home with outpatient ST!

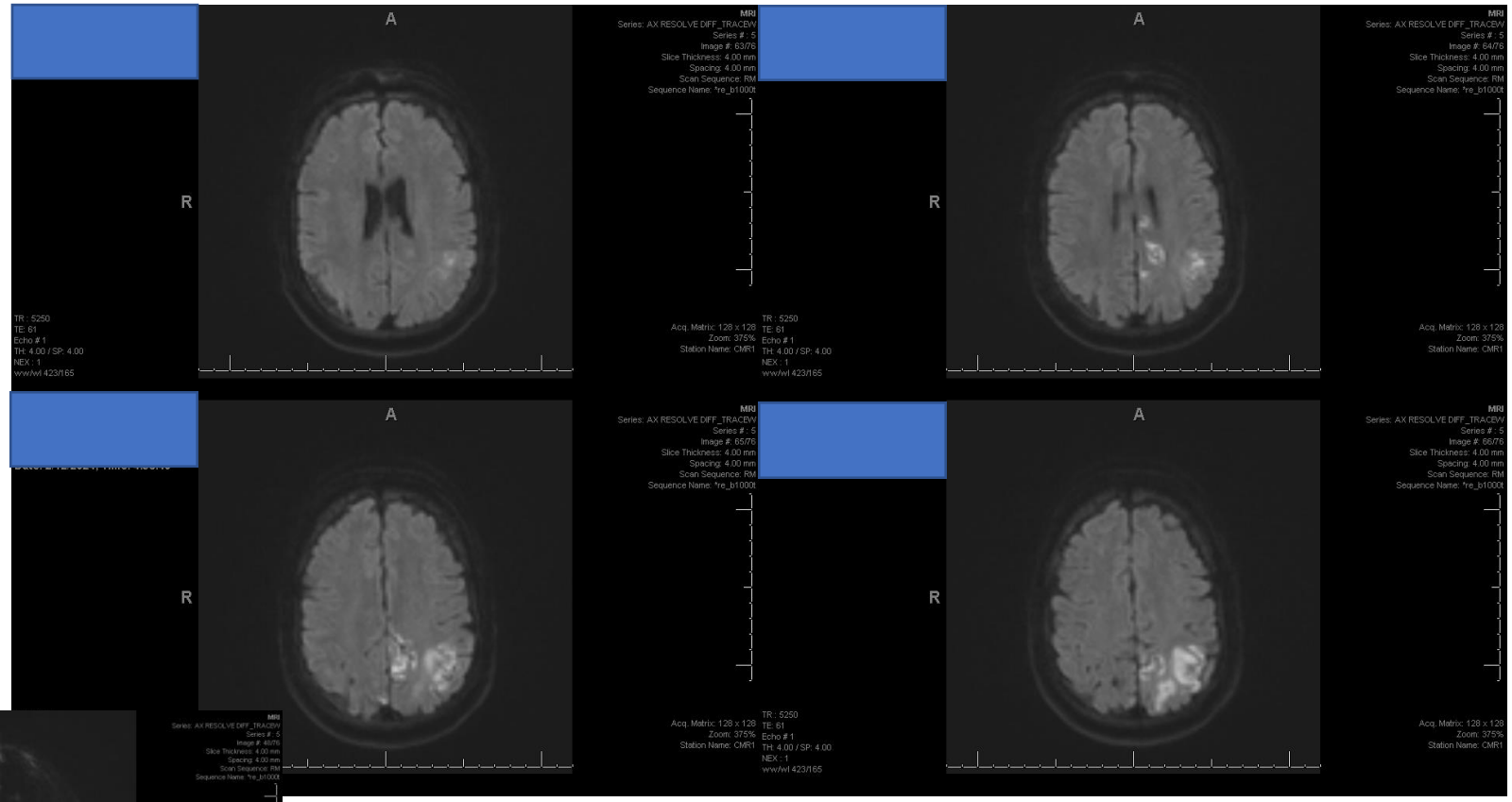
- The CTA is not 100% accurate.
- We periodically find high-grade stenoses or string signs on ultrasounds when the CTA appears completely consistent with total occlusion.
- We also use ultrasound to better characterize degree of stenosis when there is terrible calcific plaque in the carotid which can make quantification of degree of stenosis difficult on the CTA.
- We follow carotid stents by ultrasound in the outpatient setting
- Wake Forest still advocates for the usefulness of ultrasound!

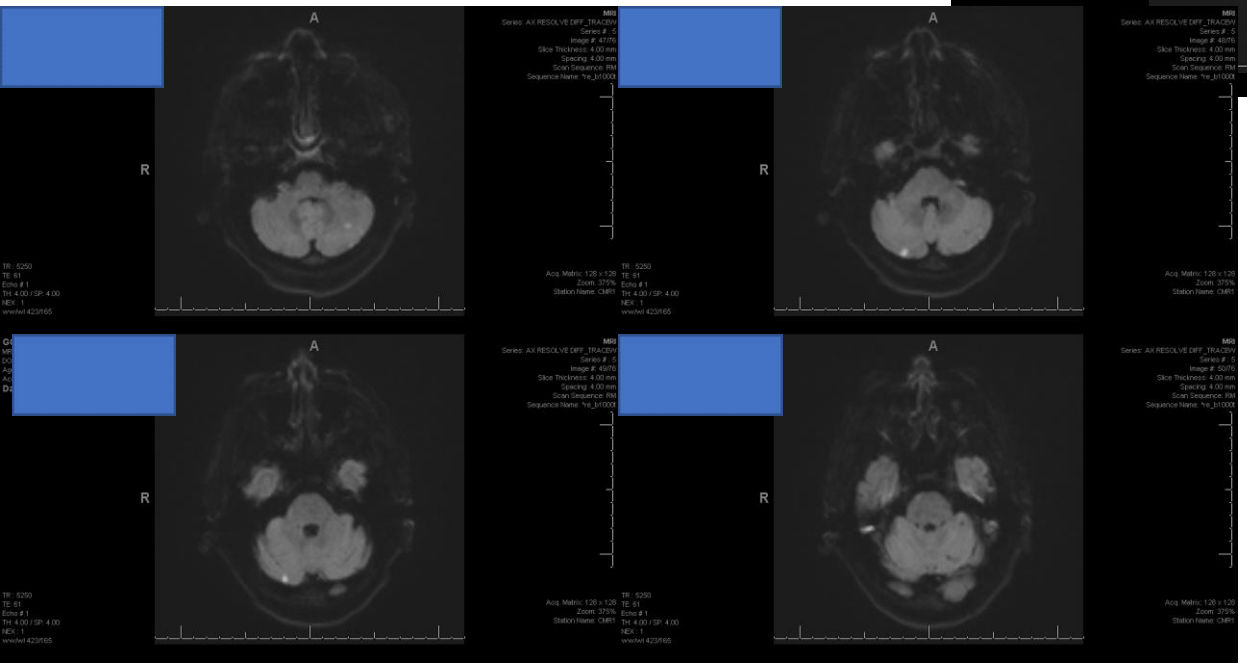
Case 6

- 60 y/o woman with HTH, DM, OSA, remote right ACA stroke 20 years ago, admitted on 2/11/2024 with confusion and altered mental status to internal medicine.
- She was found to have multifocal embolic-appearing strokes.

