12. Hypertension Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

BP > 130/80mmHg

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO_2, T°C, **RBS**)
- Start Oxygen **IF** SPO_2 < 94%. Maintain SPO_2 ≥ 94%
- Perform brief, targeted history and physical exam
- Obtain/review 12-lead ECG (if indicated)
- Send samples for **FBC, UEC, TSH and Urinalysis** (for proteinuria) and **PDT** (as applicable)
- **DO NOT ADMINISTER ORAL ANTIHYPERTENSIVES (e.g. nifedipine) TO LOWER THE BLOOD PRESSURE IN THE ED.**
- Allow patient to rest awaiting results. Repeat BP checks hourly.

Are there any features of progressive or impending end organ damage (especially if BP > 180/110 mmHg)?

a) Neurological
- Cerebral vascular accident/cerebral infarction
- Hypertensive encephalopathy
- Subarachnoid haemorrhage
- Intracranial haemorrhage

b) Cardiovascular
- Acute pulmonary oedema
- Congestive heart failure
- Myocardial ischemia/infarction
- Acute left ventricular dysfunction
- Aortic dissection

c) Other
- Acute renal failure/insufficiency
- Retinopathy
- Pre-eclampsia/Eclampsia
- Micro angiopathic haemolytic anaemia

Headache/Epistaxis is **NOT** a hypertensive emergency, no matter how high the blood pressure. It is likely the headache/epistaxis is causing the hypertension, not the other way around. Treat the headache/epistaxis and the pressure will come down.

No

Known Hypertensive – Resume regular treatment; if unknown, **low dose thiazide type diuretic** for most; may consider ACE inhibitor, ARB, β-blocker, CCB. Follow-up as below (**see Guideline for Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults**)

New Onset Hypertension - Final BP prior to discharge
- **BP > 160/100 – low dose thiazide type diuretic** for most; may consider ACE inhibitor, ARB, β-blocker, CCB. (**see Guideline for Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults**). Follow-up as below
- **BP < 160/100** – Follow-up as below

Daily BP checks at nearest clinic and follow-up in a **Medical Clinic in 1 week** with BP chart

Yes

See 13. Hypertensive Emergencies Algorithm

Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults

BLOOD PRESSURE MEASUREMENT TECHNIQUES

1. Have the patient relax, sitting in a chair (feet on floor, back supported) for >5 min.
2. The patient should avoid caffeine, exercise, and smoking for at least 30 min before measurement.
3. Ensure patient has emptied his/her bladder.
4. Neither the patient nor the observer should talk during the rest period or during the measurement.
5. Remove all clothing covering the location of cuff placement.
6. Measurements made while the patient is sitting or lying on an examining table do not fulfil these criteria.
7. Use a BP measurement device that has been validated and ensure that the device is calibrated periodically. *
8. Support the patient's arm (e.g., resting on a desk).
9. Position the middle of the cuff on the patient's upper arm at the level of the right atrium (the midpoint of the sternum).
10. Use the correct cuff size, such that the bladder encircles 80% of the arm, and note if a larger- or smaller-than-normal cuff size is used.
11. Either the stethoscope diaphragm or bell may be used for auscultatory readings.
12. At the first visit, record BP in both arms. Use the arm that gives the higher reading for subsequent readings.
13. Separate repeated measurements by 1–2 min.
14. For auscultatory determinations, use a palpated estimate of radial pulse obliteration pressure to estimate SBP. Inflate the cuff 20–30 mm Hg above this level for an auscultatory determination of the BP level.
15. For auscultatory readings, deflate the cuff pressure 2 mm Hg per second, and listen for Korotkoff sounds.
16. Record SBP and DBP. If using the auscultatory technique, record SBP and DBP as onset of the first Korotkoff sound and disappearance of all Korotkoff sounds, respectively, using the nearest even number.
17. Note the time of most recent BP medication taken before measurements.
18. Use an average of **≥ 2 readings** obtained on **≥2** occasions to estimate the individual's level of BP.
19. Provide patients the SBP/DBP readings both verbally and in writing.

