

Summary of Hypertension in Adults Care Model

Hypertension: Introduction

One third of all adults have HTN; but only about half of individuals with HTN are adequately controlled. HTN, especially isolated systolic HTN, is more common in elderly: about 70% of adults older than 60 YO have HTN.

The risk of CV events (stroke, MI, sudden death, HF, PAD) and kidney disease increases above BP of 115/75. For each increase of 20 mmHg systolic and 10 mmHg diastolic, the risk of CV events and strokes doubles. Conversely, lowering an elevated BP reduces risk of stroke, dementia, MI, HF, CV-related mortality and all-cause death, even in patients ≥ 80 YO. The absolute benefit of lowering BP is greatest for those with more severe HTN and higher CV risk.

After the age of 50 - 60, DBP stabilize or decreases. Due to progressive stiffening of the arterial circulation, SBP continue to rise. Increased pulse pressure and SBP are greater predictors of risk in those > 50 -60 YO whereas DBP is a better predictor of mortality in those < 50 YO.

African Americans have higher incidence of HTN, earlier onset, higher pressures, higher incidence of strokes and kidney disease, and tend to be more salt sensitive. Also, they tend to respond more to CCBs and diuretics than ACEi/ARBs or BB.

About 95% adults with HTN have primary (essential) HTN. Definitive cause unknown; though to be due to combination of factors: genetic, environmental, lifestyle.

Main causes of secondary HTN are chronic kidney disease, renal artery stenosis, excessive aldosterone secretion, pheochromocytoma and sleep apnea.

HTN often occurs with other metabolic risk factors, such as obesity, DM and hyperlipidemia.

Hypertension: Diagnosis

Correct BP measurement technique is very important.

- In office, use automated electronic device or manual auscultation. Calibrate per manufactures recommendations.
- Arm cuffs preferred - must be correct size. Too small cuff will artificially elevate reading.
- Initially, measure both arms. > 15 mmHg difference may indicate subclavian stenosis.
- Patients should not need to void, be seated with back supported, legs uncrossed, feet on ground, resting for 5 minutes, no talking during reading. No eating, smoking or drinking caffeine 30 minutes prior. The measured arm should be supported and at heart level.
- Preferable to average ≥ 2 readings taken several minutes apart.
- Useful to obtain standing blood pressure (after 2 - 5 minutes) to evaluate for orthostatic changes. Drop of $\geq 20/10$ mmHg carries increased risk of mortality.
- Home monitoring (using correct technique) valuable. HTN $\geq 135/85$
- Ambulatory 24 hr may also be beneficial. Absence of "dipping" (10 - 20% decrease in BP during sleep) may indicate increased risk CVD and cognitive impairment. HTN if 24 hr average $\geq 130/80$.
- Home or ambulatory monitoring helpful with "white coat" HTN and masked HTN (normal in office but elevated at home).

SBP and DBP	Classification
<120 and <80	Normal
120 -139 or 80-89	Pre-HTN
140-159 or 90-99	HTN, Stage 1
≥ 160 or ≥ 100	HTN, Stage 2
> 180 or >120	Emergency or urgency
≥ 140 and <90	Isolated Systolic HTN
<140 and ≥ 90	Isolated Diastolic HTN

Hypertension: Evaluation

Screening

Check BP q 2 yr if normal and yearly if pre-HTN.

Evaluation entails searching for CV risk factors, target-organ damage, concomitant clinical conditions, and lifestyle or interfering substances.

History

- Risk factors for HTN: \uparrow age, obesity, FMH, race, \uparrow NA diet, \uparrow ETOH, physical inactivity, DM, dyslipidemia, \downarrow Vit D
- PMH: previous CV events, such as stroke or TIA, CAD, HF, CKD, PAD, DM, sleep apnea
- Previous elevated BP / dx of HTN and any treatment / SE
- ROS: gout, hyperlipidemia, angina, \uparrow or \downarrow thyroid, parathyroid, etc.
- FMH, tobacco, alcohol, illicit drug use, current medications or supplements:
 - NSAIDS, oral contraceptives, antidepressants, glucocorticoids, decongestants, weight loss medications, stimulants (RX or illicit), others

Physical

- Height, weight (BMI), waist circumference (> 102 cm men or > 88 cm women increased risk of metabolic syndrome.)
- Complete exam, including fundoscopic exam, cardiac and vascular exam, neurologic exam

Tests

Fasting lab: electrolytes, glucose, BUN, creatinine (eGFR), lipids, liver function H/H, UA with dipstick protein (microalbumin if DM)