Case 6

MRI 2/2024: multfocal infarcts





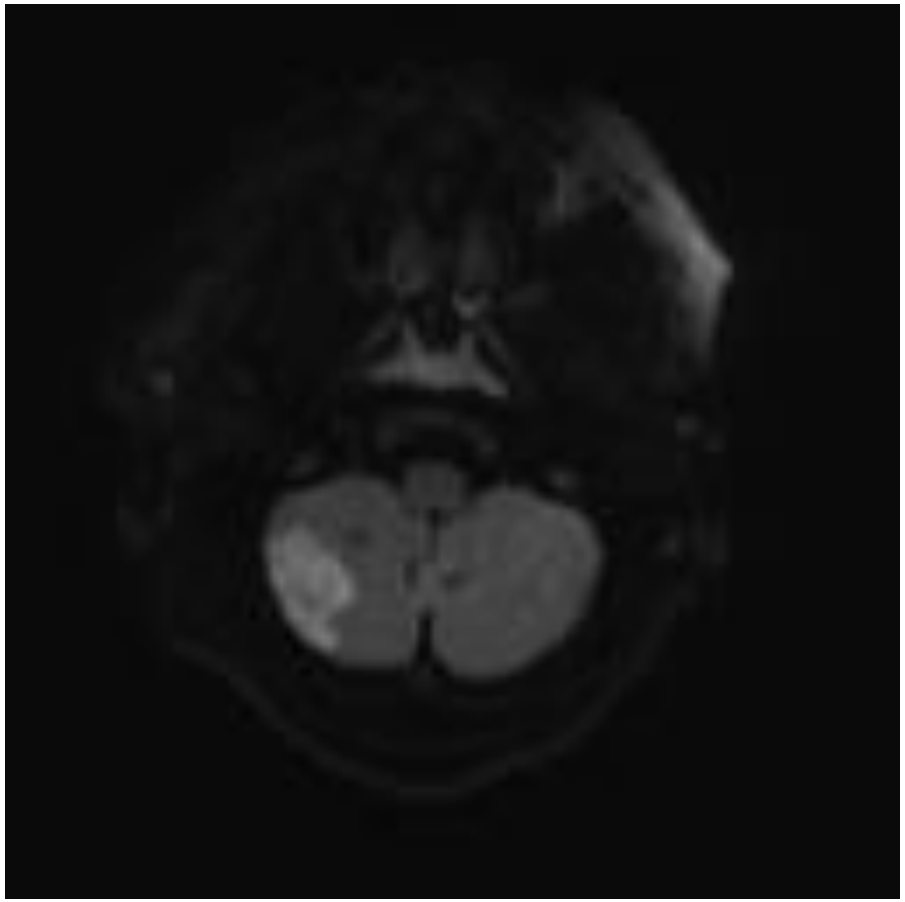
Case 6 : February Workup

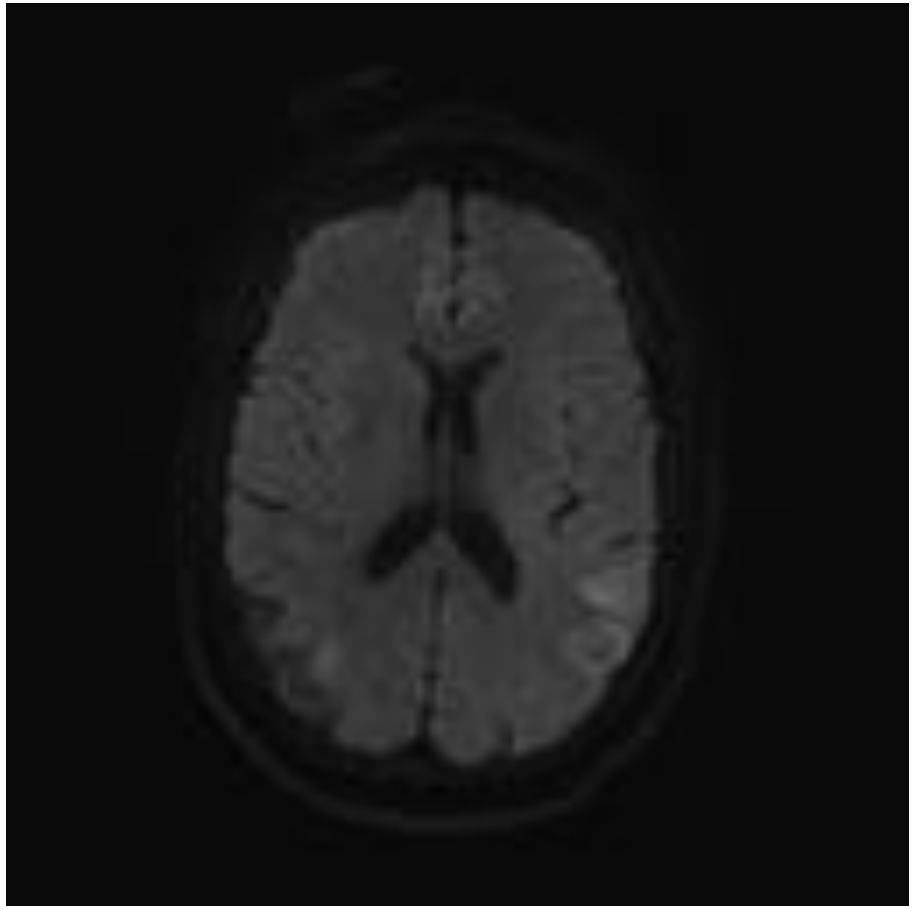
- CTA: no significant stenosis, mild athero
- TTE with bubble: no shunt, normal EF, severely dilated left atrium
- Hbg A1C: 9.0
- Lipids: LDL 73
- She was discharged home on a zio patch heart monitor and aspirin, statin, enhanced blood sugar treatment.
- 14-day zio negative for a-fib

Case 5

- 5 weeks after initial strokes, she presented to the ED with new word-finding difficulty and right face numbness.
- CT/CTA showed a new proximal M3 occlusion and possible new right cerebellar infarct
- She was admitted for further workup.

