

htn

2017 AHA/ACC BP Classification

Category	Systolic	Diastolic
Normal	<120	<80
Elevated BP	120–129	<80
Stage 1 HTN	130–139	80–89
Stage 2 HTN	≥140	≥90

BP in mmHg. Average ≥ 2 measurements $> 1-2$ min apart. Confirm stage 1 w/in 1–4 wk; can Rx stage 2 immediately. (*J Clin HTN* 2014;16:14; *Circ* 2018;138:e426)

etiologies

Etiologies (*JACC* 2017;71:127)

- Essential (95%): onset 25–55 y; ⊕ FHx. Unclear mechanism but ? additive microvasc renal injury over time w/ contribution of hyperactive sympathetics (*NEJM* 2002;346:913).
↑ Age → ↓ art compliance → HTN. Genetics + environment involved (*Nature* 2011;478:103).

2ry causes

- Secondary: Consider if Pt <30 y or if sudden onset, severe, refractory HTN

Secondary Causes of Hypertension			
Diseases		Suggestive Findings	Initial Workup
RENAL	Renal parenchymal (2–3%)	h/o DM, polycystic kidney disease, glomerulonephritis	CrCl, albuminuria See “Renal Failure”
	Renovascular (1–2%) Athero (90%) FMD (10%, young women) PAN, scleroderma	ARF induced by ACEI/ARB Recurrent flash pulm edema Renal bruit; hypokalemia (<i>NEJM</i> 2009;361:1972)	MRA (>90% Se & Sp, less for FMD), CTA, duplex U/S, angio, plasma renin (low Sp)
ENDO	Hyperaldo or Cushing’s (1–5%)	Hypokalemia Metabolic alkalosis	See “Adrenal Disorders”
	Pheochromocytoma (<1%)	Paroxysmal HTN, H/A, palp.	
	Myxedema (<1%)	See “Thyroid Disorders”	TFTs
	Hypercalcemia (<1%)	Polyuria, dehydration, Δ MS	iCa
OTHER	Obstructive sleep apnea (qv); alcohol		
	Medications: OCP, steroids, licorice; NSAIDs (espec COX-2); Epo; cyclosporine		
	Aortic coarctation: ↓ LE pulses, systolic murmur, radial-femoral delay; abnl TTE, CXR		
	Polycythemia vera: ↑ Hct		

Standard workup

- Goals: (1) identify CV risk factors; (2) consider 2° causes (3) assess for target-organ damage
- History: CAD, HF, TIA/CVA, PAD, DM, renal insufficiency, sleep apnea, preeclampsia; ⊕ FHx for HTN; diet, Na intake, smoking, alcohol, prescription and OTC meds, OCP
- Physical exam: ✓ BP in both arms; funduscopic exam, BMI, cardiac (LVH, murmurs), vascular (bruits, radial-femoral delay), abdominal (masses or bruits), neuro exam
- Testing: K, BUN, Cr, Ca, glc, Hct, U/A, lipids, TSH, urinary albumin:creatinine (if ↑ Cr, DM, peripheral edema), ? renin, ECG (for LVH), CXR, TTE (eval for valve abnl, LVH)
- Ambulatory BP monitoring (ABPM): consider for episodic, masked, resistant, or white coat HTN; stronger predictor of mortality than clinic BP (*NEJM* 2018;378:1509); 24 h target <130/80

Complications of HTN

- Neurologic: TIA/CVA, ruptured aneurysms, vascular dementia
- Retinopathy: stage I = arteriolar narrowing; II = copper-wiring, AV nicking; III = hemorrhages and exudates; IV = papilledema
- Cardiac: CAD, LVH, HF, AF
- Vascular: aortic dissection, aortic aneurysm (HTN = key risk factor for aneurysms)
- Renal: proteinuria, renal failure

Treatment

Treatment options :

1. treatment goals
2. non pharmacological
3. pharmacological

- Every ↓ 10 mmHg → 20% ↓ MACE, 28% ↓ HF, 13% ↓ mort.

Initiation of treatment :

ACC/AHA: initiate BP med if BP $\geq 130/80$ & *either* clinical CVD (ischemic heart disease, HF, stroke) *or* 10-y ASCVD risk $\geq 10\%$; otherwise if BP $\geq 140/90$

- In high CV risk w/o DM, SBP target of <120 (via unattended automated cuff) \downarrow MACE & mortality vs. target of <140 , but w/ \uparrow HoTN, AKI, syncope, electrolyte abnl (*NEJM* 2015;373:2103). Same pattern in subgp ≥ 75 y (*JAMA* 2016;315:2673).