Categories of BP in Adults*

BP Category	SBP		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 2 categories should be designated to the higher BP category.

DIAGNOSTIC WORKUP OF HYPERTENSION

- Assess risk factors and comorbidities
- Reveal identifiable causes of hypertension
- Assess presence of target organ damage
- Conduct history and physical examination
- **Obtain/review 12-lead ECG, RBS, FBC, UEC, TSH, Urinalysis for proteinuria, Lipid profile**

Blood Pressure (BP) Thresholds and Recommendations for Treatment and Follow-Up

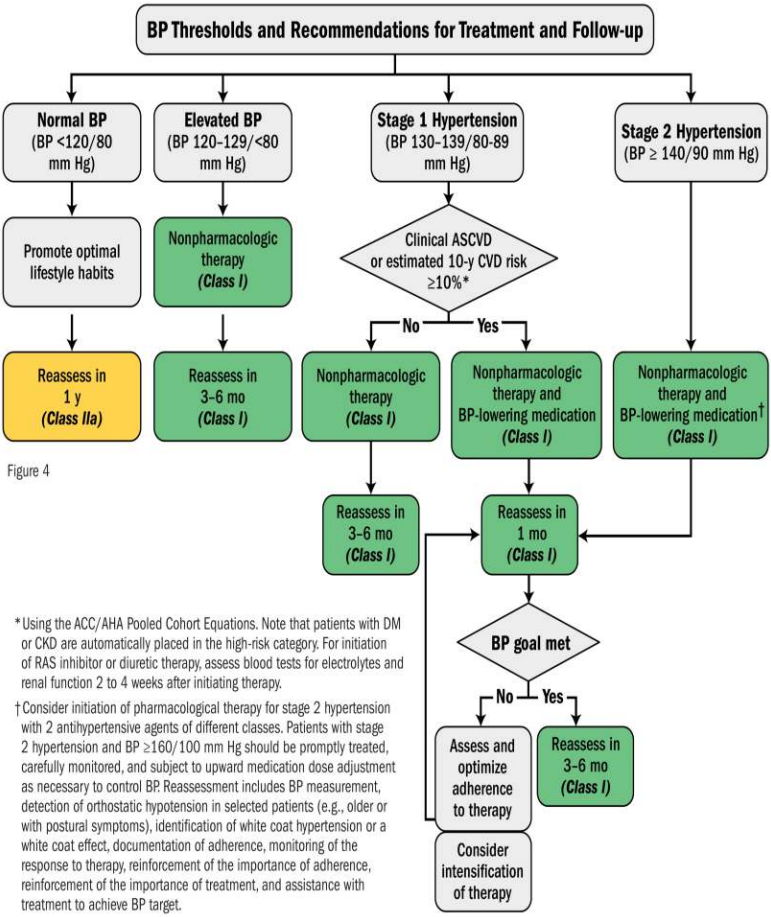

Figure 4

*Using the ACC/AHA Pooled Cohort Equations. Note that patients with DM or CKD are automatically placed in the high-risk category. For initiation of RAS inhibitor or diuretic therapy, assess blood tests for electrolytes and renal function 2 to 4 weeks after initiating therapy.

†Consider initiation of pharmacological therapy for stage 2 hypertension with 2 antihypertensive agents of different classes. Patients with stage 2 hypertension and BP ≥160/100 mm Hg should be promptly treated, carefully monitored, and subject to upward medication dose adjustment as necessary to control BP. Reassessment includes BP measurement, detection of orthostatic hypotension in selected patients (e.g., older or with postural symptoms), identification of white coat hypertension or a white coat effect, documentation of adherence, monitoring of the response to therapy, reinforcement of the importance of adherence, reinforcement of the importance of treatment, and assistance with treatment to achieve BP target.