Case 5





New infarcts since the prior scan in multiple vascular territories

Case 5

- Recurrent embolic strokes now in just a few weeks. What workup does she need? She is not a substance abuser to suggest a cause for RCVS
- TEE: negative
- Cardiac CT (not the best quality TEE): negative
- CT CAP for occult malignancy (3 territory sign on imaging)
  - Nouh AM, Staff I, Finelli PF. Three Territory Sign: An MRI marker of malignancy-related ischemic stroke (Trousseau syndrome). Neurol Clin Pract. 2019 Apr;9(2):124-128. doi: 10.1212/CPJ.0000000000000603. PMID: 31041126; PMCID: PMC6461422.
- Catheter angiogram: negative for vasculitic/vasospasm changes
- LP: no inflammatory process
- Hypercoag profile: negative
- ESR/CRP, ANCAs, ANA, etc, negative

Case 5

- How do you treat her?
- She has just been on aspirin. She is an aspirin-responder
- A1C is down to 8
- LDL is now 41

- Continue high-potency statin, continue to optimize blood sugar control, improve diet and exercise
- What about antithrombotic therapy?
  - Continue aspirin?
  - Escalate to DAPT?
  - Convert to anticoagulation?

Case 5

- This patient has embolic strokes of unknown source (ESUS)
- All of the ESUS trials have been negative for empiric treatment with anticoagulation.
- As far as I know there have never been any *recurrent* ESUS trials.
- This patient has had recurrent, multifocal strokes despite aspirin
- I talked to her about anticoagulation and recommended apixaban.
- She agreed.
- I discharged her on apixaban with another zio

Case 5: what happened?

- Repeat zio was negative.
- She has had a loop implanted. So far negative.
- She has done well with no recurrent symptoms on the apixaban
- I just saw her about a month ago and she is neurologically normal with no bleeding complications on anticoagulation
  - Her A1c is down to 7.2, LDL 40

- I think we have good data now that for embolic strokes, you need to prove a reason for anticoagulation. However, for patients with recurrent embolic strokes, I think empiric anticoagulation with shared decision-making with the patient is the way to go, at least until we have better evidence but I don't think we ever will.

Transition Slide….

Clinical Update on Primary Prevention

ADAPTED FROM:

2024 Guideline for the
Primary Prevention of Stroke:

A Guideline from the American Heart Association/American Stroke Association

AHA Clinical Update PPTX

Table 1.
Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care

CLASS (STRENGTH) OF RECOMMENDATION
CLASS 1 (STRONG) **Benefit >>> Risk**
Suggested phrases for writing recommendations: • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B
CLASS 2a (MODERATE) **Benefit >> Risk**
Suggested phrases for writing recommendations: • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases†: – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B
CLASS 2b (Weak) **Benefit ≥ Risk**
Suggested phrases for writing recommendations: • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established
CLASS 3: No Benefit (MODERATE) **Benefit = Risk**
Suggested phrases for writing recommendations: • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other
CLASS 3: Harm (STRONG) **Risk > Benefit**
Suggested phrases for writing recommendations: • Potentially harmful • Causes harm • Associated with excess morbidity/mortality

LEVEL (QUALITY) OF EVIDENCE‡
LEVEL A
• High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies
LEVEL B-R (Randomized)
• Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
LEVEL B-NR (Nonrandomized)
• Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies
LEVEL C-LD (Limited Data)
• Randomized or nonrandomized observational or registry studies with limitations of design or execution • Meta-analyses of such studies • Physiological or mechanistic studies in human subjects
LEVEL C-EO (Expert Opinion)
• Consensus of expert opinion based on clinical experience

•COR and LOE are determined independently (any COR may be paired with any LOE).

•A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Concepts of expert opinion can be based on clinical experience sus that a particular test or therapy is useful or effective.

•*The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

• †For comparative-effectiveness recommendation (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

•‡The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

•COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

American Heart Association.

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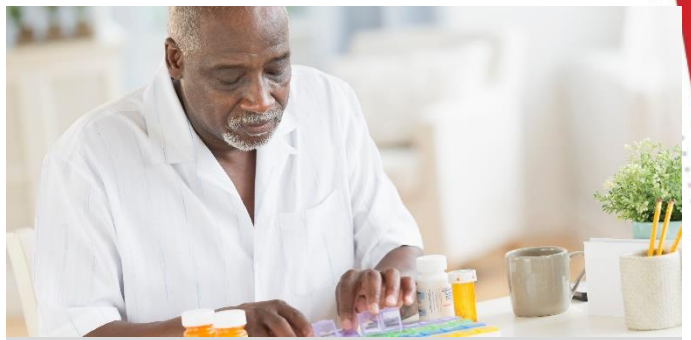
Elements Associated with Elevated Stroke Risk

Adverse Social Determinants of Health

- Poor Access to Care
- Socioeconomic Disadvantage
- Lack of Social and Community Support
- Poor Access to Education
- Racism and Discrimination

Inadequate Management of Common Risk Factors

- Undiagnosed Risk Factors
- Untreated Risk Factors
- Best Practices Not Followed
- Lack of Shared Decision Making
- Health System Barriers
- De-Emphasis of Lifestyle Factors *(Life's Essential 8)*



Commonly Unrecognized Risk-enhancing Factors

- Lipoprotein(a)
- Thrombophilias
- Endometriosis
- Early Menopause
- Complications of Pregnancy

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Closing the Prevention Gap

Prevention Gap: Difference between current and potential control of stroke risk factors in the US.

Factors Affected:

- Lifestyle factors
- Medical factors that can be managed with behavior change and/or medication
- Non-medical factors including health literacy, food security, housing security, and access to medication
- Social determinant of health factors including access to education, access to health insurance, economic stability, neighborhood environment, and social and community context

Importance:

- Represents the opportunity to reduce the burden of stroke on patients, communities, and society
- Presents modifiable factors that allow us to address disparities in stroke risk
- Underscores the imperative for quality improvement and health services research to improve risk factor detection and control

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Sources of Evidence Used in Prevention Recommendations in this Guideline

Outcome data from research in populations:

- Without CVD
- With CVD but not any Stroke or TIA
- With CVD but ≤50% with history of stroke

Abbreviations: CVD indicates cardiovascular disease; and TIA, transient ischemic attach.