- Lifestyle modifications (each may ↓ SBP ~5 mmHg)
 - weight loss: goal BMI 18.5–24.9; aerobic exercise: 90–150 min exercise/wk
 - diet: rich in fruits & vegetables, low in saturated & total fat (DASH, *NEJM* 2001;344:3)
 - limit Na: ideally ≤ 1.5 g/d or ↓ 1 g/d; enhance K intake (3.5–5 g/d)
 - limit alcohol: ≤ 2 drinks/d in men; ≤ 1 drink/d in women & lighter-wt Pts; avoid NSAIDs

INDICATIONS

- Pharmacologic options

Pre-HTN: ARB prevents onset of HTN, no ↓ in clinical events (*NEJM* 2006;354:1685)

HTN: choice of therapy controversial, concomitant disease and stage may help guide Rx

Uncomplicated: CCB, ARB/ACEI, or thiazide (chlorthalidone preferred) are 1st line; βB not

For black, elderly, and ? obese Pts: reasonable to start with CCB or thiazide

+ CAD (*Circ* 2015;131:e435): ACEI or ARB (*NEJM* 2008;358:1547); ACEI+CCB superior to ACEI+thiazide (*NEJM* 2008;359:2417) or βB+diuretic (*Lancet* 2005;366:895); may require βB and/or nitrates for anginal relief; if h/o MI, βB ± ACEI/ARB ± aldo antag (see “ACS”)

+ HF: ACEI/ARB/ARNi, βB, diuretics, aldosterone antagonist

+ prior stroke: ACEI ± thiazide (*Lancet* 2001;358:1033)

+ diabetes mellitus: consider ACEI or ARB; can also consider thiazide or CCB

+ chronic kidney disease: ACEI or ARB (*NEJM* 1993;329:1456 & 2001;345:851 & 861)

- Tailoring therapy: if stage 1, start w/ monoRx; if stage 2, consider starting w/ combo (eg, ACEI + CCB; *NEJM* 2008;359:2417); start at 1/2 max dose; after 1 mo, uptitrate or add drug

- Pregnancy: methyldopa, labetalol, & nifed pref. Hydral OK; avoid diuretics; ∅ ACEI/ARB. Targeting DBP 85 vs. 105 safe and ↓ severe HTN (*NEJM* 2015;372:407).

Resistant HTN (BP $>$ goal on ≥ 3 drugs incl diuretic; *HTN* 2018;72:e53)

- Exclude: 2^o causes (see table) and *pseudoresistance*: inaccurate measure (cuff size), diet noncomp (\uparrow Na), poor Rx compliance/dosing, white coat HTN (\checkmark ABPM)
- Ensure effective diuresis (chlorthalidone or indapamide $>$ HCTZ; loop $>$ thiazide if eGFR < 30)
- Can add aldosterone antagonist (*Lancet* 2015;386:2059), β -blocker (particularly vasodilators such as labetalol, carvedilol, or nebivolol), α -blocker, or direct vasodilator

Htn crisis

- Hypertensive emergency: SBP >180 or DBP >120 w/ target-organ damage
 - Neurologic damage: encephalopathy, hemorrhagic or ischemic stroke, papilledema
 - Cardiac damage: ACS, HF/pulmonary edema, aortic dissection
 - Renal damage: proteinuria, hematuria, acute renal failure; scleroderma renal crisis
 - Microangiopathic hemolytic anemia; preeclampsia-eclampsia
- Hypertensive urgency: SBP >180 or DBP >120 w/o target-organ damage

Precipitants

- Progression of essential HTN \pm medical noncompliance (espec clonidine) or Δ in diet
- Progression of renovascular disease; acute glomerulonephritis; scleroderma; preeclampsia
- Endocrine: pheochromocytoma, Cushing's
- Sympathomimetics: cocaine, amphetamines, MAO inhibitors + foods rich in tyramine

Treatment – tailor to clinical condition (*Circ* 2018;138:e426)

- AoD, eclampsia/severe preeclampsia, pheo: target SBP <140 (<120 for AoD) in 1 hour
- Emerg w/o above: ↓ BP by ~25% in 1 h; to 160/100–110 over next 2–6 h, then nl over 1–2 d
- Acute ischemic stroke (w/in 72 hr from sx onset): <185/110 before lysis initiated, o/w target <220/120 (same SBP goal for ICH)
- Watch UOP, Cr, mental status: may indicate a lower BP is not tolerated

- HTN urgency: goal to return to normal BP over hrs to days. Reinstitute/intensify anti-HTN Rx. Additional PO options: labetalol 200–800 mg q8h, captopril 12.5–100 mg q8h, hydralazine 10–75 mg q6h, clonidine 0.2 mg load → 0.1 mg q1h.

IV Drugs for Hypertensive Emergency (*Circ* 2018;138:e426; *Stroke* 2018;49:46)

Drug	Dose	Preferred for
Labetalol	20–80 mg IVB q10min or 0.4–2 mg/min	AoD, ACS, Stroke, Eclampsia
Esmolol	0.5–1 mg/kg load → 50–200 µg/kg/min	AoD, ACS
Nitroprusside*	0.25–10 µg/kg/min	Pulm edema
Nitroglycerin	5–500 µg/min	Pulm edema, ACS
Nicardipine	5–15 mg/h (can ↑ 2.5 mg/h q 5 min)	Stroke, AKI, Eclampsia, Pheo
Clevidipine	1–32 mg/h (can titrate q 5–10 min)	Stroke, Pulm edema, AKI, Pheo
Fenoldopam	0.1–1.6 µg/kg/min	AKI
Hydralazine	10–20 mg q20–30min prn	Eclampsia
Phentolamine	5–15 mg bolus q5–15min	Pheo
Enalaprilat	1.25–5 mg q6h	