- ECG
- Other testing based on H&P
 - Echo for LVH, valvular disease
 - Stress test for angina
 - Carotid or abdominal US if bruit
 - Ankle brachial index if claudication

Complications of HTN

Complications associated with chronic HTN

- LVH (associated with HF, MI, sudden death, stroke)
- HFrEF and HFpEF
- Ischemic heart disease (MI, occlusive CAD)
- Aneurysm
- Small vessel ischemic changes leading to impaired cognition
- Ischemic stroke
- Intracerebral hemorrhage
- Chronic kidney disease and endstage renal disease
- Erectile dysfunction
- Peripheral artery disease
- Premature death

Acute complications from hypertensive emergency (evidence of end-organ damage)

- Hypertensive encephalopathy
- Cerebral infarction, subarachnoid hemorrhage, intracranial hemorrhage
- Acute LV dysfunction
- Acute pulmonary edema
- Acute coronary syndrome
- Aortic dissection
- Acute renal failure / insufficiency (nephrosclerosis)
- Retinopathy

Barriers to effective blood pressure control:

- Access to healthcare
- Access to medications
- Clinical inertia
- Patient factors: treatment associated with current negative impact on quality of life for an asymptomatic, common condition which may have deleterious effects in the distant future.

Hypertension: Goal of Treatment

Goal: reduce risk of CV disease, strokes and kidney disease while also managing other CV risk factors (elevated lipids and / or glucose, obesity, tobacco) as well as managing other disease states (HF, CAD, CKD, DM).

There is debate as to the ideal blood pressure. (See ASH/ISH (2014), JNC8 (2013), ESH/ESC (2013), AHA/ACC/CDC (2013).)

As with all guidelines, clinical judgment and shared decision making shape individual goals and management decisions.

In general, the treatment goal is < 140 / < 90.

In elderly, non-diabetic, non-CKD patients, recommended to treat to < 150/90. The controversy occurs as to the definition of elderly (based on age (≥60 or ≥80)) or overall "fitness"). JCN 8 expert opinion is that ≥ 60 YO should be treated for a BP > 150/90, but if treatment results in lower SBP, without adverse effects on health or quality of life, treatment does not have to be adjusted.

It is also suggested that diastolic BP should not be lower than 60 - 65 mm Hg due to concerns of hypoperfusion, especially in the elderly.

It is suggested by some experts (KDIGO) that a lower goal be considered (< 130/80) if albuminuria is present in patients with CKD or DM.

It is currently unknown if younger patients (< 50 YO) would benefit from a lower BP. There does not appear to be an upper age limit on benefits of treatment.

BP may be less than goal in patients taking evidence-based anti-HTN medication for survival benefit (examples: BB + ACEi or ARB in post-MI or HFrEF).

Hypertension treatment: Lifestyle Modification and General Medical Considerations

Lifestyle Modification is the cornerstone of HTN and pre-HTN management. It may be adequate to prevent progression of pre-HTN, manage Stage 1, and facilitate control of Stage 2. May use 6 - 12 month trial for Stage 1 prior to initiating medication (informed decision making with patient). Stage 2 generally requires medication(s) plus lifestyle changes to achieve control.

Management of HTN is a lifetime commitment.

Modification	Ave SBP ↓
<u>Weight reduction:</u> maintain normal BMI (18.5 - 24.9 kg/m ²)	5 - 20 mmHg / 10 kg
<u>DASH Diet:</u> fruits, vegetables, low-fat dairy, reduced saturated and total fat	8 - 14 mmHg
<u>Sodium restriction:</u> < 2.4 g sodium or < 6 gm NaCl	2 - 8 mmHg
<u>Aerobic Physical Activity:</u> regular aerobic exercise for 30 minutes per day most days of week	4 - 9 mmHg
<u>Moderate Alcohol Consumption:</u> Limit men ≤ 2 drinks/day; women ≤ 1 drinks/day (15 ml ethanol)	2 - 4 mmHg
<u>Stop Smoking:</u> be cognizant about potential weight gain	No BP effect, but decreases CV risk

Do not delay medical management if BP > 20 / 10 mmHg over goal.

Self-monitoring of BP is encouraged in most patients.

Hypertension: Medication Management

Once daily drugs and fixed-dose combination products improve compliance; increased cost (direct or co-pay) leads to ↓ compliance.

Certain class of anti-HTN drugs are indicated in certain conditions to improve survival, independent of BP (e.g. HFrEF, MI).

