Adult and Elderly Hypertension: The Pressure's On!

David Schneider, MD, FAAFP

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David Schneider, MD, FAAFP

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Dr. Schneider cares for the underserved in Santa Rosa, California, serving Latino, Southeast Asian, and Eritrean populations. He has taught the breadth and depth of family medicine for more than 20 years, and his professional interests include the physician-patient relationship and clinical skills. Cardiovascular system conditions are one of his specialty topics, and he points to "the growing body of evidence suggesting that lifestyle is as effective as, or more effective than, pharmacologic interventions in primary prevention." Dr. Schneider also focuses on conditions of the endocrine system (especially thyroid); skin conditions and dermatology; primary prevention, with a focus on lifestyle; and procedures. Board certified in both family medicine and integrative holistic medicine, he produces Dr. Dave's To Your Health segments for Wine Country Radio and BlogTalkRadio.com.
Learning Objectives

1. Evaluate current management of hypertension in adult and elderly patients, as compared to current guidelines.

2. Apply current evidence regarding more accurate methods of blood pressure monitoring.

3. Recognize how therapeutic inertia presents a barrier to blood pressure control.

4. Prepare treatment regimens of antihypertensive medications and tools with an emphasis on patient adherence.

Audience Engagement System

Step 1

Step 2

Step 3
HTN: Scope of the Problem

- ~ 30 – 34% of adults >18 y.o.
- 75-85 million hypertensive adults in US (100X10^6 per AHA).
- Hypertension **on the rise:**
  - Elderly (>65% of pts >65 – systolic or systolic + diastolic).
  - Obesity epidemic.
- 2013-14 NHANES data: finally, >50% controlled (53%—up from 52% in 2011-12).

https://www.cdc.gov/nchs/data/hus/hus16.pdf#054; Circulation 2018;137:e67–e492; JAMA 2010;303:2043-50; Circ 2013;127:e6-e245; HTN online http://hyper.ahajournals.org/content/early/2013/11/14/HYP.0000000000000003; http://www.cdc.gov/nchs/data/databriefs/db111.htm

Ethnic/Racial Disparities

- African Americans:
  - **Higher prevalence** of HTN (43% vs 29%).
    - 2018: 75% by age 55, vs 55% W men/40% W women.
  - **Earlier onset** of HTN.
  - Disproportionate prevalence of “severe” HTN.
  - High frequency of **comorbid conditions.**
  - ½ as likely as Caucasians to have BP controlled.

Ethnic/Racial Disparities – 2

• Latinos/Hispanics:
  – HTN prevalence ~ or lower than Caucasians.
    • 19-30% > 18 y.o.
    • 24% of CA Latinos.
    • US-born Latinos more likely.
  – Increasing rates of HTN.
  – Significant comorbidities.
  – Less likely to have BP controlled or even treated vs White or African-American people.


Ethnic/Racial Disparities – Why?

• Uncertain. Possible contributors:
  – Access to health care.
  – Fragmentation of health care.
  – Different management by doctors.
  – Severity of HTN.
  – Genetic predispositions (African Americans).
  – Comorbidities.
  – Adherence.
    • Trust in health care system.
    • Perception (severity, benefit, etc).

Barriers to Care: Elderly

- Psychological: desire to always see same MD; 
  embarrassment about health/concerns or inability to 
  pay.
- Physical: difficulty getting to appts.
- Financial: donut hole—ACA ↓; 2018 tax law ↑.
- Practical: no time (working), caregiver.
- Other: Dr not responsive to concerns (#1 reason in one study).

Reducing Health Disparities

- Clinicians have implicit biases that impair communication & 
  contribute to disparities.
  - ↑ awareness of our biases \(\Rightarrow\) ↓ biases \(\Rightarrow\) ↑ pt-centered care.
- Beware “accidental paternalism.”
- Reduce waiting room times.
- Leverage EHR.
- Interpretation services.
- Non-judgmental responses.
Current BP target for 65 yo WM w/DM2, according to JNC-8 & AAFP:

A. 130/80
B. 130/85
C. 135/85
D. 140/90
E. 150/90
### Defining HTN & BP Goals

<table>
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<tr>
<th>Guideline</th>
<th>Population</th>
<th>BP Goal</th>
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<td>JNC 8 (2014)</td>
<td>&lt;60</td>
<td>&lt;140/90</td>
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<tr>
<td></td>
<td>≥60</td>
<td>&lt;150/90</td>
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<td>Any age DM or CKD</td>
<td>&lt;140/90</td>
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<td>CKD w/o proteinuria</td>
<td>&lt;140/90</td>
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<td></td>
<td>CKD w/ proteinuria</td>
<td>&lt;130/85</td>
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<td>ACC/AHA (2017)</td>
<td>All adults</td>
<td>&lt;130/80</td>
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<td>ADA (2018—NB: 2019 = ACC/AHA)</td>
<td>DM</td>
<td>&lt;140/90 (&lt;130/80 for some w/↑ CV risk)</td>
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<tr>
<td>KDIGO (2012—review in process)</td>
<td>CKD w/o proteinuria</td>
<td>&lt;140/90</td>
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<tr>
<td></td>
<td>CKD w/ proteinuria</td>
<td>&lt;130/80 (KDOQI disagrees)</td>
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### SPRINT Trial – New BP Goals?!?

- **Open label** RCT, 9361 pts, 102 sites (➔ 91.8/site avg).
- **>50 yo,** SBP 130-180.
- **Pts w/”increased CV risk.”**
  - Clinical or subclinical CV dz—excluding stroke.
  - CKD, GFR 20-60—excluding polycystic kidney dz.
  - 10-yr Framingham risk ≥15%.
  - Age ≥75.
- **DM & prior stroke excluded.**
- Composite endpoint: MI + ACS + stroke + HF + CV death.

NEJM 2015;373:2103-16
SPRINT Trial – Results

• Goal SBP:
  – Intensive treatment $\rightarrow$ <120.
  – Standard treatment $\rightarrow$ <140.

• Stopped early at 3.26 years (plan = 5-6) – 1° endpt met.
  – Standard (mean SBP = 136) = 2.19%/yr.
  – Intensive (mean SBP = 121) = 1.65%/yr $\rightarrow$ HR = 0.75.
  – [NNT = 185/year.]
  – ↓ HF (0.62), mortality (0.73), CV mortality (0.57).

NEJM 2015;373:2103‑16

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SPRINT Trial – Results 2

• No difference:
  – MI/ACS.
  – Stroke.
  – Progression of CKD in pts w/CKD @ baseline.

• Intensive treatment worse:
  – ↓ of GFR in pts without CKD @ baseline (HR=3.5), incl AKI.
  – Syncope, hypotension, electrolyte abnormality (↓K+, ↓/↑Na+).
    • However, asymptomatic orthostatic hypotension higher in standard (?!?) — though symptomatic (dizzy) equal.

NEJM 2015;373:2103‑16
SPRINT Trial – Limitations

- Open label.
- Population:
  - ↑ CV risk population. What about low risk pt (Cochrane 2012)?
  - No DM, no CVA, none <50.
- Difficulty achieving control – SPRINT population, US pts.
  - Intensive grp mean = 121 ➔ >50% had SBP >120.
  - Intensive grp avg 1 more med (2.8 vs 1.8).
- Intensive grp meds: 66% more thiazides; 47% more ARB’s.
- Data interpretation – based on coding + safety officer.


SPRINT—BP Measurement Method

- Mandatory seated rest in quiet room for 5 minutes.
- 3 recordings at 1-min intervals—no observer present in room during measurement.
- Average of these recordings ➔ BP.
- “Research-grade” BP measurement, rarely used in practice.
  - This method averaged SBP 12.7 lower than routine, 7.9 lower than ambulatory BP monitor.
  - May correlate better w/LVH.
  - Prior study ➔ prior research BP gives 10/7 lower than routine.

ACC/AHA 2017 Guideline

• Endorsed by 11 societies.
• Only 1 PCP on panel (geriatrician).
• Redefines BP categories:
  – Normal BP: 120/80.
  – Stage 1 HTN: 130-139/80-89.
  – Stage 2 HTN: ≥140/90

ACC/AHA 2017 Guideline—2

• Treat at ≥140/90:
  – No clinical CVD and 10 yr ASCVD risk <10%.
  – 2° stroke prevention.
• Treat at ≥130/80:
  – Clinical CVD or 10 yr ASCVD risk ≥10%.
  – Comorbidities: DM, CKD (incl p-transplant), HF, stable IHD, PAD.
• Goal for all treated pts is <130/80.
AAFP Did **NOT** Endorse ACC Guideline

- Not true systematic review of evidence.
  - Evidence review for only 4 questions.
  - >100 recommendations provided.
  - Harms of treating to lower BP not reviewed.
- No benefit in all-cause mortality, CV mortality, MI, renal events.
- No assessments of quality of studies or reviews included.


AAFP Did **NOT** Endorse ACC Guideline

- Heavy weight on SPRINT, results from other trials minimized.
  - Early discontinuation of trial could lead to exaggerated benefits & underreporting of harms.
  - Needs to be considered in totality of evidence.
- ASCVD risk tool used to determine BP thresholds & targets – **no evidence** for using tool this way.
- Conflicts of interest—intellectual, commercial.
  - SPRINT chair = guideline chair.

