The Role of Central Aortic Pressure in the Management of High Blood Pressure

CASE STUDIES

Objective of Presentation

The presentation will outline hypothetical cases that illustrate the potential utility of PWA for management decisions based on the following:

- Clinical evidence supports incorporating non-invasive central aortic blood pressure measurements into blood pressure management.
- Numeric thresholds for central BP variables can be defined utilizing published research.
- The SphygmoCor® System can help guide treatment decisions designed to prevent or reduce long-term target organ damage and cardiovascular events resulting from increased aortic pressure and therefore reduce the socioeconomic burden of hypertension.

Rationale for Utilizing PWA and Central BP Variables: Optimizing Hypertension Pharmacotherapy

Pharmacotherapy Concerns

- Undertreatment, overtreatment, compliance, drug cost, adverse events, drug interactions
- Generally, lifetime treatment
- All above impact a patient's adherence behavior to prescribed treatment and the burden of hypertension

Prescription Optimization

- Optimizing prescription medication including self-administration of therapy is critical to controlling hypertension

Rationale for Utilizing PWA and Central BP Variables: Optimizing Hypertension Pharmacotherapy

- Incorporation of non-invasive measurements of central aortic pressures can improve hypertension management in the following areas:
- Refine monitoring requirements.
- Reduce over-treatment.
- Improve under-treatment.
- Reduce costs of management (e.g., medication costs, monitoring such as ambulatory blood pressure monitoring (ABPM)).

Rationale for Utilizing PWA and Central BP Variables: Optimizing Hypertension Pharmacotherapy

1. Incorporation of PWA into the treatment paradigm for hypertension (i.e., in addition to brachial pressure monitoring) can provide clinically relevant value to patient care:
2. Confirmation of hypertension so that initiation of medication is more likely to be the correct decision for an individual patient

   ***Scenario**: Concurrent elevation in brachial and central pressures*
3. Avoiding initiation of medication when white coat hypertension is suspected

   ***Scenario**: Elevated brachial pressure and normal central pressures*
4. Confirmation that increased treatment may not be needed

   ***Scenario**: Borderline high peripheral pressures and normal central pressures*
5. Targeting when to consider reduction of medication

   ***Scenario**: Normal peripheral and low central pressures, or extended period of normal peripheral and normal central pressures (particularly in the setting of medication tolerance issues)*

Central Aortic Pressures: Clinical Thresholds*

Central aortic systolic pressure

- Normal: < 112 mmHg
- Elevated: 113 – 130 mmHg (equivalent to Stage 1 hypertension)
- High: >130 mmHg (equivalent to Stage 2 hypertension)

Augmentation Index (AIx)

- Normal: < 35%
- High: > 35%

Central aortic pulse pressure

- Normal: <50 mmHg
- High: > 50 mmHg

Central aortic diastolic pressure

- Expected to be similar to brachial diastolic pressure. Threshold for brachial pressure can be used.

*based on research and review peer-reviewed publications.

Case Examples*

*Cases are not actual patients and have been developed to illustrate utility of PWA

Clinical Cases

Case 1: Untreated hypertension

Case 2: Persistent systolic hypertension on drug therapy

Case 3: Suspicion of white coat hypertension

Case 4: Possible adverse effects of hypertension medications

Case 5: Reducing hypertension medications

Case 1a: Untreated Hypertension

History: 48-years, male, moderately overweight, sedentary, non-smoker, no previous history of hypertension

Reason for Visit: annual routine assessment

Clinical Findings:

- HR: 76 bpm, BMI: 29 kg/m^2
- Brachial BP: 145/90 mmHg
- Central BP: 129/88 mmHg, AIx = 38%
- No evidence of secondary hypertension

Diagnosis:

- Stage 2 hypertension, minimal elevation in central BP

Interpretation:

- Brachial BP elevation either essential hypertension or white coat hypertension
- Given minor elevation in central BP, extended trial of lifestyle modification may be indicated prior to medication initiation.
- Follow-up: clinic visit for reassessment. Consider 24-hour ABPM.

