HYPERTENSION MANAGEMENT: CASE STUDIES

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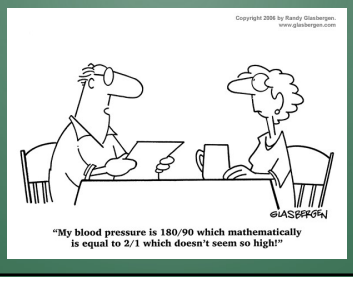
BP MANAGEMENT



Q.1. WHAT IS THE TARGET BLOOD PRESSURE GOAL FOR CURRENT HYPERTENSION MANAGEMENT AHA/ACC

a) < 140/90 mm Hg
b) < 120/80 mm Hg
c) < 120/90 mm Hg
d) < 130/80 mm Hg
e) < 130/90 mm Hg

Q.2. WHICH OF THE FOLLOWING DRUGS IS NOT RECOMMENDED FOR 1ST LINE MONOTHERAPY FOR MANAGEMENT OF HYPERTENSION?

a) Amlodipine
b) Enalapril
c) Atenolol
d) Losartan
e) Hydrochlorothiazide

Q.3. BLOOD PRESSURE OF AN ASYMPTOMATIC PERSON CONSISTENTLY SHOWS 150/70 MM HG. WHICH STAGE OF HYPERTENSION DOES THE PERSON FIT IN?

a) Stage 1 Hypertension
b) Stage 2 Hypertension
c) Hypertensive crisis
d) Hypertensive urgency
e) Normal blood pressure

WHAT IS BLOOD PRESSURE?

- Lateral Pressure exerted by blood in the walls of blood vessels.
- Dependents of blood pressure:
  - Arteriolar tone
  - Cardiac: systolic pressure/ Contractility
  - Intravascular volume/blood
  - Elasticity of blood vessels
  - Autonomic output/ hormones/ neural activity

WHY IS HYPERTENSION IMPORTANT?

- Very common
- Hypertension significantly increases the risk of cardiovascular diseases, stroke and other major illnesses
- In younger patients, it may be an indicator of underlying disease process

HYPERTENSION: LEADING MODIFIABLE RISK FACTOR FOR GLOBAL MORTALITY

Prevalence in 2016:

- 29% of adult Americans → 41% by 2030
- 40% of adult black Americans – highest in world
- 63% of Americans age ≥ 60y
- 90% of Americans age ≥ 85y

↓

80 million Americans with hypertension!

- 60% of strokes
- 50% of heart failure, chronic kidney disease
- 30% of end-stage renal disease
- 25% of MI, premature death

Lancet 2015; 386:399
NCHS Data Brief 2017; No.289

SCREENING

- All patients 18+ years every year
- OR, Every 6 months in patients with risk factors or SBP: 120-130

PHYSIOLOGIC PRINCIPLES

- More than 90% of hypertension are primary hypertension.
- The **term essential hypertension is no longer in vogue**; it evolved in the early 1920s or 1930s with the notion that older people who were living longer had elevations in BP.
- Clusters in families and results from a complex interaction of genetic and environmental factors.
- Hypertension-related genes identified to date regulate renal salt and water handling.
- Major pathophysiologic mechanisms of hypertension include **activation of the sympathetic nervous system and renin–angiotensin–aldosterone system.**
- Endothelial dysfunction, increased vascular reactivity, and vascular remodeling may be causes, rather than consequences, of blood pressure elevation; increased vascular stiffness contributes to isolated systolic hypertension in the elderly.

ACC/AHA 2017 BP GUIDELINE: WHAT'S NEW?

- New BP classification scheme
- Out-of-office BP necessary to Dx HTN
- New target BP levels
- HTN Rx according to:
  - BP level
  - 10y cardiovascular risk
- Initial low-dose, 2-drug Rx for most patients
- Favor indapamide/chlorthalidone over HCTZ
- Adjust Rx using home BP (HBP) or ambulatory BP (ABP) monitoring
- Recommends team-based care to manage hypertension

BP Category	Systolic Blood Pressure (SBP)		Diastolic Blood Pressure (DBP)
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120-129 mm Hg	and	<80 mm Hg
Hypertension			
Stage 1	130-139 mm Hg	or	80-89 mm Hg
Stage 2	≥140 mm Hg	or	≥90 mm Hg

* Individuals with SBP and DBP in two categories should be designated to the higher BP category. Blood pressure is based on an average of ≥2 careful readings obtained on ≥2 occasions.

SINGLE HIGH BLOOD PRESSURE IN OFFICE DOESN'T MEAN DIAGNOSIS OF HYPERTENSION

- White coat hypertension:
  - Home blood pressure monitoring
  - 24 hour ambulatory blood pressure monitoring

DIAGNOSIS REQUIRES MULTIPLE MEASUREMENTS, WHETHER AT HOME OR AT OFFICE

- Except in case of hypertension emergency and hypertensive urgency or malignant hypertension
- If you need more data to work up elevated BP noted in the office visit, the working diagnosis is "Elevated BP without the diagnosis of hypertension " ICD RO3.0

OUT-OF-OFFICE BP MEASUREMENTS

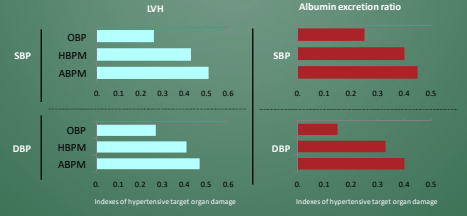
- Out-of-office measurement identifies white coat hypertension and masked hypertension
- ABPM has better predictive ability than OBPM and is the recommended out-of-office measurement method
- HBPM has better predictive ability than OBPM and is recommended if ABPM is not tolerated, not readily available or due to patient preference

ABPM = ambulatory blood pressure measurement
HBPM = home BP measurement
OBPM = office BP measurement

ABPM

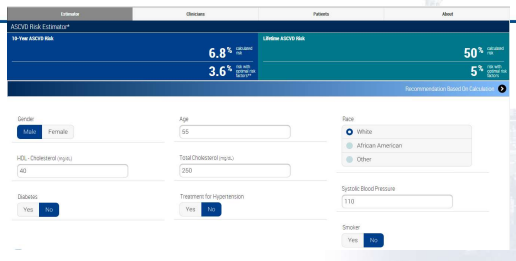
- Ambulatory blood pressure (ABP) monitoring involves measuring blood pressure (BP) at regular intervals (usually every 20–30 minutes) over a 24 hour period while patients undergo normal daily activities, including sleep.

OUT-OF-OFFICE BP MEASUREMENTS ARE MORE HIGHLY CORRELATED WITH BP-RELATED RISK



Mulè G, et al. *J Cardiovasc Risk* 2002;9:123-9.

Results of Risk Estimator



2013 PREVENTION GUIDELINES ASCVD RISK ESTIMATOR

The ACC and the American Heart Association (AHA), in collaboration with the National Heart, Lung, and Blood Institute and other specialty societies, have released four guidelines focused on the assessment of cardiovascular risk, lifestyle modifications to reduce cardiovascular risk and management of elevated blood cholesterol and body weight in adults.

In order to support the implementation of these guidelines the ACC and AHA have jointly published a new mobile application (app).

The ASCVD Risk Estimator application helps health care providers and patients estimate 10-year and lifetime risks for atherosclerotic cardiovascular disease (ASCVD) using the Pooled Cohort Equations and lifetime risk prediction tools. The ASCVD Risk Estimator provides easy access to recommendations specific to calculated risk estimates. Additionally, the app includes readily accessible guideline reference information for both providers and patients related to therapy, monitoring, and lifestyle.

The app is available on both iTunes (iPhones, iPads) and Google Play (Galaxy, Nexus, other Android devices). Use the links below from your mobile device to download the app.

American College of Cardiology | American Heart Association.

