Hypertension: Classification, Workup, and Treatment Algorithm

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Quick Reference: BP Classification (2023 AHA Guidelines)

Category	Systolic (mmHg)	Diastolic (mmHg)	Action
Normal	<120	<80	Lifestyle modification
Elevated	120-129	<80	Lifestyle modification
Stage 1 HTN	130-139	80-89	Lifestyle ± medication
Stage 2 HTN	≥140	≥90	Medication required
Hypertensive Crisis	>180	>120	Immediate intervention

> [!important] Key Point Always repeat BP measurement on separate occasions before diagnosing HTN. Home and out-of-office BP readings increasingly guide decision-making.

Primary vs. Secondary Hypertension

Primary (Essential) HTN — ~90-95% of cases - Multiple contributing factors: genetics, sodium sensitivity, activation of RAAS, sympathetic overactivity - Diagnosis of exclusion after secondary HTN ruled out

> [!tip] Clinical Pearl In a patient <30 years old with stage 2 HTN and no family history, always screen for secondary causes. Don't assume "primary" in the young.

Secondary HTN — ~5-10% of cases, requires investigation if: - Severe HTN (≥180/120) - Sudden onset or rapid escalation - Resistant HTN (see below) - Age <30 years at diagnosis - Unexplained hypokalemia or metabolic alkalosis - Family history of early HTN or stroke

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Common Secondary Causes (Rule of 4s)

Renal Causes (50% of secondary HTN)

- **Renovascular HTN**: Fibromuscular dysplasia (FMD, women <50) vs atherosclerotic RAS (men >60) → renal artery stenosis

  - Screen: Captopril challenge test (captopril-induced ↓ BP + ↑ renin), duplex ultrasound, CTA, MRA
  - Treatment: ACE-I/ARB if preserved renal function; stenting if flash pulmonary edema or ischemic nephropathy
- **Glomerulonephritis**: Presenting with hematuria + RBC casts
- **Chronic kidney disease**: Fluid retention + RAAS activation
- **Polycystic kidney disease**: HTN precedes renal insufficiency

Endocrine Causes (15% of secondary HTN)

- **Primary hyperaldosteronism (Conn syndrome)**: Hypokalemia, metabolic alkalosis, low-renin HTN
  - Screen: Serum aldosterone-to-renin ratio (ARR) >20 with positive confirmatory test
  - Pitfall: ACE-I/ARB and K-sparing diuretics falsely elevate renin → avoid before testing
- **Pheochromocytoma**: Episodic headache, palpitations, diaphoresis, weight loss
  - Screen: 24-hr urine catecholamines or plasma metanephrines
  - Triad: Hypertension + headache + sweating is diagnostic until proven otherwise
- **Hyperthyroidism**: ↑ heart rate, hyperreflexia, atrial fibrillation
- **Cushing syndrome**: Central obesity, purple striae, proximal muscle weakness, metabolic alkalosis

Vascular Causes

- **Coarctation of aorta**: Arm BP » leg BP (normally leg BP 10-20 mmHg higher), radio-femoral pulse delay, weak femoral pulses
  - Diagnosis: Chest X-ray showing rib notching; CTA or MRA confirms
  - Association: Turner syndrome, bicuspid aortic valve

Obstructive Sleep Apnea (OSA)

- Nocturnal repetitive hypoxia → sympathetic surge → sustained HTN
- Risk factors: Obesity, male, neck circumference >17 inches, Mallampati score III-IV
- Screen: STOP-BANG questionnaire; confirm with sleep study polysomnography

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Diagnostic Workup Algorithm

All patients with newly diagnosed HTN: 1. **Labs**: BMP (K+, Cr), glucose, lipid panel, uric acid, UA (hematuria/protein) 2. **Imaging**: ECG (LVH, ischemia), CXR (cardiomegaly, pulmonary edema) 3. **If abnormal labs or severe HTN**: Consider renal artery duplex, renin-aldosterone ratio, plasma metanephrines, TSH

Resistant HTN (BP ≥140/90 on ≥3 drugs including diuretic) requires: - Confirm adherence, rule out pseudoresistance (white coat effect) - 24-hr ABPM - Urine sodium (assess volume status) - Secondary HTN workup: Renal artery stenosis, hyperaldosteronism, pheochromocytoma, OSA, renal parenchymal disease

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Treatment Algorithm (2023 AHA)

Lifestyle Modifications (first-line for all, even on meds)

- **DASH diet**: ↓ sodium to <2,300 mg/day (goal <1,500 mg/day); ↑ potassium, calcium, magnesium, fiber
- **Exercise**: ≥150 min/week moderate aerobic activity
- **Weight loss**: 5-10% weight reduction → ~5 mmHg BP reduction
- **Limit alcohol**: ≤1 drink/day women, ≤2 drinks/day men
- **Stress management**: Meditation, biofeedback
- **Reduce caffeine** (modest effect)

  [!warning] High-Yield Board Point The DASH diet combined with Na restriction can lower BP by 11 mmHg — as effective as a single antihypertensive drug.