The degree of BP reduction, not the choice of anti-HTN drug, is the major determinant in CV risk reduction. There is wide inter-patient variability in drug response. May need to try different class if poor response. Most patients require at least 2 meds for control. Combination therapy more effective than maximizing single therapy.

Thiazide -like (long acting), CCB (dihydropyridine), ACEi or ARB considered first line .

ACEi (angiotensin-converting enzyme inhibitors)

- SE: Angioedema (rare) & cough - not dose dependent. May ↑ creatinine by 30% - reversible. Hyperkalemia - dose dependent.

- Considerations: HF, LV dysfunction, post MI, albuminuria, CKD

- Do not combine with ARB

ARB (angiotensin receptor blocker)

- SE: reversible ↑ creatinine. Does not cause cough and very rarely causes angioedema

- Considerations: as for ACEi

Thiazide diuretics

- Chlorthalidone (thiazide-like) more powerful than HCTZ and longer duration of action; chlorthalidone used in clinical studies.

- SE: hypokalemia, hyponatremia, hyperglycemia, hyperlipidemia, and hyperuricemia.

- Considerations: thiazide and CCB initial monotherapy in African Americans.

Hypertension Medication Management, Cont.

CCB (calcium channel blocker)

- Very effective combined with ACEi or ARBs for controlling BP.
- Dihydropyridines (dilate arteries) and non-dihydropyridines (reduce HR and contractility and less dilation of arteries).
- SE: postural hypotension and peripheral edema (dose dependent, attenuated with combination with ACEi or ARB).
- Considerations: Dihydropyridines (amlodipine or nifedipine) beneficial on CV and stroke outcomes in trials. Non-dihydropyridines not indicated in HF, but may be beneficial for rate control in AF. Also can reduce proteinuria.

BB (beta blockers)

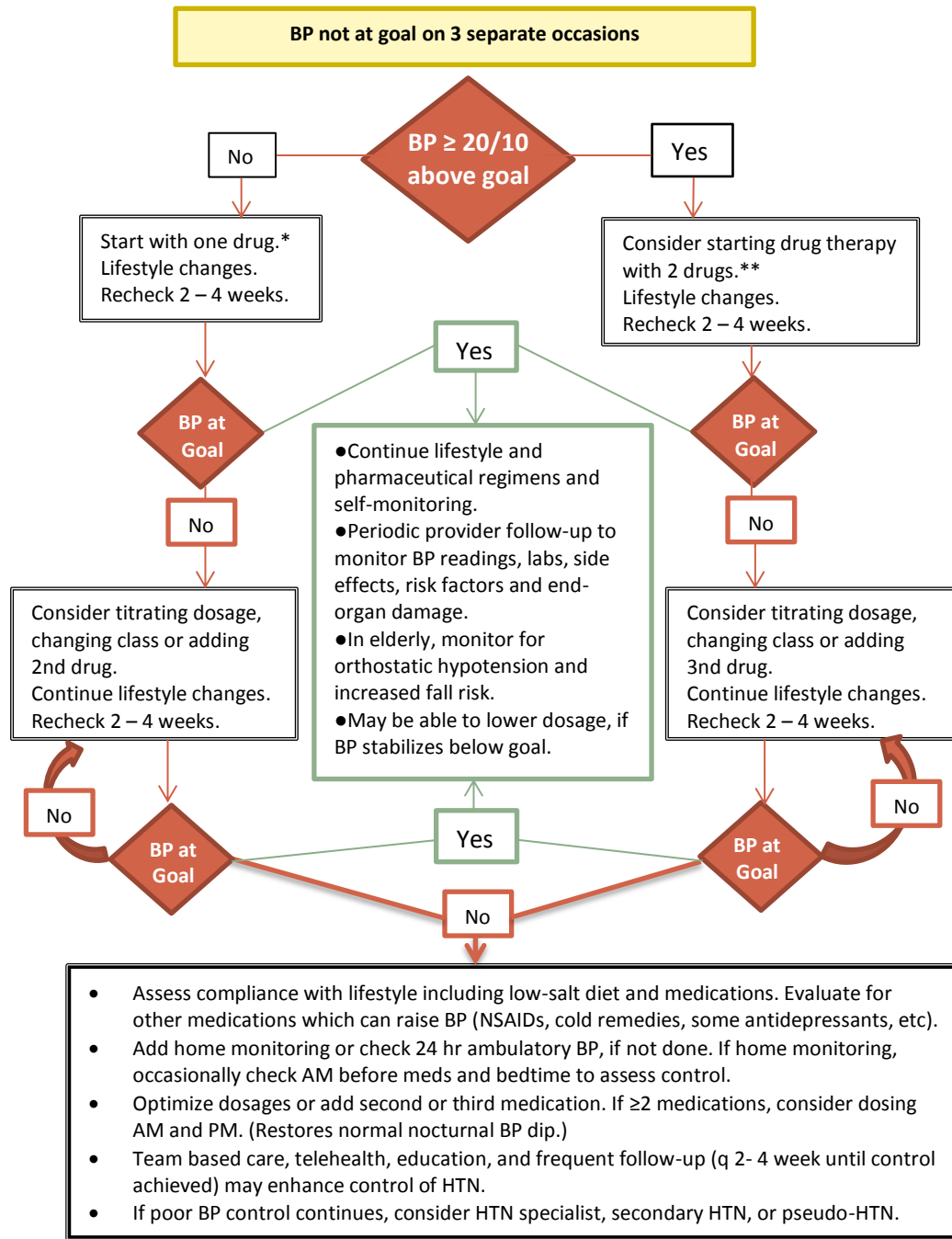
- May not be as effective in reducing stroke or CV events. Not recommended as initial therapy.
- SE: adverse effects on glucose. May be associated with heart block, reduced sexual function, fatigue, reduced exercise tolerance.
- Considerations: ischemic heart disease, HFrEF.