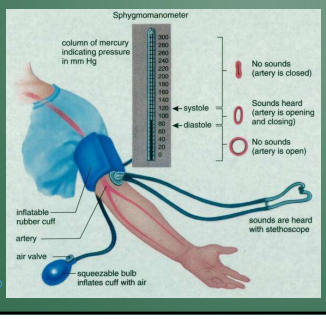
2013 Prevention Guidelines
ASCVD RISK ESTIMATOR

Download the App From iTunes | Download the App From Google Play | Launch the Web Version

FOLLOW-UP AFTER INITIAL BP EVALUATION

COR	LOE	Recommendations for Follow-Up After Initial BP Elevation
I	B-R	Adults with an elevated BP or stage 1 hypertension who have an estimated 10-year ASCVD risk less than 10% should be managed with nonpharmacological therapy and have a repeat BP evaluation within 3 to 6 months.
I	B-R	Adults with stage 1 hypertension who have an estimated 10-year ASCVD risk of 10% or higher should be managed initially with a combination of nonpharmacological and antihypertensive drug therapy and have a repeat BP evaluation in 1 month.
I	B-R	Adults with stage 2 hypertension should be evaluated by or referred to a primary care provider within 1 month of the initial diagnosis, have a combination of nonpharmacological and antihypertensive drug therapy (with 2 agents of different classes) initiated, and have a repeat BP evaluation in 1 month.

GENERAL APPROACH: BP MEASUREMENT

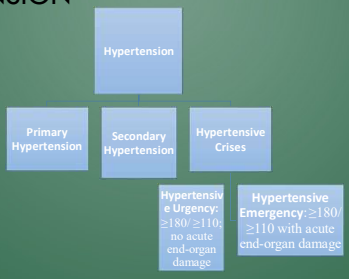


- Proper measurement of blood pressure:
  - Well-calibrated machine
  - Cover at least 80% arm circumference by the bladder of the cuff
  - Patient rested for at least 5 mins
  - At least 30 mins after coffee or smoking
- Identify immediately if the patient has hypertensive crises

MEASURE APPROPRIATELY AND IN BOTH ARMS:

- Difference between the arms:
  - ➢Subclavian stenosis
  - ➢Peripheral arterial disease
  - ➢Aortic dissection

CLASSIFICATION OF HYPERTENSION



CLINICAL CLUES FOR PRIMARY HYPERTENSION

- ***History:***
  - Have they been told they have high blood pressures during previous examinations?
  - Risk factors for development of hypertension
  - Dietary history
  - Family history of hypertension and cardiovascular diseases
  - Evaluation of previous therapies, focusing on blood pressure response and side
  - History of end organ damage

CLINICAL CLUES FOR PRIMARY HYPERTENSION

- ***Examination:***
  - Weight and height. Calculate body mass index.
  - Measure blood pressure in both arms.
  - Check pulses
  - Fundoscopy
  - Apical impulse
  - Heart sounds

CLINICAL CLUES FOR PRIMARY HYPERTENSION

- ***Investigations***
  - Renal function tests: Blood urea, serum creatinine.
  - Urinalysis for blood, protein and glucose.
  - Fasting blood glucose.
  - Total, HDL and LDL cholesterol, and triglycerides.
  - ECG.
  - Echocardiogram.

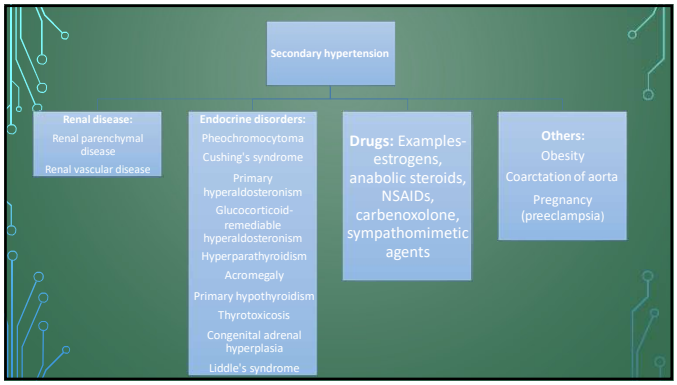


Table 15 : The percentage prevalence of various causes of Hypertension[81,82]

A. Primary or Essential	94-95%
B. Secondary	
Renal	
Renal parenchymal	2-3%
Renovascular	1-2%
Endocrinal	0.3-1%
Primary aldosteronism	
Phaeochromocytoma	
Cushing's Syndrome	
Acromegaly	
Vascular – Coarctation of aorta	
Nonspecific aortoarteritis	
Drugs – Oral Contraceptives, NSAIDs	0.50%
Steroids, Cyclosporine	
Miscellaneous	0.50%
Obstructive Sleep apnoea	

SECONDARY HTN-CLUES IN MEDICAL HISTORY

- Onset: at age < 30 yrs (Fibromuscular dysplasia) or > 55 (athelosclerotic renal artery stenosis), sudden onset (thrombus or cholesterol embolism).
- Severity: Grade II, unresponsive to treatment.
- Episodic, headache and chest pain/palpitation (pheochromocytoma, thyroid dysfunction).
- Morbid obesity with history of snoring and daytime sleepiness (sleep disorders)

CLINICAL CLUES FOR SECONDARY HYPERTENSION

- ***History:***
  - Personal or family history of kidney diseases.
  - Episodic headaches, palpitations, sweating and paroxysmal hypertension.
  - Development of central obesity, facial rounding and redness, easy skin bruising, diabetes, muscle weakness.
  - History of hypokalemia along with hypertension.
  - Low-trauma bone fracture, kidney stones, anorexia, abdominal pain, psychiatric disturbances.

CLINICAL CLUES FOR SECONDARY HYPERTENSION (CONTD)

- Weight gain, fatigue, cold intolerance and constipation.
- Weight loss, palpitations, tremors, heat intolerance and hyperdefecation.
- Drug history.
- Weight gain and pattern of change in weight.
- Onset of hypertension in a pregnant woman after 20 weeks of gestation.
- Blood in urine, swelling of body
- Thyromegaly, fine tremors of hands, palmar perspiration.
- Coarse thick skin, leg swelling, periorbital puffiness.

CLINICAL CLUES FOR SECONDARY HYPERTENSION

- ***Examination:***
  - Weight and height. Calculate body mass index.
  - Measure blood pressure in both arms.
  - Listen for abdominal bruits.
  - Rounding of facies, increase in supraclavicular fat pad, presence of dorsocervical fat pad, wide purple abdominal striae, proximal muscle weakness.

- ***Investigations***

Investigation for a specific disease is guided by clues from history and physical examination. Some of the specific tests, as guided by suspicion, might be as follows.

- Chest X-ray
- Renal ultrasound
- Renal angiography
- Plasma or urinary catecholamines
- Urinary cortisol and dexamethasone suppression tests
- Plasma renin activity and aldosterone
- Thyroid function tests

SECONDARY HTN-SCREENING TESTS

Diagnosis	Diagnostic Test
Chronic kidney disease	Estimated GFR
Coarctation of the aorta	CT angiography
Cushing's syndrome and other glucocorticoid excess states including chronic steroid therapy	History; dexamethasone suppression test
Drug induced/related (see table 18)	History; drug screening
Pheochromocytoma	24-hour urinary metanephrine and normetanephrine
Primary aldosteronism and other mineralocorticoid excess states	24-hour urinary aldosterone level or specific measurements of other mineralocorticoids
Renovascular hypertension	Doppler flow study; magnetic resonance angiography
Sleep apnea	Sleep study with O_2 saturation
Thyroid/parathyroid disease	TSH; serum PTH

www.nhlbi.nih.gov

HYPERTENSIVE URGENCIES

- **Severe elevated BP** in the upper range of stage II hypertension.
- **Without** progressive end-organ dysfunction.
- **Examples**: Highly elevated BP without severe headache, shortness of breath or chest pain.
- Usually due to under-controlled HTN.

HYPERTENSIVE EMERGENCIES

- Severely elevated BP (>180/120mmHg).
- **With** progressive target organ dysfunction.
- Require emergent lowering of BP.