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Social Determinants of Health and Health-Related Social Needs

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Primary Prevention: Screening

COR	RECOMMENDATIONS
1	In persons aged 40-79 years, estimations of risk for CVD every 1-5 years is beneficial to guide decisions on treatments and lifestyle recommendations that may reduce risk for stroke.
1	In persons with AF, calculations of CHA2DS2-VASc score is recommended to guide decisions on prescription of oral anticoagulation to reduce risk for stroke.
1	In persons aged 18 or greater, periodic screening for modifiable behaviors and medical conditions that increase stroke risk is recommended.
1	In persons aged 18 and up, periodic screening for SDoH is beneficial to identify additional factors which contribute to stroke risk.

Abbreviations: CVD indicates cardiovascular disease; and SDoH , social determinants of health.

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Life’s Essential 8

- Healthy Diet
- Physical Activity
- Maintaining a healthy weigh
- Healthy Sleep
- Avoidance of tobacco
- Healthy levels of lipids
- Healthy Blood glucose levels
- Blood Pressure Control

Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Diet Quality	
COR	**RECOMMENDATIONS**
1	In adults without prior CVD and who are at high or intermediate CVD risk, a Mediterranean diet is recommended to reduce the risk of incident stroke.
2a	In adults who are aged 60 years or older and have uncontrolled BP, compared to using 100% sodium chloride, salt substitution is reasonable to reduce the risk of incident stroke.
2b	In adults, folic acid supplementation and B-complex vitamins supplementation for reducing the risk of stroke is not well-established.
3: No Benefit	In adults without prior CVD, long-chain fatty acids are not effective for reducing the risk of stroke.
3: No Benefit	In adults, vitamin C, vitamin E, selenium, antioxidants, calcium, calcium with vitamin D, and multivitamin supplementation are not effective for reducing the risk of stroke.

Abbreviations: BP indicates blood pressure; and CVD, cardiovascular disease.

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Management of Health Behaviors and Health Factors for Primary Prevention of Strok

Physical Activity	
COR	**RECOMMENDATIONS**
1	In adults, screening for physical activity is recommended to estimate stroke risk.
1	In adults, counseling patients to get at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity physical activity per week is recommended to reduce stroke risk.
1	In adults, counseling to avoid excessive time spent in sedentary behavior is recommended to reduce stroke risk.

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Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Blood Sugar	
COR	**RECOMMENDATIONS**
1	In asymptomatic adults aged 18 or over, who have overweight, obesity , or ASCVD, screening for diabetes is recommended to inform stroke risk.
1	In patients with diabetes and high CV risk or established CVD, treatment with a GLP-1 receptor agonist is effective to reduce the risk of stroke.
3: No Benefit	In patients with T1D or T2D, intensive glycemic control is not beneficial for stroke prevention.

Abbreviations: ASCVD indicates atherosclerotic cardiovascular disease; CV, cardiovascular; CVD, cardiovascular disease; GLP-1, glucagon-like protein-1; T1D, type 1 diabetes mellitus; and T2D, type 2 diabetes mellitus.

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Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Weight and Obesity	
COR	**RECOMMENDATIONS**
1	In adults over age 18, screening for overweight and obesity is recommended to inform the risk of stroke.
2b	In patients with Obesity Class II and above, bariatric surgical procedures to promote weight loss may be considered to reduce the risk of stroke.

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Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Lipids	
COR	**RECOMMENDATIONS**
1	In adults who qualify for treatment with lipid-lowering therapy according the AHA guidelines, treatment with a statin is recommended to reduce the risk of a first stroke.
2b	Patients without CVD who are treated with lipid-lowering therapy, according to AHA guidelines, who cannot reach goals with statins, the benefit ofalirocumab or evolocumab has not been proven for stroke risk reduction.
2b	In adults who do not tolerate statin therapy and have elevated LDL-C and increased CV risk, treatment bempedoic acid has not been proven to reduce risk of stroke.
3: No Benefit	In adults in moderate or low intake of long chain omega-3 fatty acid is not recommended to reduce the risk of a first stroke.

Abbreviations: AHA indicates the American Heart Association ; CV, cardiovascular; CVD, cardiovascular disease; and LDL-C, low-density lipoprotein cholesterol.

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Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Blood Pressure	
COR	**RECOMMENDATIONS**
1	In adults aged 18 or over, screening for hypertension is recommended to identify stroke risk and eligibility for treatment.
1	In adults with stage 1 or stage 2 hypertension, lifestyle modification and drug treatment to a BP less than 130/80 is recommended to reduce stroke risk.
1	In adults with HTN, thiazide and thiazide –like diuretics, CCB, ACEI, and ARBs are recommended as initial therapies to reduce stroke risk.
1	In adults with HTN, drug therapy with one or more medications is indicated to reach BP control necessary to prevent stroke.

Abbreviations: ACEI indicates angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; and HTN, hypertension.

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Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Tobacco Use / Cessation Intervention	
COR	**RECOMMENDATIONS**
1	For active smokers, cessation medication delivered with behavioral counseling is recommended.
1	For active smokers of cigarettes and other tobacco products assistance with cessation is recommended to reduce the risk of stroke.
2a	For active smokers who are in a hospital setting, cessation medications alongside behavioral counseling is reasonable for smoking cessation.
2b	For active smokers, the long-term health benefits of using e-cigarettes in place of nicotine replacement therapy for smoking cessation is not well-established.

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Management of Health Behaviors and Health Factors for Primary Prevention of Stroke

Sleep	
COR	**RECOMMENDATIONS**
2b	The effectiveness of screening adults for obstructive sleep apnea to prevent stroke is unclear.
2b	In patients with obstructive sleep apnea, continuous positive airway pressure might be reasonable to reduce the risk of stroke.

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Atherosclerotic and Non-Atherosclerotic Risk Factors:
Asymptomatic Carotid Artery Stenosis

	RECOMMENDATIONS
3: No Benefit	 In the asymptomatic population, routine screening for carotid artery stenosis is **not** recommended to reduce the risk of stroke.
1	 In patients with asymptomatic carotid artery stenosis **>70%**, shared decision-making between the patient and the health care team to decide between carotid revascularization or medical management is recommended.
2a	 In patients with asymptomatic atherosclerotic carotid artery stenosis, medical treatment with **statins** can be beneficial to reduce the risk of stroke.
2b	 In patients with asymptomatic atherosclerotic carotid artery stenosis **>70% and low perioperative risk**, the use of carotid revascularization, in addition to intensive medical therapy, may be reasonable to reduce the risk of stroke.
2b	 In patients with asymptomatic carotid artery stenosis >50%, **annual carotid duplex ultrasound** might be reasonable to assess progression of disease and subsequent increased risk of stroke.
2b	 In patients with asymptomatic atherosclerotic carotid artery stenosis and high perioperative risk, the effectiveness of carid revascularization to reduce stroke risk is not established.