Updated BP Goals >60: AAFP + ACP

• ACP/AAFP Guideline for HTN in pts >60.
  – SBP target >60 yo = still <150.
  – Consider target SBP <140 in adults >60 w/hx of stroke, TIA (weak rec, mod-quality evidence).
  – Consider target SBP <140 in adults >60 w/high CV risk (weak rec, low-quality evidence).
  – Discuss benefits & risks.

Ann Intern Med 2017;166:430-37

Brief Evidence Review: HTN Tx >60

• Targets <140 not always achieved; small diffs in BP between intensive & regular groups in some studies.
  – Pooled risk reductions not significantly different for CV events or mortality.
  – 1st stroke reduced more in regular group (SBP≥140) vs intensive group (<140).
  – More adverse events & tx withdrawal with lower SBP (falls, AKI, E-lyte disturbance, hypotension, syncope).

Brief Evidence Review: HTN Tx >60—2

- High-quality evidence ➔ treating HTN in older adults to ≤150/90 reduces stroke (ARR, 0.92) & cardiac events (ARR, 0.72).
  - Effects favorable across outcomes.
  - Most consistent benefit found in trials w/mean baseline SBP >160.
  - Mortality reduction not statistically sig (RR, 0.93 [CI, 0.85 to 1.00]).
- Most benefits similar w/ or w/o DM.
- Any additional benefit from aggressive BP control is small (less benefit & inconsistent results).


Is This An Accurate BP?

- Cuff must fit!
- No clothing!
- No talking, empty bladder.
- Uncrossed legs, feet on floor.
- Supported arm.
- Research protocol?

https://www.ama-assn.org/delivering-care/hypertension/how-get-most-accurate-blood-pressure-measurement

Photo from personal collection, David Schneider
Ambulatory BP Monitoring

- Most accurate BP measurement.
- Correlates best with morbidity & mortality.
  - Fatal & nonfatal stroke.
  - Fatal & nonfatal CV events/MACE’s.
- Ideal for high-normal BP, white coat HTN, masked HTN, hard to control, pregnancy.
- Confirm office dx to avoid overtreatment.


Ambulatory BP Monitoring

- USPSTF:
  - “Convincing evidence that ABPM is the best method for diagnosing hypertension.”
  - “Home blood pressure monitoring using appropriate protocols is an alternative method of confirmation if ABPM is not available.”

CMS Decision 7/2/2019: ABPM!

- Evidence sufficient to cover ABPM for Dx of HTN in Medicare beneficiaries if:
  - Suspected white coat HTN – avg office BP 131-159/81-99 X 2, ≥2 BPs each visit + ≥2 BPs outside ofc <130/80.
  - Suspected masked HTN – avg office BP 120-129/75-79 X 2, ≥2 BPs each visit + ≥2 BPs outside ofc ≥130/80.
- For eligible patients, ABPM is covered once/yr.


White Coat HTN Matters

- F/U 3-19 years.
- Untreated WCH ↑ risk for:
  - CV events (HR=1.36), CV events incl stroke (HR=1.26)
  - All-cause mortality (HR=.33), CV mortality (HR=2.09).
- Treated white coat effect (WCE) ➔ no sig ↑ risk.

Physical Exam in HTN

- Proper sized cuff, correct position.
  - Avoid public BP machines—useless info!! (See supplemental.)
- Remember BP in both arms.
- Funduscopic exam.
- Ht/wt/BMI; waist circumference.
- Signs of HF.
- Neuro (prior stroke).
- Pulses (PAD).


AES Question
AES Question 2

Per JNC-7 & 8, which is NOT indicated for all HTN pts?

A. Blood glucose.
B. Electrolyte panel.
C. Urinalysis.
D. Urine albumin/creatinine ratio.
E. EKG
F. None of the above

Diagnostic Workup of HTN

- **Laboratory** tests:
  - UA
  - Hematocrit
  - Lipid panel
  - Blood chemistry tests:
    - Blood glucose
    - Serum potassium, creatinine, and calcium
  - Optional (unless DM or CKD): urinary albumin/creatinine ratio.
- Obtain **electrocardiogram**
Identifiable Causes of HTN (Secondary HTN)

• 2 – 10% (or more??) of hypertensive pts.
  – Chronic kidney disease (2.5 – 6%)
  – Primary aldosteronism and other mineralocorticoid excess states (1 – 10% prevalence; 17-23% of resistant HTN)
  – Renovascular HTN – renal artery stenosis (0.2 – 4%)
  – Drug-induced or drug-related

• Mnemonic: CARD or KARD

• See supplemental info.