- **Examples: Severely elevated BP** with:
  - Hypertensive encephalopathy
  - Acute left ventricular failure with pulmonary edema
  - Acute MI or unstable angina pectoris
  - Dissecting aortic aneurysm

COMPLICATIONS OF PROLONGED UNCONTROLLED HTN

- Changes in the vessel wall leading to vessel trauma and arteriosclerosis throughout the vasculature
- Complications arise due to the "target organ" dysfunction and ultimately failure.

TARGET ORGANS

- CVS (Heart and Blood Vessels)
- The kidneys
- Nervous system
- The Eyes

MAJOR CONTROLLED TRIALS

❑ **SPRINT trial (included high risk patients with ≥ 15% Framingham risk score without diabetes):**

- Patients were ≥ 50 years
- Lower targets (<120/80) in these patient:
  - ➢ 27% reduction in mortality
  - ➢ 38% reduction in heart failure

❑ **ACCORD trial (diabetic patients):**

- Target < 130 mm Hg systolic is justified in diabetic patients with high risk for CVA

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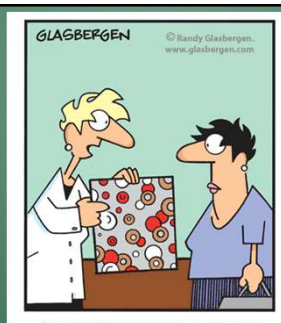
* Individuals with SBP and DBP in two categories should be designated to the higher BP category. Blood pressure is based on an average of ≥2 careful readings obtained on ≥2 occasions.

NON PHARMACOLOGICAL MANAGEMENT

- Reduce sodium intake
- Take low-fat dairy products
- Maintain normal body weight
- Quit smoking
- Decrease alcohol consumption
- To increase physical activity
- Exercise



BEST PROVEN NONPHARMACOLOGICAL INTERVENTIONS FOR PREVENTION AND TREATMENT OF HYPERTENSION*

Nonpharmacological Intervention	Dose	Approximate Impact on SBP	
		Hypertension	Normotension
Weight loss	Weight/body fat	Best goal is ideal body weight, but aim for at least a 1-kg reduction in body weight for most adults who are overweight. Expect about 1 mm Hg for every 1-kg reduction in body weight.	-5 mm Hg	-2/3 mm Hg
Healthy diet	DASH dietary pattern	Consume a diet rich in fruits, vegetables, whole grains, and low-fat dairy products, with reduced content of saturated and total fat.	-11 mm Hg	-3 mm Hg
Reduced intake of dietary sodium	Dietary sodium	Optimal goal is <1500 mg/d, but aim for at least a 1000-mg/d reduction in most adults.	-5/6 mm Hg	-2/3 mm Hg
Enhanced intake of dietary potassium	Dietary potassium	Aim for 3500–5000 mg/d, preferably by consumption of a diet rich in potassium.	-4/5 mm Hg	-2 mm Hg

*Type, dose, and expected impact on BP in adults with a normal BP and with hypertension.
DASH indicates Dietary Approaches to Stop Hypertension; and SBP, systolic blood pressure.
Resources: Your Guide to Lowering Your Blood Pressure With DASH—How Do I Make the DASH? Available at: https://www.nhlbi.nih.gov/health/resources/heart/hbp-dash-how-to
Top 10 Dash Diet Tips. Available at: http://dashdiet.org/dash_diet_tips.asp

BEST PROVEN NONPHARMACOLOGICAL INTERVENTIONS FOR PREVENTION AND TREATMENT OF HYPERTENSION* (CONT.)

Nonpharmacological Intervention	Dose	Approximate Impact on SBP	
		Hypertension	Normotension
Physical activity	Aerobic	• 90–150 min/wk • 65%–75% heart rate reserve	-5/8 mm Hg	-2/4 mm Hg
	Dynamic resistance	• 90–150 min/wk • 50%–80% 1 rep maximum • 6 exercises, 3 sets/exercise, 10 repetitions/set	-4 mm Hg	-2 mm Hg
	Isometric resistance	• 4 × 2 min (hand grip), 1 min rest between exercises, 30%–40% maximum voluntary contraction, 3 sessions/wk • 8–10 wk	-5 mm Hg	-4 mm Hg
Moderation in alcohol intake	Alcohol consumption	In individuals who drink alcohol, reduce alcohol† to: • Men: ≤2 drinks daily • Women: ≤1 drink daily	-4 mm Hg	-3 mm

*Type, dose, and expected impact on BP in adults with a normal BP and with hypertension.
†In the United States, one "standard" drink contains roughly 14 g of pure alcohol, which is typically found in 12 oz of regular beer (usually about 5% alcohol), 5 oz of wine (usually about 12% alcohol), and 1.5 oz of distilled spirits (usually about 40% alcohol).

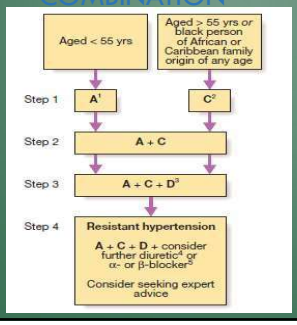
STAGE 1 HYPERTENSION

- High risk patients (≥10% ASCVD) should be started on medications and patients with CVD, CKD, diabetes
- Low risk patients (<10% ASCVD)) can be managed with lifestyle modifications alone
- Pharmacotherapy Options: ACE/ARBS ,long acting CCBs, Thiazide diuretics

STAGE 2 HYPERTENSION

- All stage 2 patients require pharmacotherapy
- If BP already at or more than 150/90 mm Hg, AHA clearly recommends for starting combination therapy directly
- If bp not controlled by combination therapy, you can either start a third agent or increased the dose of first two agents

ANTIHYPERTENSIVE IN COMBINATION



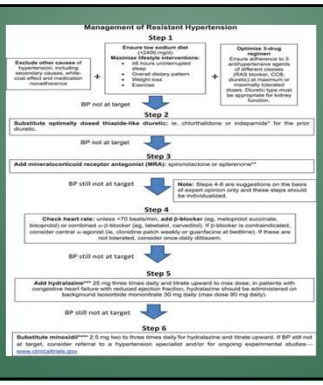
A = ACE inhibitor (consider angiotensin II receptor antagonist if ACE-intolerant);
C = calcium channel blocker;
D = thiazide-type diuretic)

SPECIAL PATIENT REQUIREMENTS

- **Black patients:** ACEI or ARBs are less effective as monotherapy. Start CCBs. If blood pressure still above goal, ACEI/ARBs can be added as 2nd agent in combination
- **Hypertension with protenuric CKD:** ACEIs and ARBs are 1st line agent
- **Hypertension with diabetes:** ACEIs or ARBs
- **Hypertension with heart failure and decreased EF (HFrEF):** Beta blockers and ACEIs or ARBs (reduce mortality, especially if h/o ACS)
- **Hypertension with AF, angina, essential tremors, migraine:** Beta blockers (monotherapy not recommended unless other indications for their use present along with hypertension)
- **Hypertension with BPH:** Alpha blockers (monotherapy again not recommended)

RESISTANT HYPERTENSION

- Uncontrolled HTN with a regimen of 3 drugs, one of which must be a diuretic
- Raises a suspicion of secondary hypertension. But first:
  - ➢Check medications appropriate or not
  - ➢Check adherence to treatment
  - ➢Workup for secondary causes of hypertension
  - ➢Add aldosterone receptor antagonist (Spironolactone, Eplerenone)
  - ➢Add adrenergic receptor blockers: Labetalol, Carvedilol, Bisoprolol
  - ➢Add direct vasodilators: Hydralazine, Minoxidil
  - ➢Add Clonidine

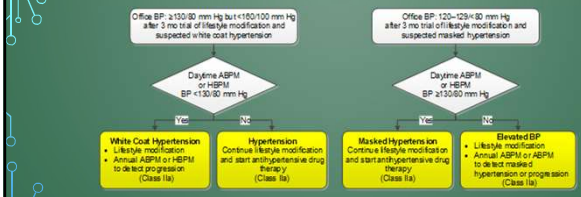


MEDICATION ADHERENCE IS CRITICAL AT SUCCESSFUL IMPLEMENTATION OF INTENSIVE TREATMENT

"Drugs don't work in patients who don't take them."