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Atherosclerotic and Non-Atherosclerotic Risk Factors: Asymptomatic Cerebral Small Vessel Disease

COR	RECOMMENDATIONS
1	In adults with asymptomatic cerebral small vessel disease, including silent infarcts, **assessment and management of risk factors** is recommended to reduce stroke risk.
2b	In adults with silent cerebral infarcts who do not have an indication for statin therapy, use of low-dose **statin therapy** might be considered to reduce the risk of ischemic stroke.
2b	In adults with silent cerebral infarcts, the benefit of **antiplatelet therapy** to reduce the risk of ischemic stroke is uncertain.

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Atherosclerotic and Non-Atherosclerotic Risk Factors: Migraine

Linking Migraine to Stroke:

- An association between migraine, particularly migraine with aura, and stroke risk has been consistently identified in observational studies.
- This association is stronger for ischemic stroke than for hemorrhagic stroke and is more evident in young women.
- Vascular risk factors are common in patients with migraine and contribute to excess stroke risk.
- Use of combined hormonal contraception in those with migraine with aura is associated with increased risk for ischemic stroke.

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Atherosclerotic and Non-Atherosclerotic Risk Factors: Migraine

COR	RECOMMENDATIONS
1	In adults aged 18-64 years with migraine with or without aura, evaluation and modification of vascular risk factors is recommended, to address the elevated risk of stroke.
1	In adults with migraine with aura who desire contraception, progestin-only or non-hormonal forms are recommended to avoid the increased risk of ischemic stroke associated with combined hormonal contraception.

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Stroke Prevention in Children with Sickle Cell Disease Ages 2-16

Screening Intervention	
COR	**RECOMMENDATIONS**
1	TCD screening frequency based on the highest mean flow velocity in the terminal portion of the internal carotid, or the proximal portion of the middle cerebral artery is recommended.

Brain MRI without Sedation	
COR	**RECOMMENDATIONS**
2a	Should be performed as soon as possible in children and young adults with SCD and Beta-Thalassemia to evaluate for SCI and determine the need for chronic transfusions for stroke prevention.

Abbreviations: SCD indicates sickle cell disease; SCI, silent cerebral infarcts/infarction; and TCD, transcranial Doppler.

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Stroke Prevention in Children with Sickle Cell Disease Ages 2-16

Other Interventions

COR	RECOMMENDATIONS
1	If considered at high risk based on TCD measurements, regularly scheduled transfusion therapy is effective for reducing stroke risk.
2a	If TCD velocities revert to normal, continued transfusion therapy can be beneficial to reduce the stroke risk.
2a	If mean flow velocities normalize and no intracranial stenosis is present, transitioning from transfusion to hydroxyurea therapy can be considered for stroke prevention.
2b	If stroke risk for stroke is high without intracranial stenosis and transfusion therapy is contraindicated, then hydroxyurea or bone marrow transplantation may be reasonable for stroke prevention.

Abbreviations: TCD indicates transcranial doppler.

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Genetic Stroke Syndromes

COR	RECOMMENDATIONS
1	In patients with CADASIL, counseling on smoking cessation and treatment of hypertension and other vascular risk factors is beneficial to reduce the risk of incident stroke.
2a	In adults with hereditary hemorrhagic telangiectasia, screening for pulmonary arteriovenous malformations is reasonable to identify the need for multidisciplinary evaluation to manage stroke risk
2b	In patients with Fabry disease, the effectiveness of enzyme replacement therapy to reduce the risk of stroke is not well established.

Abbreviations: CADASIL indicates Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy.

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Inflammation in Atherosclerosis

COR	RECOMMENDATIONS
2b	In adults with a recent MI, the addition of low dose colchicine to intensive statin therapy might be reasonable to decrease the risk of ischemic stroke

Abbreviations: CAD indicates coronary artery disease; and MI, myocardial infarction.

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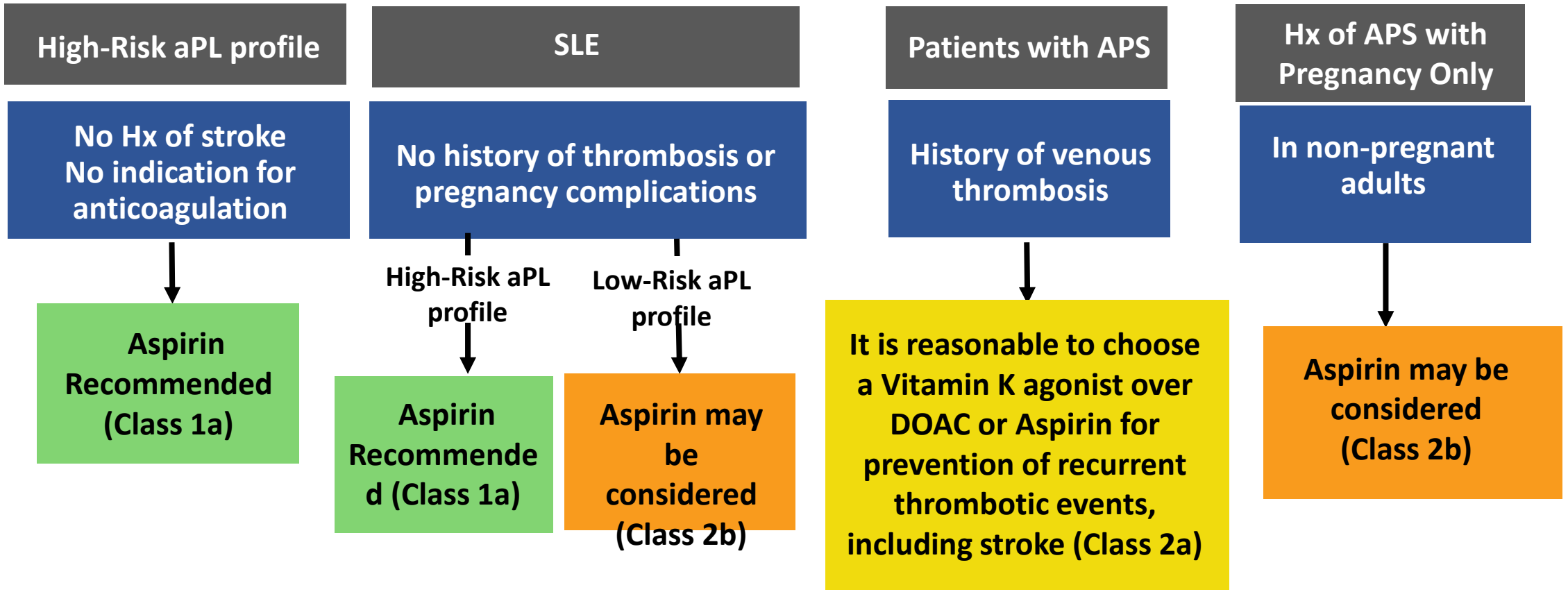
Stroke Prevention in Autoimmune Disorders: Antiphospholipid Syndrome (APS) and Systemic Lupus Erythematosus (SLE)