Pharmacotherapy

Monotherapy (initiate if lifestyle fails or BP ≥140/90): 1. **ACE-I or ARB** — first-line for CKD, LVH, post-MI, or diabetes - Contraindications: Pregnancy (teratogenic 2nd/3rd trimester), hyperkalemia, bilateral renal artery stenosis - Side effect ACE-I: Dry cough (~20%), hyperkalemia, acute kidney injury in certain settings - Examples: Lisinopril 10-40 mg daily; Losartan 50-100 mg daily

2. **Thiazide-like diuretic** (chlorthalidone preferred over HCTZ due to longer half-life)
   - First-line in isolated systolic HTN, HF with preserved EF, older adults
   - Monitor: K+, glucose, uric acid, lipids (metabolic effects)
   - Dose: HCTZ 25 mg daily; Chlorthalidone 12.5-25 mg daily
3. **Calcium channel blocker (CCB)** (dihydropyridine type: amlodipine, nifedipine ER)
   - Best tolerated, especially in older adults; no metabolic effects
   - Common side effect: Peripheral edema (dose-dependent), reflex tachycardia (immediate-release nifedipine)
   - Dose: Amlodipine 5-10 mg daily
4. **Beta-blocker** — specific indications only (post-MI, HF with reduced EF, atrial fibrillation, hyperthyroidism)
   - Not first-line for uncomplicated HTN (metabolic effects, ↓ glucose tolerance)
   - Examples: Metoprolol succinate 100-190 mg daily

Combination Therapy (two drugs): - ACE-I/ARB + Thiazide diuretic (synergistic) - ACE-I/ARB + CCB (very effective, well-tolerated) - Thiazide + CCB (good for CKD) - Avoid: ACE-I + ARB together (no added benefit, ↑ hyperkalemia/renal dysfunction risk)

Resistant HTN (≥3 drugs including diuretic): - Add 4th agent: Often aldosterone antagonist (spironolactone 12.5-25 mg daily) if no hyperkalemia - Consider: Loop diuretic if GFR <30; vasodilator (hydralazine, minoxidil) - Recheck: Adherence, white coat effect (24-hr ABPM), rule out secondary causes

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Special Populations

Hypertensive Crisis

Hypertensive Urgency (BP >180/120 without end-organ damage): - Oral medications; close follow-up in 24 hours - Risk of overly aggressive lowering: Stroke, MI from hypoperfusion

Hypertensive Emergency (BP >180/120 WITH end-organ damage): - **End-organ damage**: Encephalopathy, acute MI, acute heart failure, acute kidney injury, eclampsia, intracranial hemorrhage - Requires **IV agents**: Nicardipine drip, labetalol, esmolol, sodium nitroprusside, IV hydralazine - Goal: Reduce BP by 10-20% in first hour, then slower titration to avoid stroke/MI - Pitfall: IV nitroprusside limits use to <4 hours (cyanide toxicity); reserved for ICU

Pregnancy-Induced Hypertension

- **Gestational HTN**: New onset HTN after 20 weeks without proteinuria
- **Preeclampsia**: HTN + proteinuria $\geq$0.3 g/day or other end-organ dysfunction
- **Eclampsia**: Preeclampsia + seizures
- Treatment: First-line agents (safe in pregnancy) = IV labetalol, PO methyldopa, nifedipine ER, labetalol PO
- **AVOID**: ACE-I, ARB, atenolol (associated with fetal growth restriction), hydrochlorothiazide
- See: Pregnancy & Kidney Disease

Older Adults

- Goal BP: Generally <130/80 (but individualize; some benefit from higher targets if frail)
- Increased sensitivity to medication side effects, orthostatic hypotension
- Preferred: Thiazide or CCB monotherapy
- Caution: Avoid rapid BP lowering (stroke risk)

Clinical Pearls & Pitfalls

> [!tip] Clinical Pearl **Resistant HTN**: Always check medication adherence first. Pill counts reveal ~50% of patients not taking meds as prescribed.

> [!tip] Clinical Pearl **Renovascular HTN**: A positive captopril test + renal artery stenosis on imaging ≠ causation. Remember ~5-10% of hypertensives have asymptomatic RAS incidentally. Only treat if clinical indicators (flash pulmonary edema, ischemic nephropathy, uncontrolled HTN on $\geq$3 drugs).

> [!important] Key Point **Hyperkalemia risk**: ACE-I/ARB contraindicated if baseline K+ >5.0 or Cr >3.0. Check baseline and recheck 1-2 weeks after initiation.

> [!important] Key Point **White coat HTN**: ~20% of patients with elevated office BP have normal home/out-of-office pressures. Confirm diagnosis with home BP monitoring or 24-hr ABPM before starting meds.

> [!warning] High-Yield Board Point **Aldosterone blockade in primary hyperaldosteronism**: Spironolactone (K-sparing) is preferred; amiloride preferred if gynecomastia with spironolactone. Surgical adrenalectomy if unilateral adenoma on imaging.

Landmark Trials & Evidence

- **SPRINT Trial** (2015): Intensive SBP target <120 mmHg reduced CV events vs standard <140 mmHg in non-diabetic older adults [1]
- **ACCORD Trial** (2010): Intensive BP control in diabetics did NOT reduce major CV outcomes vs standard targets [2]
- **JAD Study**: ARB monotherapy superior to ACE-I in patients with proteinuria >0.5 g/day (but not evidence-based in current guidelines)

Related Resources

- Full Hypertension Management Review
- Renovascular Hypertension Deep Dive
- Pregnancy & Kidney Disease Hub
- CKD Management Pathways
- Drug Dosing in CKD

References

[1] SPRINT Research Group. A randomized trial of intensive versus standard blood-pressure control. *N Engl J Med.* 2015;373(22):2103–2116. PMID: 26551272

[2] ACCORD Study Group. Effects of intensive blood-pressure control in type 2 diabetes mellitus. *N Engl J Med.* 2010;362(17):1575–1585. PMID: 20228401

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