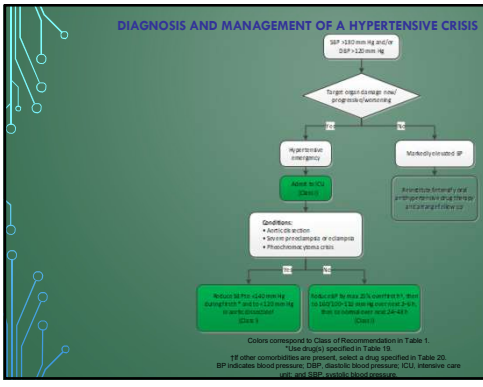
~ Former US Surgeon General:

C. Everett Koop



ISOLATED SYSTOLIC HYPERTENSION

- Not distinguished as a separate entity as far as management is concerned.
- SBP should be primarily considered during treatment and not just diastolic BP.
- Systolic BP is more important cardiovascular risk factor after age 50.
- Diastolic BP is more important before age 50.



LET'S REVIEW THE INITIAL QUESTIONS.

Q.1. WHAT IS THE TARGET BLOOD PRESSURE GOAL FOR CURRENT HYPERTENSION MANAGEMENT BY AHA/ACC?

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b) < 120/80 mm Hg
c) < 120/90 mm Hg
d) < 130/80 mm Hg
e) < 130/90 mm Hg

Q.2. WHICH OF THE FOLLOWING DRUGS IS NOT RECOMMENDED FOR 1ST LINE MONOTHERAPY FOR MANAGEMENT OF HYPERTENSION?

a) Amlodipine
b) Enalapril
c) Atenolol
d) Losartan
e) Hydrochlorothiazide

Q.3. BLOOD PRESSURE OF AN ASYMPTOMATIC PERSON CONSISTENTLY SHOWS 150/70 MM HG. WHICH STAGE OF HYPERTENSION DOES PERSON FIT IN?

a) Stage 1 Hypertension
b) Stage 2 Hypertension
c) Hypertensive crisis
d) Hypertensive Urgency

TREATMENT INITIATION IS BASED BP LEVELS AND CVD RISK

- **SBP <130 and <80 mm Hg**
  - Don't treat
- **SBP ≥130-140 or DBP ≥80-90 mm Hg**
  - Treat if any of the following:
    - History of CVD, DM, or CKD
    - 10 yr risk of CVD ≥ 10% using the Pooled Cohort equations
    - Age ≥65 years and SBP ≥130
- **SBP ≥140 or DBP ≥ 90, mm Hg**
  - Treat all

HYPERTENSION GUIDELINES IN A NUTSHELL

- **Stage 1 (Systolic: 130-139 or Diastolic: 80-89) & Low risk patients:** Lifestyle modifications
- **Stage 1 (Systolic: 130-139 or Diastolic: 80-89): & High risk patients:** ACEI or ARB or CCB. Thiazide. Switch classes if not controlled.
- **Stage 2 (Systolic: ≥ 140 or Diastolic ≥ 90) :** Medications similar to Stage 1. If already ≥ 150/90 mm Hg, start combination therapy. If not controlled:

i. Check compliance
ii. Switch to more suitable class (ACEI/ARB for DM, ß-blocker for HF) or add a 3rd agent
iii. Suspect resistant HTN/Secondary hypertension
iv. Treat cause. Initiate Spironolactone, Eplerenone; Labetalol, Carvedilol, Hydralazine, Clonidine.

"COMPELLING INDICATIONS"

Diabetes	ACE-I, ARB, Thiazide, CCB
Heart Failure	ACE-I, ARB, B-blocker, Diuretic, Aldosterone antagonist
CKD	ACE-I, ARB, Thiazide
Recurrent CVA prevention	ACE-I, ARB, Thiazide
Post-MI	B-blocker, ACE-I/ARB, Aldosterone antagonist

Clinician's Sequential Flow Chart for the Management of Hypertension
Measure office BP accurately
Detect white coat hypertension or masked hypertension by using ABPM and HBPM
Evaluate for secondary hypertension
Identify target organ damage
Introduce lifestyle interventions
Identify and discuss treatment goals
Use ASCVD risk estimation to guide BP threshold for drug therapy
Align treatment options with comorbidities
Account for age, race, ethnicity, sex, and special circumstances in antihypertensive treatment
Initiate antihypertensive pharmacological therapy
Insure appropriate follow-up
Use team-based care
Connect patient to clinician via telehealth
Detect and reverse nonadherence
Detect white coat effect or masked uncontrolled hypertension
Use health information technology for remote monitoring and self-monitoring of BP

CLINICIAN'S SEQUENTIAL FLOW CHART FOR THE MANAGEMENT OF HYPERTENSION

- ASCVD indicates atherosclerotic cardiovascular disease; BP, blood pressure; CVD, cardiovascular disease; and SBP, systolic blood pressure.

CASE STUDIES

CASE OFFICE VS. OUT-OF-OFFICE BP MEASUREMENTS IN THE DIAGNOSIS OF HYPERTENSION: WHICH ONE TO BELIEVE?

- 57-year-old account executive presents for BP follow-up visit
- Elevated BP identified 2 months ago during annual exam
- Interim BPs taken at local pharmacies have all been normal
- Normal hematology, biochemistry, renal function and electrolytes
- Normal EKG with no evidence of LVH
- Office BP using auscultatory wall-mounted mercury sphygmomanometer: 152/102 mmHg
- How would you explain this observation?

CASE: BP CONTROL: A MOVING TARGET?

- Jim is 76 years old, recent MI 2 years ago
- Comes to the office for hypertension follow-up, no residual angina
- Hypertension known for the last 20 years with BP ~135/80 mmHg average at home
- Rx: amlodipine 5 mg qd, olmesartan 20 mg qd, hydrochlorothiazide 25 mg qd, bisoprolol 5 mg qd for hypertension
- Normal cardiovascular exam today, office BP 135/80 mmHg
- Normal hematology, LDL-C at target, creatinine and electrolytes within normal limits
- EKG with anterior infarct, no LVH, normal LV function on echo
- What should be his BP target?

A 67 year old black male presents to your primary care clinic having recently moved to town. He has no complaints. His PMHx includes high cholesterol (with an unknown LDL) for which he takes Simvastatin 10mg. He had one prior hospitalization for chest pain, but was told "nothing was wrong" with his heart after a 1 night hospital stay. He has a 15 pck-yr history of tobacco use and quit 17 years ago. He swims regularly and abides by a strict Mediterranean diet.

On exam, his BP = 146/86 (repeated to verify) and other vital signs are normal. His cardiovascular and eye exam are unremarkable.

Lab studies reveal a normal CBC, normal serum creatinine, and no proteinuria. His EKG exhibits voltage criteria for LVH.

How would you manage his BP (assume his reading is verified by home monitoring)?

A. Encourage more exercise and a better diet
B. Order 24 hr ambulatory monitoring and decide therapy based on those results
C. Begin therapy with a calcium channel blocker
D. Inform him that based on new guidelines, no anti-hypertension therapy is needed
E. Let him decide if he wants to take medicines

WHAT WOULD I DO?

A. Encourage more exercise and a better diet
B. Order 24 hr ambulatory monitoring and decide therapy based on those results
C. Begin therapy with a calcium channel blocker
D. Inform him that based on new guidelines, no anti-hypertension therapy is needed
E. Let him decide if he wants to take medicines

A 43 y/o woman with HTN returns for a follow up visit of her BP. She is without complaints but admits that she has gained about 15 pounds over the last year due to stress of COVID 19, poor diet, and inactivity. At her last visit 6 months ago, her BP was 132/78 mmHg on Lisinopril HCTZ 20/12.5mg.

On exam today, her BP is 139/88 (and verified on repeat). Her exam is unchanged. Her serum creatinine is 1.3 mg/dL, and her RUA reveals > 500 mg/dL of proteinuria.