Abbreviations: aPL indicates antiphospholipid antibodies; APS, autoimmune condition characterized by the presence of venous or arterial thrombosis and/or pregnancy-related complications in patients with antiphospholipid antibodies; DOAC, direct oral anticoagulant; Hx, history; and SLE, systemic lupus arthritis.

Stroke Prevention in Autoimmune Disorders: Rheumatoid Arthritis

Patients with rheumatoid arthritis

Statin treatment may be reasonable for stroke prevention (Class 2b)

American Heart Association.

Stroke Prevention Related to Infections

COR	RECOMMENDATIONS
2a	In patients with periodontal disease, good oral hygiene and regular dental care can be beneficial to lower stroke risk.
3: No Benefit	In patients hospitalized with COVID-19, treatment with full-dose anticoagulation is not recommended to prevent stroke.

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Stroke Prevention in Substance Use Disorders

COR	RECOMMENDATIONS
1	In all adults, screening for substance misuse and substance use disorders is recommended to inform stroke risk.
2a	In patients who use recreational drugs or misuse alcohol or prescription medications or have a substance use disorder, counseling to stop, or appropriate substance use disorder treatments as appropriate is reasonable to reduce stroke risk.

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Prevention of Pregnancy-Associated Stroke

In pregnant or early postpartum (within 6 weeks of delivery) patients with severe hypertension, BP-lowering treatment to a target <160/110 mmHg as soon as possible is recommended to reduce the risk of fatal maternal ICH. (Class 1)

In patients with hypertensive disorders of pregnancy, including chronic hypertension in pregnancy, treatment with antihypertensive medication to a goal BP of <140/90 mmHg is reasonable to reduce the risk of pregnancy-associated stroke. (Class 2a)

Abbreviations: BP indicates Blood Pressure; and ICH, Intracranial Hemorrhage.

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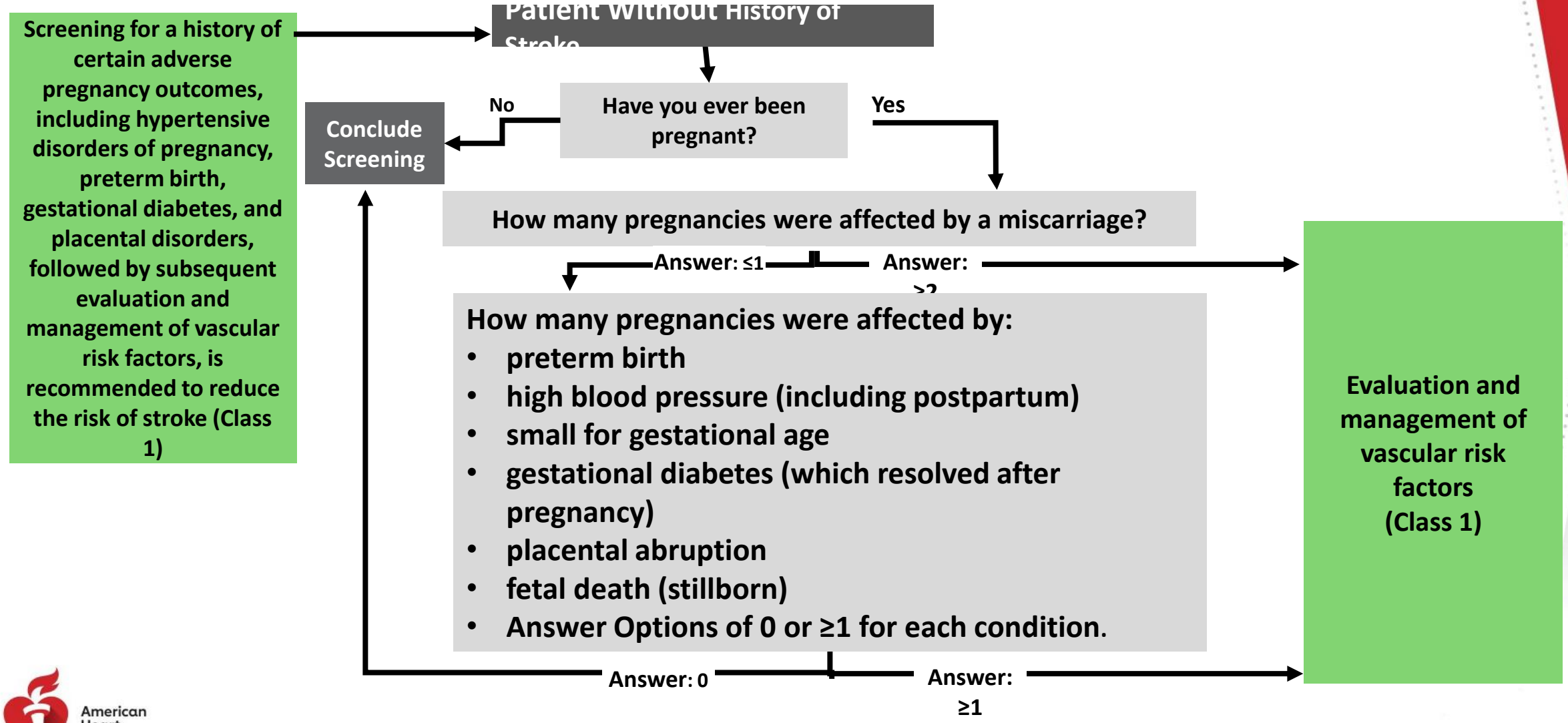
Prevention of Stroke in Women at Increased Risk because of Pregnancy Events



Endometriosis Increases the Risk of Future Stroke

Positive History of Endometriosis increases the risk of:

- Stroke
- Hypertension
- Hypercholesterolemia
- Inflammation
- Cardiovascular Disease

COR	RECOMMENDATIONS
2a	Screening for Endometriosis history is reasonable to inform the risk of stroke
	POSITIVE HISTORY
2a	Vascular risk factor evaluation and modification of vascular risk factors are reasonable to reduce stroke risk.