Case 1b: Untreated Hypertension

History: 56-years, female, physically active, current smoker 20 pack years, no previous history of hypertension

Reason for Visit: routine assessment

Clinical Findings:

- HR: 78 bpm, BMI: 24 kg/m^2
- Brachial BP: 148/92 mmHg
- Central BP: 138/90 mmHg, AIx = 48%
- No evidence of secondary hypertension

Diagnosis:

- Stage 2 hypertension, elevation in central BP and AIx

Interpretation:

- Elevation in both brachial BP, central BP and AIx. Increased risk for vascular end-organ damage.
- Prompt follow-up is indicated to confirm elevated BP. Confirmation should result in initiation of medication. Counseling for smoking cessation.
- Follow-up: Clinic visit for reassessment, recommend home BP monitoring.

Case 2a: Persistent Systolic Hypertension on Drug Therapy

History: 62-years, female, physically active, ex-smoker (30 pack years), known essential hypertension, asymptomatic

Reason for Visit: BP follow-up

Clinical Findings:

- HR: 64 bpm, BMI: 26 kg/m^2
- Brachial BP: 130/86 mmHg
- Central BP: 116/84 mmHg, AIx = 15%

Diagnosis:

- Stage 1 hypertension (on treatment), almost normal central variables

Interpretation:

- Acceptable control of brachial BP although not normal. No indication of increased risk based on central BP and AIx.
- Although research suggests that more aggressive brachial BP control may be beneficial, the near normal central BP informs management decision towards maintaining current therapeutic measurement.
- Follow-up: Routine BP follow-up clinic visit as per usual schedule.

Case 2b: Persistent Systolic Hypertension on Drug Therapy

History: 62-years, female, physically active, ex-smoker (30 pack years), known essential hypertension, asymptomatic

Reason for Visit: BP follow-up

Clinical Findings:

- HR: 72 bpm, BMI: 26 kg/m^2
- Brachial BP: 132/88 mmHg
- Central BP: 126/88 mmHg, AIx = 48%
- No evidence of secondary hypertension

Diagnosis:

- Stage 1 hypertension (on treatment), elevated central variables

Interpretation:

- Borderline acceptable control of brachial BP although above normal. Additional increased risk of adverse vascular events based on central BP and AIx.
- The combination of borderline acceptable brachial BP and elevated central BP variables suggests that more aggressive hypertension management is indicated, through increasing dose of current medications (if possible) and/or adding another class of medication.
- Follow-up: More frequent monitoring including home BP monitoring.

Case 3: Suspicion of White Coat Hypertension

History: 32-years, male, mildly overweight, sedentary, non-smoker, hypercholesterolemia on routine testing

Reason for Visit: annual assessment

Clinical Findings:

- HR: 82 bpm, BMI: 27 kg/m^2
- Brachial BP: 145/86 mmHg
- Central BP: 112/84 mmHg, AIx = 20%

Diagnosis:

- Stage 2 hypertension based on brachial BP, normal central BP and AIx

Interpretation:

- Brachial BP elevation either essential hypertension or white coat hypertension (WCH)
- Suspect white coat hypertension based on normal central pressures. However, data suggest that white coat hypertension may increase risk for vascular adverse events that is between normal (no risk) and essential hypertension. Lifestyle counseling (exercise, diet, weight loss) and investigation for WCH is indicated.
- Follow-up: Clinic visit for reassessment. 24-hour ABPM.

Case 4: Possible Adverse Effects of Hypertension Medications

History: 74-years, female, never-smoker, sedentary, diabetes (controlled), NYHA class II, LVEF 45%

Reason for Visit: increased dyspnea, fatigue, presyncope on standing

Medications: furosemide, oral hypoglycemics, ARB, CCB

Clinical Findings:

- HR: 74 bpm, BMI: 32 kg/m^2
- Brachial BP: 124/82 mmHg (sitting), 118/78 mmHg (standing)
- Central BP: 108/78 mmHg, AIx = 39%

Diagnosis:

- Normal brachial hypertension, low central BP, mild elevation in AIx

Interpretation:

- Controlled brachial BP. Low central BP with slight elevation in AIx.
- Low central BP suggests that hypotension may be contributing to symptoms.
- Consider reducing dose or stopping at least one medication for hypertension. Central BP provides additional data supporting safety of stopping one medication (e.g., central BP is not elevated and is low).
- Follow-up: Prompt clinic visits for reassessment and monitoring of BP and symptoms. Should be recommended for home BP monitoring if not currently using HBPM. Consider ABPM.