What would be your next step in managing her blood pressure and proteinuria?

A. Encourage improved lifestyle adherence and weight reduction but make no medication changes
B. Increase her thiazide diuretic
C. Increase her ACE-inhibitor
D. Increase both her ACE-I and her TZD

WHAT WOULD I DO?

B. Increase her thiazide diuretic

CASE SCENARIO 1 : MARY

Presentation

38 year old, attending for routine appointment about her contraception, for which she uses a diaphragm.

Medical history

From her records you notice that Mary's blood pressure has increased since her last check twelve months ago. She does not smoke, drinks 10-12 glasses of wine or mixed drink a week and has no notable medical history.

On examination

Mary's first clinic blood pressure measurement is 158/94 mmHg. Her heart rate is 72 beats per minute and regular

You are considering a diagnosis of hypertension and therefore take another reading in Mary's other arm. There is no notable difference between readings.

Next steps for diagnosis

Question 1.1

What would you do next?

CASE SCENARIO 1 : MARY

- **Answer *1.1***
- You would take Mary's blood pressure a third time during the consultation.

- ***Question 1.2***
- The third reading is 149/93 mmHg. You suspect hypertension – what would you do next?
-

CASE SCENARIO 1 : MARY

- ***Answer 1.2***
- Organize for Mary to receive do HBP monitoring or ambulatory blood pressure monitoring (ABPM) If you are responsible for setting up the monitoring device, you ensure that at least two measurements per hour are taken during Mary's usual waking hours (for example, between 8 am and 10 pm). You would use the average value of at least 14 measurements taken during Mary's usual waking hours to confirm a diagnosis of hypertension.

- At the same time you would also carry out investigations for target organ damage (such as left ventricular hypertrophy, chronic kidney disease and hypertensive retinopathy).

CASE SCENARIO 1 : MARY

- ***Answer 1.2 (continued)***
  - test for the presence of protein in the urine by sending a urine sample for estimation of the albumin:creatinine ratio and test for hematuria using a reagent strip
  - take a blood sample to measure plasma glucose, electrolytes, creatinine, estimated glomerular filtration rate, lipid panel
  - examine the fundi for the presence of hypertensive retinopathy
  - arrange for a 12-lead electrocardiograph to be performed.

CASE SCENARIO 1 : MARY

- ***Answer 1.2 (continued)***
- You would also carry out a formal assessment of cardiovascular risk (Mary's clinic blood pressure must be used in the calculation of cardiovascular risk) using a cardiovascular risk assessment tool, in line with Identification and assessment of CVD risk
- Additionally, you would also ascertain information about lifestyle in areas such as diet, exercise, alcohol, smoking and caffeine consumption and dietary sodium intake and offer appropriate lifestyle advice.
- Record the results of all investigations and assessment in Mary's notes.

CASE SCENARIO 1 : MARY

- ***Question 1.3***
- You identify her dietary sodium intake is greater than recommended levels. What advice would you offer?

CASE SCENARIO 1 : MARY

- ***Answer 1.3***
- You would advise that healthy diet and regular exercise can reduce blood pressure. You would also encourage her to keep her dietary sodium intake low as this can reduce blood pressure.

CASE SCENARIO 1 : MARY

- ***Question 1.4***
- The result of Mary's HBPM shows daytime average blood pressure of 139/87mmHg.
- What would your diagnosis and your next steps be?

CASE SCENARIO 1 : MARY

- ***Answer 1.4***
- This result shows that Mary has stage 1 hypertension.
- If you had not already done so (answer 1.2), you would estimate cardiovascular risk and offer tests for target organ damage.
- You would use the results of the cardiovascular risk assessment to discuss prognosis and healthcare options with Mary.
- Continue to ascertain information about her lifestyle in order to provide tailored lifestyle advice in accordance with the guideline on areas such as diet (including sodium and caffeine intake) and exercise and alcohol consumption.

CASE SCENARIO 1 : MARY

- ***Question 1.5***
- The results of the investigations for target organ damage and formal assessment of cardiovascular risk are:
- no evidence of target organ damage
- 10-year cardiovascular risk > 10%
- Nothing abnormal was detected in the other investigations you organised.
- What is your next step and what treatment and follow up would you offer?

CASE SCENARIO 1 : MARY

- ***Answer 1.5***
- **Further assessment**
- You could consider seeking specialist evaluation of secondary causes of hypertension and a more detailed assessment of potential target organ damage. This is because 10-year cardiovascular risk assessments can underestimate the lifetime risk of cardiovascular events in these people. Additionally, people under 40 years with stage 1 hypertension are less likely to have overt evidence of target organ damage or vascular disease. Consider renal doppler

CASE SCENARIO 1 : MARY

- ***Answer 1.5 (continued)***
- Mary does not have target organ damage, established cardiovascular disease, renal disease, diabetes, but a 10-year cardiovascular risk equivalent to 10% or greater, therefore you would offer antihypertensive drug treatment.

CASE SCENARIO 1 : MARY

- ***Question 1.6***
- You have considered starting her on lisinopril: what should you consider when prescribing antihypertensive drugs for a woman of child-bearing potential?

CASE SCENARIO 1 : MARY

- ***Answer 1.6***
- There is an increased risk of congenital abnormalities if women take angiotensin-converting enzyme (ACE) inhibitors or angiotensin III receptor blockers (ARBs) during pregnancy, and it is important that women of child-bearing age know this. If the woman is planning a pregnancy she should discuss this with you. If a woman taking ACE inhibitors or ARBs becomes pregnant, these antihypertensive drugs should be stopped and alternatives offered.

CASE SCENARIO : DANNY

- **Presentation**
- Danny is a 39-year-old black male of Caribbean family origin. He presents to you with a sore ankle after "rolling over on it"
- **Medical history**
- Danny has no significant past medical history. Previous presentations have been related to coughs and colds.
- He smokes 25 cigarettes a day, alcohol consumption around 20 drinks/week and has done for 18 years. He works various shifts and says that he considers his diet to be unhealthy as a result.
- **On examination**
- You conclude that Danny's ankle is sprained. As part of your routine examination you measure his blood pressure. The first measurement in his left arm is 150/92 mmHg, the second measurement in his right arm is 149/91 mmHg and the third measurement in his left arm is 151/92 mmHg.
- ***Question 2.1***
- What would you do next?

CASE SCENARIO 2 : DANNY

- ***Answer 2.1***
- You would record Danny's clinic blood pressure as 149/91 mmHg. In order to diagnose hypertension, you organise ambulatory blood pressure monitoring (ABPM) to confirm a diagnosis of hypertension. When organising this you ensure that at least two measurements per hour are taken during Danny's usual waking hours. You would use the average value of at least 14 measurements taken during Danny's usual waking hours to confirm a diagnosis of hypertension.
- At the same time you would also carry out investigations for target organ damage (such as left ventricular hypertrophy, chronic kidney disease and hypertensive retinopathy).

CASE SCENARIO : DANNY

- ***Answer 2.1 (continued)***
- You would:
- test for the presence of protein in the urine by sending a urine sample for estimation of the albumin:creatinine ratio and test for haematuria using a reagent strip
- take a blood sample to measure plasma glucose, electrolytes, creatinine, estimated glomerular filtration rate, serum total cholesterol and HDL cholesterol
- examine the fundi for the presence of hypertensive retinopathy
- arrange for a 12-lead electrocardiograph to be performed.

CASE SCENARIO 2 : DANNY

- ***Answer 2.1 (continued)***
- You would also carry out and a formal assessment of cardiovascular risk (Danny's clinic blood pressure must be used in the calculation of cardiovascular risk) using a cardiovascular risk assessment tool, in line with the recommendations on Identification and assessment of ACVD risk Additionally, you would ascertain information about lifestyle in areas such as diet, exercise, alcohol, smoking and caffeine consumption and dietary sodium intake and offer appropriate lifestyle advice. Given the history provided you ensure that you include lifestyle advice about smoking, alcohol consumption and diet and exercise
- Record the results of the investigations and assessments in Danny's notes.