Aldo (aldosterone antagonist)

- SE: gynecomastia, sexual dysfunction and hyperkalemia.
 - Consideration: treatment resistant HTN add-on.
- 4th line therapies** - alpha blockers, centrally acting agents, direct vasodilators.

Resistant HTN (BP not controlled ≥ 3 meds, including diuretic, dosed at ≥50% maximum dose).

- Many people actually have pseudoresistance: inaccurate BP readings, white coat HTN, poor adherence to meds or lifestyle choices, suboptimal therapy.
- True resistant: extracellular volume expansion, increased sympathetic tone, secondary causes HTN.



BP Goal (Adults)	
Population	Goal mmHg
Age < 60 YO	< 140/90
Any age with DM or CKD	< 140/90
Age > 80 YO	< 150/90
Age 60 – 79 [^]	< 150/90

[^] <140/90 may be appropriate for some 60 – 79 YO patients, if treatment not associated with adverse effects, and depending on comorbidities, general health, postural BP changes, number of medications needed to reach goal, and shared decision making. <150 mmHg systolic may be preferred goal if aggressive tx lowers DBP < 60 or if signs of hypoperfusion occur.

- *Initial choice of drug –no special considerations: thiazide (long acting may be preferred), ACEi or ARB, CCB (dihydropyridine)
- **Initial choice of two drugs – no considerations: (CCB or thiazide) + ACEi or ARB (Some evidence that CCB and ACEi combination superior for reducing CV events vs. ACEi and thiazide.)
- Unlikely to control BP >20/10 mmHg over goal with 1 drug, consider starting with combination in appropriate patient.
- Combining 2 classes of drugs results in more BP reduction than increasing the dose of one agent, with fewer side effects. Caution with cost, complexity and potential drug interactions.
- In general, lowering BP to target more important than choice of drug(s), except with special considerations.
- If less than expected response to one drug class, consider changing class.
- In elderly patients without HTN urgency/emergency initially use lower dosages and titrate slower, to minimize adverse events.

Special considerations examples:	
Specific Population	Drug Classes
Female (pregnant or could become pregnant)	No ACEi or ARB
African American	Thiazide and/or CCB
CKD	ACEi or ARB
Albuminuria (DM or CKD)	ACEi or ARB
HFrEF	ACEi or ARB + BB, loop diuretic, Aldo
CAD, post MI	BB, ACEi or ARB
Angina, stable	BB or CCB
Atrial fibrillation, rate control	BB or CC (non-dihydropyridine)

2014 Evidence-Based Guidelines for the Management of High Blood Pressure in Adults: Report for the Panel Members Appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014; 311(5):507-20.
 Clinical Practice Guidelines for the Management of Hypertension in the Community: a Statement by the American Society of Hypertension and the International Society of Hypertension. *J Clin Hypertens* 2014; 16(1):14-26.
 KDIGO Clinical Practice Guideline for the Management of Blood Pressure in Chronic Kidney Disease. *Kidney Int*. 2013;83(3):377-83.