Case 5a: Controlled Hypertension - Reducing Hypertension Medications

History: 56-years, female, smoker (40 pack-years), moderately active, diabetic (controlled on oral hypoglycemic drug)

Reason for Visit: annual assessment, treated for hypertension (diuretic, ACEI)

Clinical Findings:

- HR: 68 bpm, BMI: 24 kg/m^2
- Brachial BP: 124/84 mmHg
- Central BP: 118/80 mmHg, AIx = 48%

Diagnosis:

- Brachial BP normal, mild elevation in central BP, high AIx

Interpretation:

- High AIx indicates increased risk for vascular end-organ damage.
- Counseling for smoking cessation. Given high AIx, should not decrease medication but may consider replacement of a medication class to attempt to lower AIx.
- Follow-up: Clinic visit for reassessment, recommend HBPM.

Case 5b: Controlled Hypertension - Reducing Hypertension Medications

History: 56-years, female, physically active, smoker 22 pack years

Reason for Visit: annual assessment, treated for hypertension (2 classes)

Clinical Findings:

- HR: 75 bpm, BMI: 24 kg/m^2
- Brachial BP: 124/84 mmHg
- Central BP: 118/72 mmHg, AIx = 18%

Diagnosis:

- Brachial BP normal, mild elevation in central BP, normal AIx

Interpretation:

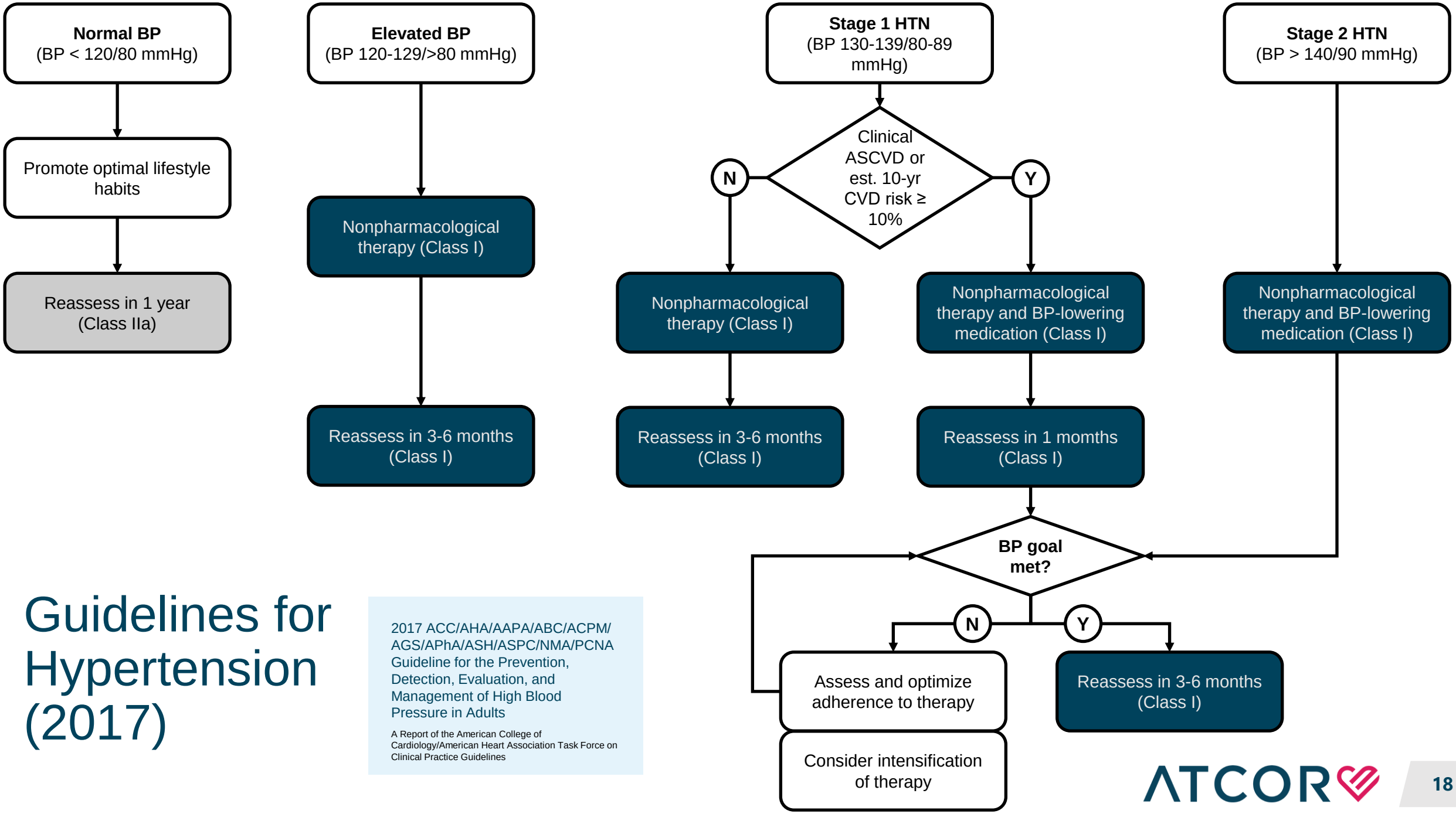
- BP controlled. Can consider reducing medications to minimum needed to control BP
- Follow-up: Clinic visit for reassessment, recommend HBPM.