CASE SCENARIO 2 : DANNY

- ***Question 2.2***
- ABPM indicates that Danny's daytime average blood pressure is 147/89 mmHg.
- There is no evidence of target organ damage, cardiovascular disease, renal disease or diabetes. You identify a 10-year cardiovascular risk > 10%.
- With this information, what is your diagnosis and what would you do next?

CASE SCENARIO 2 : DANNY

- ***Answer 2.2***
- You would diagnose stage 1 hypertension and do further evaluation of secondary causes of hypertension and a more detailed assessment of potential target organ damage. (may refer to specialist)
- If you had not already done so (answer 2.1) you would also assess cardiovascular risk and offer to test for target organ damage
- You would use the results of the initial cardiovascular risk assessment to discuss prognosis and healthcare options with Danny.
- You would also offer Danny lifestyle advice in accordance with the guideline on areas such as diet (including sodium and caffeine intake), exercise, alcohol consumption and smoking.

CASE SCENARIO 2 : DANNY

- ***Question 2.3***
- The results of the tests you arranged (presence of protein in the urine, estimation of the albumin:creatinine ratio, hematuria, plasma glucose, electrolytes, creatinine, estimated glomerular filtration rate, cholesterol, hypertensive retinopathy, 12-lead electrocardiograph) have been returned. All are normal
- What would you consider next in order to help you decide on the best management strategy for Danny?

CASE SCENARIO 2 : DANNY

- ***Answer 2.3***
- You consider seeking specialist evaluation of secondary causes of hypertension and a more detailed assessment of potential target organ damage. This is because 10-year cardiovascular risk assessments can underestimate the lifetime risk of cardiovascular events in these people. Additionally, people under 40 years with stage 1 hypertension are less likely to have overt evidence of target organ damage or vascular disease.
- You decide to refer Danny for the specialist assessment.

CASE SCENARIO 2 : DANNY

- ***Question 2.4***
- The results of the specialist assessment are returned. There are no secondary causes of hypertension; however, he was noted to have left ventricular hypertrophy and early evidence of impaired diastolic relaxation on his echocardiogram. The report suggests that these changes are most likely related to hypertension. Thus, Danny has evidence of target organ damage.
- What would you do next?

CASE SCENARIO 2 : DANNY

- ***Answer 2.4***
- You would offer Danny treatment with a calcium-channel blocker, for example amlodipine. You would also offer him appropriate information about the drug and unwanted side effects.
- You would see the results of the more detailed cardiovascular risk assessment, which included the cholesterol levels to discuss prognosis and healthcare options with Danny (detailed in answer 2.2).
- As appropriate, you would repeat the lifestyle advice that was given in answers 2.1 and 2.2 in accordance with the guideline on areas such as diet (including sodium and caffeine intake), exercise, alcohol consumption and smoking. As Danny's cholesterol level is marginally elevated, you would also enquire about the fat content of his diet and recommend that he reduces his fat intake. You would note that his cholesterol needs rechecking.
- You would ask Danny to return to your practice in 4 weeks for a review of his blood pressure

CASE SCENARIO 2 : DANNY

- ***Question 2.5***
- You have previously concluded that Danny's sprained ankle has healed and all swelling had cleared. Danny returns to the clinic and you notice both ankles are very swollen, which are new to him. This is likely to indicate that he is not tolerating his calcium-channel blocker.
- His clinic blood pressure is 122/76 mmHg.
- Would you consider that his blood pressure has been controlled? What would you do next?

CASE SCENARIO 2 : DANNY

- ***Answer 2.5***
- Danny's blood pressure has been controlled as his clinic blood pressure is now below 130/80 mmHg mmHg which is what you were aiming for. However, he was not tolerating the calcium channel blocker. You could change the calcium-channel blocker to a thiazide like diuretic such as chlorthalidone once daily. You would arrange for him to return to clinic to check his blood pressure again in 4 weeks.

CASE SCENARIO 3 : DORIS

- **Presentation**
- Doris is an 81-year-old female non-smoker. She was diagnosed with stage 2 hypertension, by a practice colleague 1 month ago. It is thought the cause is probably arterial stiffening. Her clinic blood pressure was 174/100 mmHg and her HBPM average was 170/95 mmHg She was not identified as having 'white-coat' hypertension. She has now returned to the practice after your colleague requested she return for a follow up appointment.

- **Medical history**
- Doris has no significant medical history.

- **Question 3.1**
- What would you have expected your colleague to have initiated with Doris?

CASE SCENARIO 3 : DORIS

- ***Answer 3.1***
- You would have expected your colleague to have:
- Arranged and reviewed the results of all appropriate tests for target organ damage and cardiovascular risk assessment in line with the guidelines
- Provided tailored advice about lifestyle interventions
- Started treatment with a calcium-channel blocker.
- Offered Doris information and guidance about her diagnosis and treatment options.
- Asked Doris to return to your practice clinic in 1 month to check her blood pressure (this is the purpose of her current visit to you).

Please note some cardiovascular risk assessments have a maximum age and may not be applicable for use with Doris. Additionally, given her age, Doris will score very highly in all cardiovascular risk assessments.

CASE SCENARIO 3 : DORIS

- ***Question 3.2***
- Doris is taking the calcium channel blocker. You have checked adherence with step 1 treatment and do not believe there is anything you can do, for instance, modify dosing regimen, provide a record for her to monitor her medicine taking, to help enhance adherence further.
- Doris's total cholesterol is 254, HDL 54 .Glucose is normal. There is no left ventricular hypertrophy or atrial fibrillation on ECG. Her 10-year cardiovascular risk is greater than 20% You measure her clinic blood pressure and it is 165/95 mmHg.
- What would you do next?

CASE SCENARIO 3 : DORIS

- ***Answer 3.2***
- Doris's blood pressure is not controlled.
- Check her adherence to the regimen and provide interventions to specific needs.
- You would offer step 2 hypertensive treatment with the addition of an ACE or a low cost ARB inhibitor. You would follow local protocols for checking bloods prior to commencing and following initiation of the ACE inhibitor or low cost ARB for a diagnosis of hypertension[1].

- ***Question 3.3***
- Doris returns to the clinic one month later. Her clinic blood pressure is 140/84 mmHg
  What would you do next?

CASE SCENARIO 3 : DORIS

- ***Answer 3.3***
- You would review Doris's antihypertensive medication and ensure that it is at the optimal or best tolerated dose.
- You would also consider her adherence to the drug regimen and ensure that any factors that may reduce her adherence are managed. You find she has not been taking her medications at the same time daily. You work on medication adherence.
- At her next clinic appointment Doris's blood pressure is 130/80mm Hg.. This is an acceptable blood pressure for a person over 80. Doris can stay on current treatment.

CASE SCENARIO 4 : DEREK

- **Presentation**
- Derek is a 53-year-old male
- **On examination**
- His clinic blood pressures is 176/108 mmHg. Additionally, you have identified left ventricular hypertrophy on ECG. You are unable to confirm the diagnosis of hypertension with ambulatory blood pressure monitoring (ABPM) because Derek has refused it because he is a bus driver and it would interfere with his driving.
- ***Question 4.1***
- What alternative test could you use to diagnose hypertension?

CASE SCENARIO 4 : DEREK

- ***Answer 4.1***
- You could offer Derek home blood pressure monitoring (HBPM).
- ***Start him on ACE or an ARB***

- ***Question 4.2***
- When instructing Derek in how to use HBPM, what instructions should you give him and what measurements would you base your diagnosis on?
-

CASE SCENARIO 4 : DEREK

- ***Answer 4.2***
- You should ensure that each blood pressure recording is based on two consecutive measurements taken at least 2-3 minutes apart with Derek seated.
- You should ask Derek to record his blood pressure twice daily (ideally in the morning and evening) and this should continue for at least four days and ideally for seven days.(To diagnose hypertension based on HBPM, you discard the measurements taken on the first day and take an average of all of the remaining measurements.)