* Calculate the 10-year risk for first atherosclerotic cardiovascular disease events (ASCVD; nonfatal myocardial infarction, coronary heart disease–related death, or fatal or nonfatal stroke) with the **ASCVD Risk Calculator (**available in **MDCalc**)

Best Proven Nonpharmacologic Interventions for Prevention and Treatment of Hypertension*

	Nonpharmacologic Intervention	Dose	Approximate Impact on SBP	
			Hypertension	Normotension
Weight loss	Weight/body fat	Ideal body weight is best goal but at least 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	Diet rich in fruits, vegetables, whole grains, and low-fat dairy products with reduced content of saturated and trans l fat	-11 mm Hg	-3 mm Hg
Reduced intake of dietary sodium	Dietary sodium	<1,500 mg/d is optimal goal but at least 1,000 mg/d reduction in most adults	-5/6 mm Hg	-2/3 mm Hg
Enhanced intake of dietary potassium	Dietary potassium	3,500–5,000 mg/d, preferably by consumption of a diet rich in potassium	-4/5 mm Hg	-2 mm Hg
Physical activity	Aerobic	• 120–150 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 x 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 Hg

*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 grams of pure alcohol, which is typically found in 12 ounces of regular beer (usually about 5% alcohol), 5 ounces of wine (usually about 12% alcohol) and 1.5 ounces of distilled spirits (usually about 40% alcohol).

Evidence-Based Dosing for Antihypertensive Drugs

Class	Drug	Usual Dose, Range (mg per day)*	Daily Frequency	Comments
Primary Agents				
Thiazide or thiazide-type diuretics	**Chlorthalidone**	12.5–25	1	• Chlorthalidone preferred based on prolonged half-life and proven trial reduction of CVD • Monitor for hyponatremia and hypokalemia, uric acid and calcium levels. • Use with caution in patients with history of acute gout unless patient is on uric acid-lowering therapy.
	Hydrochlorothiazide	25–50	1	
	Indapamide	1.25–2.5	1	
	Metolazone	2.5–10	1	
ACE Inhibitors	**Benazepril**	10–40	1 or 2	• Do not use in combination with ARBs or direct renin inhibitor • Increased risk of hyperkalemia, especially in patients with CKD or in those on K+ supplements or K+-sparing drugs • May cause acute renal failure in patients with severe bilateral renal artery stenosis • Do not use if history of angioedema with ACE inhibitors. • Avoid in pregnancy
	Captopril	12.5–150	2 or 3	
	Enalapril	5–40	1 or 2	
	Fosinopril	10–40	1	
	Lisinopril	10–40	1	
	Moexipril	7.5–30	1 or 2	
	Perindopril	4–16	1	
	Quinapril	10–80	1 or 2	
	Ramipril	2.5–10	1 or 2	
	Trandolapril	1–4	1	
ARBs	**Azilsartan**	40–80	1	• Do not use in combination with ACE inhibitors or direct renin inhibitor • Increased risk of hyperkalemia in CKD or in those on K+ supplements or K+-sparing drugs • May cause acute renal failure in patients with severe bilateral renal artery stenosis • Do not use if history of angioedema with ARBs. Patients with a history of angioedema with an ACEI can receive an ARB beginning 6 weeks after ACEI discontinued. • Avoid in pregnancy
	Candesartan	8–32	1	
	Eprosartan	600–800	1 or 2	
	Irbesartan	150–300	1	
	Losartan	50–100	1 or 2	
	Olmesartan	20–40	1	
	Telmisartan	20–80	1	
	Valsartan	80–320	1	
CCB—dihydropyridines	**Amlodipine**	2.5–10	1	• Avoid use in patients with HFrEF; amlodipine or felodipine may be used if required • Associated with dose-related pedal edema, which is more common in women than men
	Felodipine	5–10	1	
	Isradipine	5–10	2	
	Nicardipine SR	5–20	1	
	Nifedipine LA	60–120	1	
	Nisoldipine	30–90	1	
CCB—nondihydropyridines	**Diltiazem SR**	180–360	2	• Avoid routine use with beta blockers due to increased risk of bradycardia and heart block • Do not use in patients with HFrEF • Drug interactions with diltiazem and verapamil (CYP3A4 major substrate and moderate inhibitor)
	Diltiazem ER	120–480	1	
	Verapamil IR	40–80	3	
	Verapamil SR	120–480	1 or 2	
	Verapamil-delayed onset ER (various forms)	100–480	1 (in the evening)	