American Heart Association.

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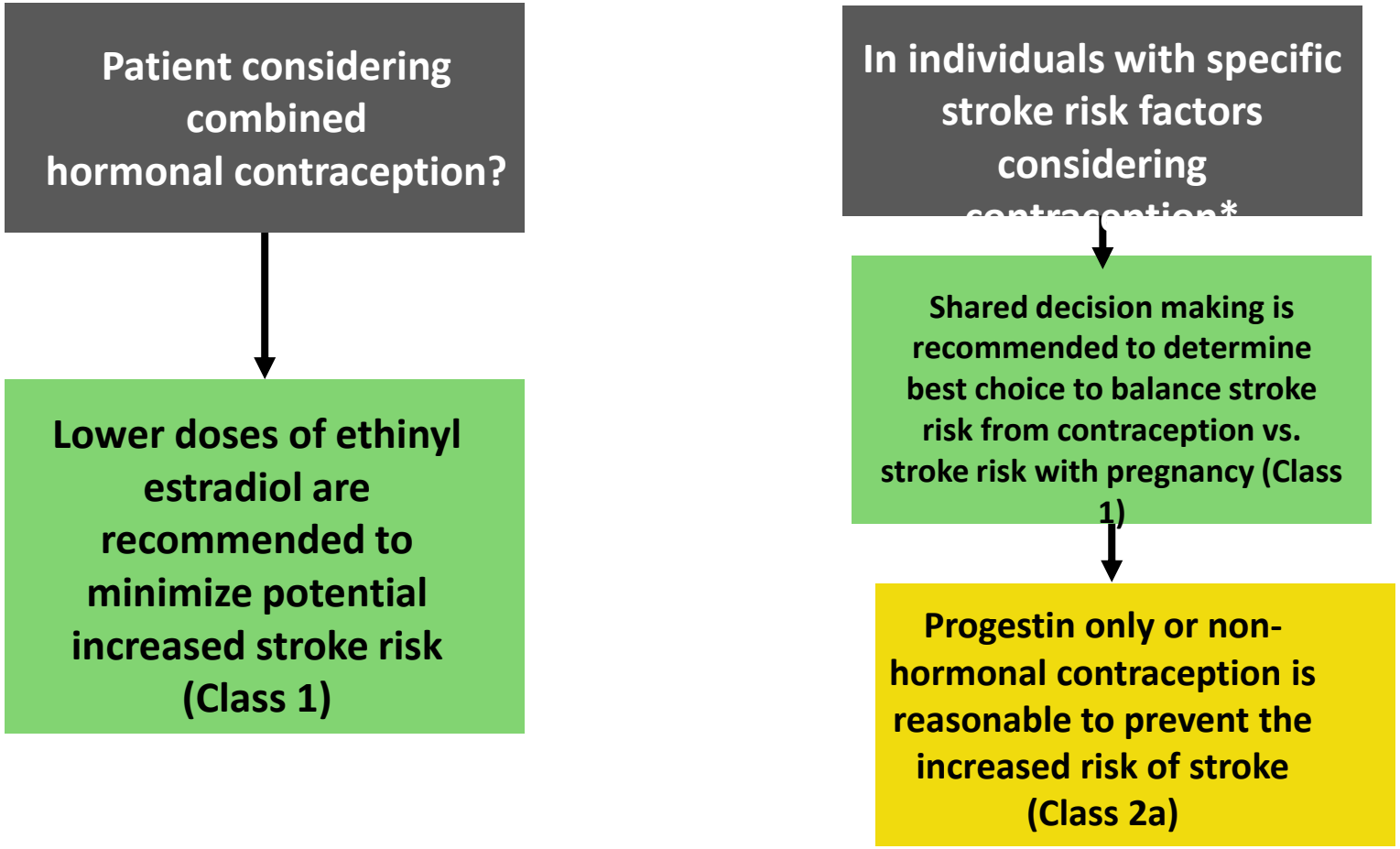
Stroke Risk with Hormonal Contraception



* i.e., age >35 years, tobacco use, hypertension, or migraine with aura

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Menopause Associated Stroke Risk Reduction

COR	RECOMMENDATIONS
1	Screening for a history of premature ovarian failure or premature early menopause can be beneficial to inform stroke risk.
1	In patients with premature ovarian failure or early menopause, evaluation and modification of vascular risk factors is recommended to reduce elevated stroke risk.
3: Harm	In women aged 60 years or older, or more than 10 years post-natural-menopause, or at elevated risk for CVD or stroke, oral estrogen-containing menopausal hormone therapy is associated with an excess risk of stroke and must be weighed against clinical benefits.

Abbreviations: MHT indicates menopausal hormonal treatment.