- ***Question 4.3***
- The average HBPM results was 155/97 mmHg. However despite this, his HBPM measurements indicate a diagnosis of stage 2 hypertension and he had target organ damage. You offer lifestyle interventions in line with recommendations 1.4.1 to 1.4.9 in the guideline and have already started Derek on step 1 treatment.

CASE SCENARIO 4 : DEREK

- ***Answer 4.3***
- You have offered Derek treatment with an ACE inhibitor lisinopril 20 mg and use HBPM to monitor his response to treatment. BMP is normal. You could increase lisinopril to 40 mg but definitely add second agent such as HCTZ (combination) as this two drug regimen is recommended for Stage 2 hypertension. You would follow his BMP
- ***Question 4.4***
- Derek has returned to you with the results of his monitoring HBPM following step 2 treatment. During the past week, his average blood pressure was 150/94 mmHg. What is the target blood pressure for HBPM when monitoring response to treatment and what would you do about this result?

CASE SCENARIO 4 : DEREK

- ***Answer 4.4***
- target HBPM blood pressure is to be <130/80 mmHg.
- Derek's blood pressure is not controlled so you would offer him step 3 treatment with a calcium-channel blocker in addition to his current ACE/HCTZ inhibitor

- ***Question 4.5***
- When he returns to you 1 month later, Derek's HBPM result is still above 135/85 mmHg. What would you do next?

CASE SCENARIO 4 : DEREK

- ***Answer 4.5***
- You would check Derek's adherence to treatment in line with recommendations 1.7.1 to 1.7.4 of the guideline.
- You would review his medication to ensure that step 3 treatment is optimal.

- ***Question 4.6***
- Derek's medication adherence is good and step 3 treatment is optimal. What would you do next?

CASE SCENARIO 4 : DEREK

- ***Question 4.6***
- Derek returns to your clinic and his blood pressure is still not controlled. What would you do next?

CASE SCENARIO 4 : DEREK

- ***Answer 4.6***
- Check that Derek has received optimal medication at step 3 and reassess his adherence to his antihypertensive medication.
- Ensure that Derek has been involved in treatment decisions throughout his care and that you have adapted your consultation style in order to facilitate this involvement.
- Review Derek's knowledge, understanding and concerns about his antihypertensive medication and .explore whether or not Derek believes that he needs the medication.

CASE SCENARIO 4 : DEREK

- ***Answer 4. 6 continued)***
- If you identify practical problems, consider interventions such as suggesting Derek records his medicine-taking and monitors his condition, simplifying the dosing regimen, using alternative packaging for the medicine or using a multi-compartment medicines system.
- Ensure that Derek has received appropriate guidance and materials about the benefits of the drugs and unwanted side effects.
- Repeat all of these actions on a regular basis when reviewing or prescribing antihypertensive drug treatment for Derek.

- ***Question 4.8***
- You conclude that Derek is adherent to his medication regime and that he is on the optimal doses of the ACE inhibitor, calcium channel blocker and thiazide-like diuretic. What would you do next?

CASE SCENARIO 4 : DEREK

- ***Answer 4.8***
- You seek a specialist opinion for Derek. You anticipate he will be started on step 4 treatment.
- Be sure further analysis of secondary hypertension has been started, and echocardiogram and renal doppler have been ordered or completed (coordination of care with specialist)

CASE SCENARIO 5 : PHILIP

- **Presentation**
- Philip is a 68-year-old male who presents to you with feelings of dizziness every time he stands up.
- **Medical history**
- Philip has migraines and takes propranolol modified-release 160 mg daily, which has reduced the frequency.
- He attends the GP surgery's weight loss clinic. He has lost 56 ppounds in 12 months as part of a controlled weight loss programme.
- **On examination**
- Philip's ECG is normal and his blood pressure is 126/82 mmHg.

- ***Question 5.1***
- What would you do next to investigate the cause of Philip's dizziness?

CASE SCENARIO 5 : PHILIP

- ***Answer 5.1***
- As he was seated for the first readings, you would ask Philip to stand up for one minute and then measure his blood pressure again.

- ***Question 5.2***
- Philip's standing blood pressure is 90/50 mmHg.
- What would you do next?

CASE SCENARIO 5 : PHILIP

- ***Answer 5.2***
- You would review Philip's medication. His recent weight loss may mean that the dose of beta-blocker needs to be reduced
- You would note the postural hypertension in Derek's records so that colleagues measuring his blood pressure in the future are aware that they should measure his standing blood pressure, as well
- If changes to the migraine prophylaxis do not relieve Derek's dizziness you would consider referral to a specialist.

TAKE AWAY

REAL WORLD

- Adoption of lower BP targets would mean
  - more cautious titration of medications
  - more combination treatment
  - more care watching for adverse effects
  - more frequent visits
  - addressing lifestyle issues (physical activity, salt intake, obesity, sleep apnea, and alcohol use)
  - population-level initiatives (eg sodium in food)

TAKE AWAY

MORE HELP

- People
  - Nurse practitioners
  - Physician assistants,
  - Pharmacists
  - Others?
- Treatment algorithms
- Algorithmic monitoring/EHRs?

QUESTIONS?

CLINICAL ADDENDUM

- The following slides are for review of the participants that present the guidelines (COR –Category of Recommendation and LOE –Level of Evidence) for hypertension, including various conditions such as SIDH, HFpEF, CKD, acute ICH, stroke (acute and previous history of stroke) valvular heart disease, aortic disease, pregnancy, hypertensive crisis, and management of patients undergoing surgery.

CHOICE OF INITIAL MEDICATION

COR	LOE	Recommendation for Choice of Initial Medication
I	A^{SR}	For initiation of antihypertensive drug therapy, first-line agents include thiazide diuretics, CCBs, and ACE inhibitors or ARBs.

SR indicates systematic review.

CHOICE OF INITIAL MONOTHERAPY VERSUS INITIAL COMBINATION DRUG THERAPY

COR	LOE	Recommendations for Choice of Initial Monotherapy Versus Initial Combination Drug Therapy*
I	C-EO	Initiation of antihypertensive drug therapy with 2 first-line agents of different classes, either as separate agents or in a fixed-dose combination, is recommended in adults with stage 2 hypertension and an average BP more than 20/10 mm Hg above their BP target.
IIa	C-EO	Initiation of antihypertensive drug therapy with a single antihypertensive drug is reasonable in adults with stage 1 hypertension and BP goal <130/80 mm Hg with dosage titration and sequential addition of other agents to achieve the BP target.

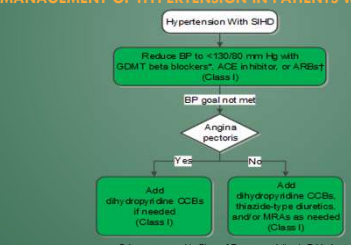
FOLLOW-UP AFTER INITIATING ANTIHYPERTENSIVE DRUG THERAPY

COR	LOE	Recommendation for Follow-Up After Initiating Antihypertensive Drug Therapy
I	B-R	Adults initiating a new or adjusted drug regimen for hypertension should have a follow-up evaluation of adherence and response to treatment at monthly intervals until control is achieved.

MONITORING STRATEGIES TO IMPROVE CONTROL OF BP IN PATIENTS ON DRUG THERAPY FOR HIGH BP

COR	LOE	Recommendation for Monitoring Strategies to Improve Control of BP in Patients on Drug Therapy for High BP
I	A	Follow-up and monitoring after initiation of drug therapy for hypertension control should include systematic strategies to help improve BP, including use of HBPM, team-based care, and telehealth strategies.