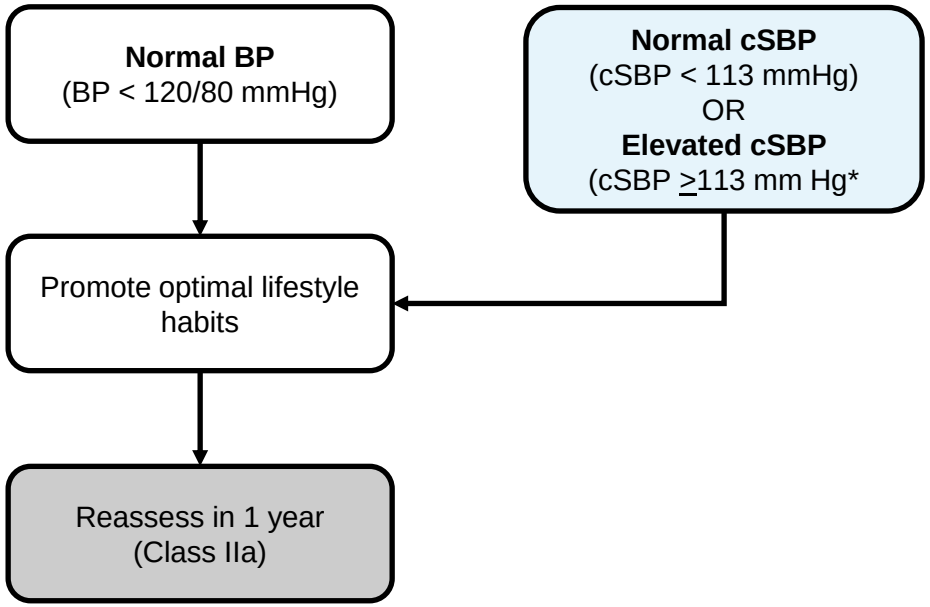
How to Use Central Blood Aortic Blood Pressure

Guidelines for Hypertension (2017)