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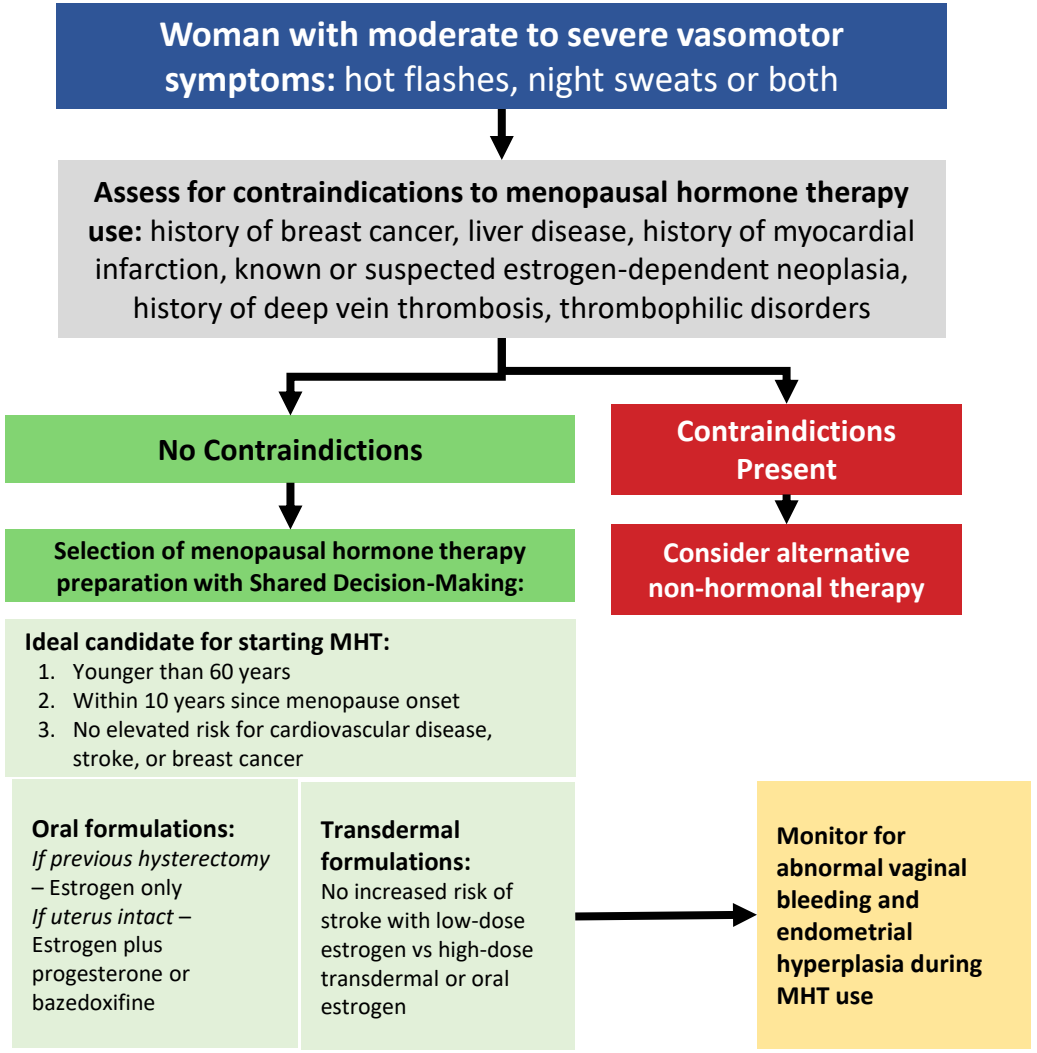
Menopause Associated Stroke Risk Reduction



Abbreviations: MHT indicates menopausal hormonal treatment.

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Hormone use and Stroke Risk Reduction

COR	RECOMMENDATIONS
2a	In transgender women and gender-diverse individuals taking estrogens for gender affirmation, evaluation and modification of risk factors can be beneficial to reduce stroke risk.
2a	In men aged 45-80 with confirmed hypogonadism who are considering testosterone therapy, initiation or continuation of testosterone replacement therapy is reasonable and does not increase stroke risk.

American Heart Association.

Cardiomyopathy and Stroke Risk Reduction

Anticoagulation Use for Primary Prevention of Stroke in Cardiomyopathy	
COR	**RECOMMENDATIONS**
3: No Benefit	In patients with left ventricular systolic dysfunction and no evidence of AF or left ventricular thrombus, anticoagulation is not indicated to prevent stroke and is associated with a higher bleeding risk.

Abbreviations: AF indicates atrial fibrillation.

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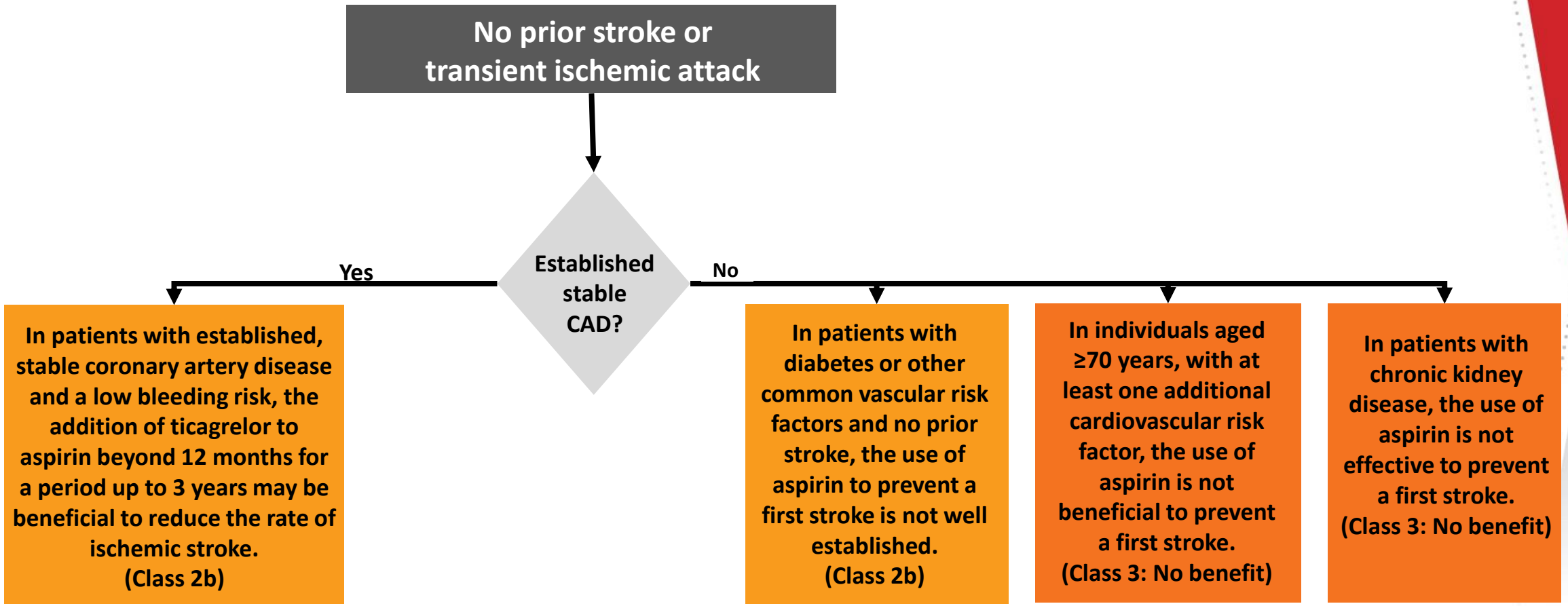
Antiplatelet Use for Primary Prevention of Stroke



Abbreviations: CAD indicates coronary artery disease.

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Acknowledgments

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Questions?

Thanks for having me Ruth and Harper and Charlotte! ☺