MANAGEMENT OF HYPERTENSION IN PATIENTS WITH SIHD

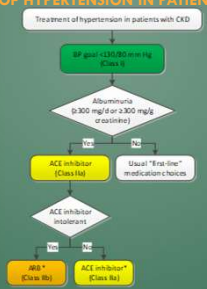


Colors correspond to Class of Recommendation in Table 1.
*GDMT beta blockers for BP control or relief of angina include carvedilol, metoprolol tartrate, metoprolol succinate, nadolol, bisoprolol, propranolol, and timolol. Avoid beta blockers with intrinsic sympathomimetic activity. The beta blocker atenolol should not be used because it is less effective than placebo in reducing cardiovascular events.
†If needed for BP control.
•ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; GDMT, guideline-directed management and therapy; and SIHD, stable ischemic heart disease.

HEART FAILURE WITH PRESERVED EJECTION FRACTION

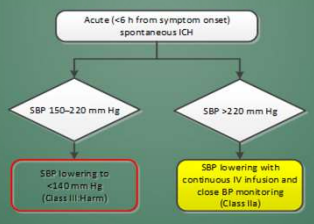
COR	LOE	Recommendations for Treatment of Hypertension in Patients With HFpEF
I	C-EO	In adults with HFpEF who present with symptoms of volume overload, diuretics should be prescribed to control hypertension.
I	C-LD	Adults with HFpEF and persistent hypertension after management of volume overload should be prescribed ACE inhibitors or ARBs and beta blockers titrated to attain SBP of less than 130 mm Hg.

MANAGEMENT OF HYPERTENSION IN PATIENTS WITH CKD



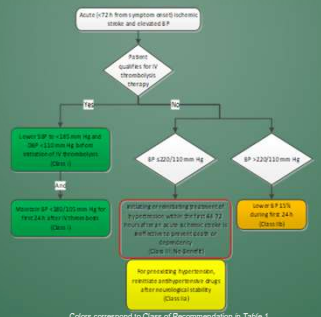
•Colors correspond to Class of Recommendation in Table 1.
•*CKD stage 3 or higher or stage 1 or 2 with albuminuria ≥300 mg/d or ≥300 mg/g creatinine.
•ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP blood pressure; and CKD, chronic kidney disease.

MANAGEMENT OF HYPERTENSION IN PATIENTS WITH ACUTE ICH



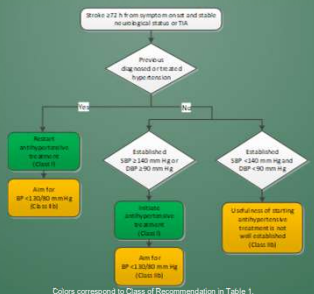
Colors correspond to Class of Recommendation in Table 1.
BP indicates blood pressure; ICH, intracerebral hemorrhage; IV, intravenous; and SBP, systolic blood pressure.

MANAGEMENT OF HYPERTENSION IN PATIENTS WITH ACUTE ISCHEMIC STROKE



Colors correspond to Class of Recommendation in Table 1.
BP indicates blood pressure; DBP, diastolic blood pressure; IV, intravenous; and SBP, systolic blood pressure.

MANAGEMENT OF HYPERTENSION IN PATIENTS WITH A PREVIOUS HISTORY OF STROKE (SECONDARY STROKE PREVENTION)



Colors correspond to Class of Recommendation in Table 1.
DBP indicates diastolic blood pressure; SBP, systolic blood pressure; and TIA, transient ischemic attack.

VALVULAR HEART DISEASE

COR	LOE	Recommendations for Treatment of Hypertension in Patients With Valvular Heart Disease
I	B-NR	In adults with asymptomatic aortic stenosis, hypertension should be treated with pharmacotherapy, starting at a low dose and gradually titrating upward as needed.
IIa	C-LD	In patients with chronic aortic insufficiency, treatment of systolic hypertension with agents that do not slow the heart rate (i.e., avoid beta blockers) is reasonable.

AORTIC DISEASE

COR	LOE	Recommendation for Management of Hypertension in Patients With Aortic Disease
I	C-EO	Beta blockers are recommended as the preferred antihypertensive agents in patients with hypertension and thoracic aortic disease.

PREGNANCY

COR	LOE	Recommendations for Treatment of Hypertension in Pregnancy
I	C-LD	Women with hypertension who become pregnant, or are planning to become pregnant, should be transitioned to methyldopa, nifedipine, and/or labetalol during pregnancy.
III: Harm	C-LD	Women with hypertension who become pregnant should not be treated with ACE inhibitors, ARBs, or direct renin inhibitors.

AGE-RELATED ISSUES

COR	LOE	Recommendations for Treatment of Hypertension in Older Persons
I	A	Treatment of hypertension with a SBP treatment goal of less than 130 mm Hg is recommended for noninstitutionalized ambulatory community-dwelling adults (≥65 years of age) with an average SBP of 130 mm Hg or higher.
IIa	C-EO	For older adults (≥65 years of age) with hypertension and a high burden of comorbidity and limited life expectancy, clinical judgment, patient preference, and a team-based approach to assess risk/benefit is reasonable for decisions regarding intensity of BP lowering and choice of antihypertensive drugs.

HYPERTENSIVE CRISES: EMERGENCIES AND URGENCIES

COR	LOE	Recommendations for Hypertensive Crises and Emergencies
I	B-NR	In adults with a hypertensive emergency, admission to an intensive care unit is recommended for continuous monitoring of BP and target organ damage and for parenteral administration of an appropriate agent.
I	C-EO	For adults with a compelling condition (i.e., aortic dissection, severe preeclampsia or eclampsia, or pheochromocytoma crisis), SBP should be reduced to less than 140 mm Hg during the first hour and to less than 120 mm Hg in aortic dissection.
I	C-EO	For adults without a compelling condition, SBP should be reduced by no more than 25% within the first hour; then, if stable, to 160/100 mm Hg within the next 2 to 6 hours; and then cautiously to normal during the following 24 to 48 hours.

PATIENTS UNDERGOING SURGICAL PROCEDURES

COR	LOE	Recommendations for Treatment of Hypertension in Patients Undergoing Surgical Procedures
		Preoperative
I	B-NR	In patients with hypertension undergoing major surgery who have been on beta blockers chronically, beta blockers should be continued.
IIa	C-EO	In patients with hypertension undergoing planned elective major surgery, it is reasonable to continue medical therapy for hypertension until surgery.
IIb	B-NR	In patients with hypertension undergoing major surgery, discontinuation of ACE inhibitors or ARBs perioperatively may be considered.

PATIENTS UNDERGOING SURGICAL PROCEDURES (CONT.)

COR	LOE	Recommendations for Treatment of Hypertension in Patients Undergoing Surgical Procedures
		Preoperative
IIb	C-LD	In patients with planned elective major surgery and SBP of 180 mm Hg or higher or DBP of 110 mm Hg or higher, deferring surgery may be considered.
III: Harm	B-NR	For patients undergoing surgery, abrupt preoperative discontinuation of beta blockers or clonidine is potentially harmful.
III: Harm	B-NR	Beta blockers should not be started on the day of surgery in beta blocker–naïve patients.
		Intraoperative
I	C-EO	Patients with intraoperative hypertension should be managed with intravenous medications until such time as oral medications can be resumed.

ANTIHYPERTENSIVE MEDICATION ADHERENCE STRATEGIES

COR	LOE	Recommendations for Antihypertensive Medication Adherence Strategies
I	B-R	In adults with hypertension, dosing of antihypertensive medication once daily rather than multiple times daily is beneficial to improve adherence.
IIa	B-NR	Use of combination pills rather than free individual components can be useful to improve adherence to antihypertensive therapy.

STRATEGIES TO PROMOTE LIFESTYLE MODIFICATION

COR	LOE	Recommendation for Strategies to Promote Lifestyle Modification
I	C-EO	Effective behavioral and motivational strategies to achieve a healthy lifestyle (i.e., tobacco cessation, weight loss, moderation in alcohol intake, increased physical activity, reduced sodium intake, and consumption of a healthy diet) are recommended for adults with hypertension.

STRUCTURED, TEAM-BASED CARE INTERVENTIONS FOR HYPERTENSION CONTROL

COR	LOE	Recommendation for Structured, Team-Based Care Interventions for Hypertension Control
I	A	A team-based care approach is recommended for adults with hypertension.