2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines



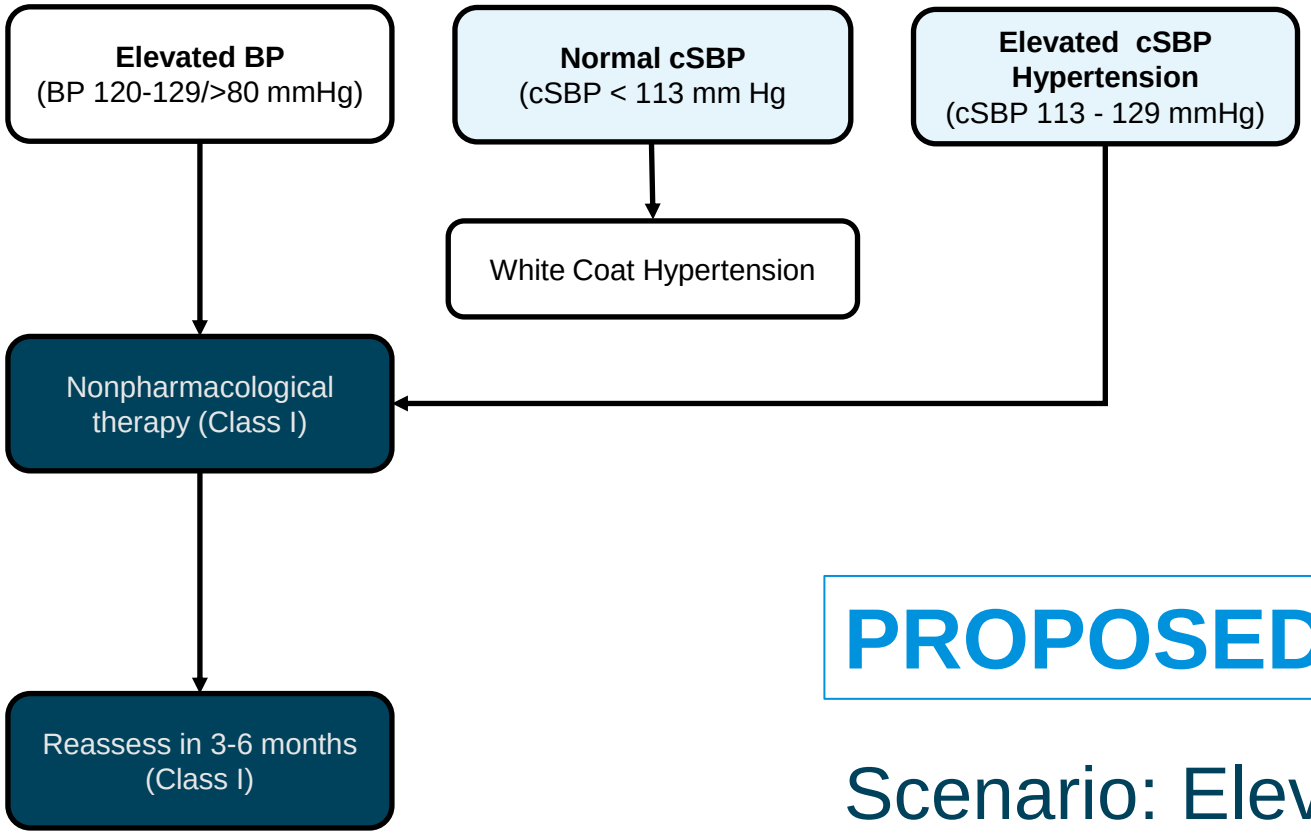


PROPOSED GUIDELINE

Scenario: Normal Brachial BP

- No change in guideline

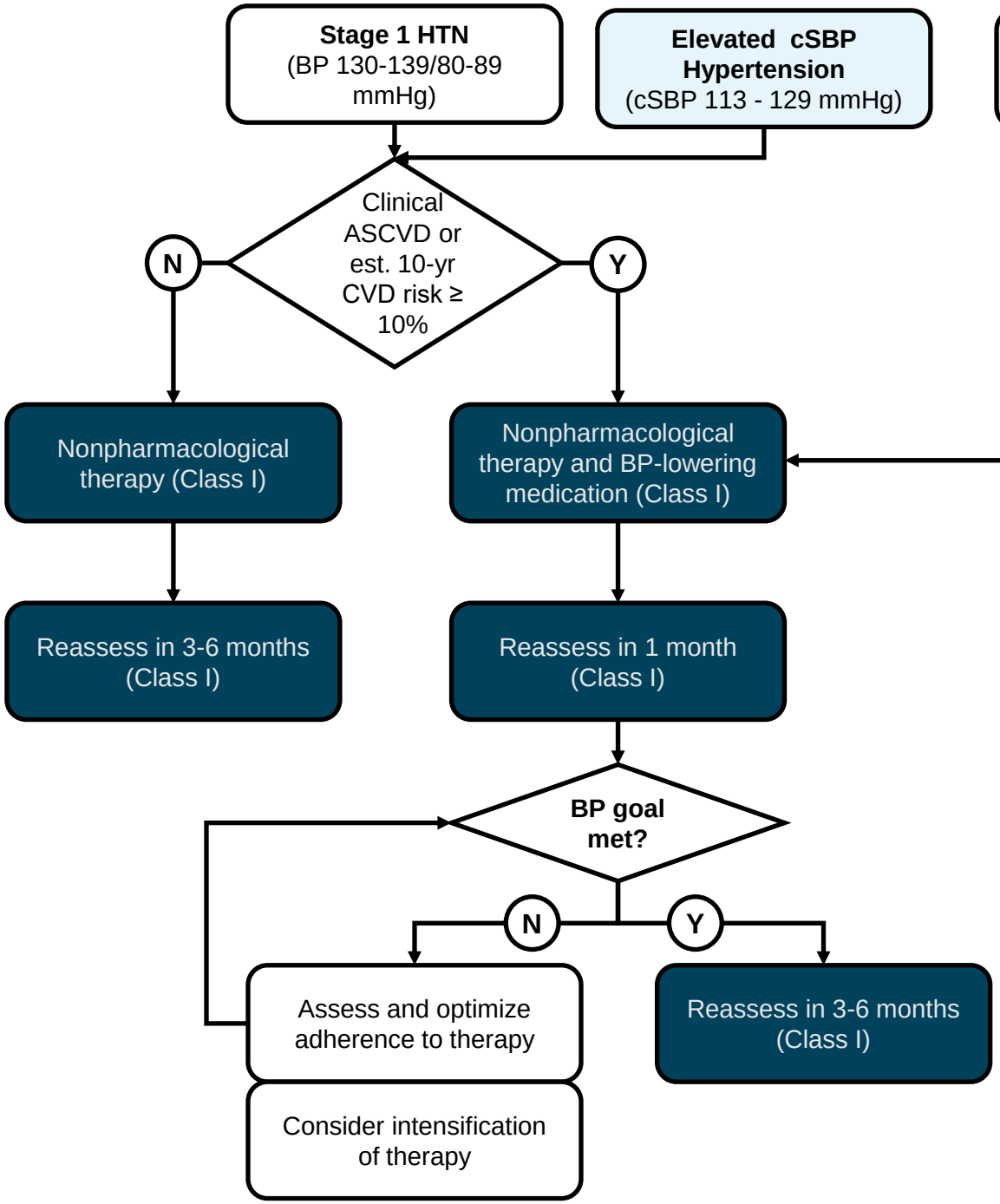
*cSBP cannot exceed brachial systolic BP (i.e., will always be < 120 mm Hg)



PROPOSED GUIDELINE

Scenario: Elevated Brachial BP

- Diagnosis of White Coat Hypertension when cSBP is normal
- Schedule routine follow-up



PROPOSED GUIDELINE

Scenario: Stage 1 Hypertension

- Largest impact in management decisions
- Diagnosis of White Coat Hypertension when cSBP is normal
- cSBP hypertension – confirmation of hypertension and initiation of treatment
- Incorporate cSBP in follow-up for management decisions related to increasing or decreasing medications

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PROPOSED GUIDELINE

Scenario: Stage 2 Hypertension

- Diagnosis of White Coat Hypertension when cSBP is normal
- Schedule follow-up in 3 to 6 months
- Incorporate cSBP in follow-up for management decisions related to increasing or decreasing medications