Identifiable Causes of HTN—2nd Tier

• “Obstructive”:
  – Obstructive uropathy
  – Sleep apnea
  – Coarctation of the aorta

• Endocrine:
  – Thyroid or parathyroid disease
  – Cushing’s syndrome and other glucocorticoid excess states, including chronic steroid therapy
  – Pheochromocytoma (rare)
Algorithm—BP Goals

- **BP Goals:**
  - DM OR CKD: 140/90, regardless of age.
  - ≥60 y.o. (ASH/ISH say ≥80): 150/90.
  - Everybody else: 140/90.

Algorithm—Initiating Meds

- CKD (w/ or w/o DM)
  - ACEI or ARB, alone or w/ other drug class

- Everybody except CKD (incl DM)
  - African American
    - Thiazide or CCB, alone or combo
  - NOT Afr Am
    - Thiazide, ACEI, ARB, or CCB—alone or combo

**Titration strategy:**
1. Maximize 1 med before adding 2nd OR
2. Add 2nd med before max dose of 1st OR
3. Use 2 meds from different classes—2 pills or combo pill
Algorithm—Not At Goal

Titrination strategy:
1. Maximize 1 med before adding 2nd OR
2. Add 2nd med before max dose of 1st OR
3. Use 2 meds from different classes—2 pills or combo pill

At Goal?

Yes

• Reinforce med & lifestyle adherence.
• If ready to add drug: add thiazide, ACEI or ARB, CCB—different class, NO ACEI+ARB
• If on 2 drugs, titrate both to max.

Algorithm—Still Not At Goal

At Goal?

Yes

• Reinforce med & lifestyle adherence.
• ADD & titrate thiazide, ACEI or ARB, CCB (different class)

At Goal?

No

• Reinforce med & lifestyle adherence.
• Add different class (β-blocker, ald antagonist, other), &/or refer to “HTN specialist”

Continue till goal met
3(½) Simple Steps to HTN Tx

1. Lifestyle
2. CKD? (no compelling indications chart!)
   a. Yes ➔ ACEI or ARB +/- other drug (B).
   b. No:
      i. African American: thiazide &/or CCB (B; C if DM).
      ii. Non-African American: thiazide or ACEI or ARB or CCB, alone or combo (B).
3. Increase or add.

Therapeutic Inertia

• Failure of a healthcare provider to increase therapy when treatment goals are unmet.
• A major cause of uncontrolled HTN.
• Retrospective study of 7523 HTNsives:
  – Rx ↑’d in 13% of visits in pts w/uncontrolled HTN.
  – ↑ therapeutic inertia ➔ 33 X less chance of achieving goal BP.
Reducing Therapeutic Inertia

- Monitoring & feedback.
- Customized case-based learning.
- Frequent office visits (monthly X4 ⇒ q3-4 mo) – esp if ≥160/100.
- Clinical decision support.
- Visit resolution tools (accountability).
- Financial incentives.

Non-Pharmacologic Therapy for HTN

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<th>Modification</th>
<th>Recommendation</th>
<th>~ SBP Reduction</th>
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</thead>
<tbody>
<tr>
<td>Weight reduction</td>
<td>Maintain NI body wt (BMI 18.5 – 24.9)</td>
<td>5 – 20 mm/10kg wt loss</td>
</tr>
<tr>
<td>DASH diet</td>
<td>Fruits, veges, lowfat dairy, low saturated &amp; total fat</td>
<td>8 – 14 mm + ↓ CAD &amp; stroke</td>
</tr>
<tr>
<td>Dietary Na restriction</td>
<td>Max 2.4 g Na = 6 g NaCl</td>
<td>2 – 8 mm</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Regular aerobic activity, ≥ 30 min/day, most days</td>
<td>4 – 9 mm</td>
</tr>
<tr>
<td>Moderate ETOH (vs higher intake)</td>
<td>Max 2/day in men, 1/day in women or lighter persons</td>
<td>2 – 4 mm</td>
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Pharmacologic Therapy of HTN

• Monotherapy will control 30-50% of pts.
  – **Majority of pts require ≥ 2 meds for control.**
  – Average hypertensive pt is on 2-3 meds.
  – Vast majority of hypertensives w/diabetes require ≥2 meds.
• Starting w/2 meds is more likely to control BP sooner.
  – Combination pill ➔ 55% ↑ chance of BP control.
  – BP 20/10 above goal unlikely to be controlled on 1 med.
  – Rule of 10’s: each med lowers SBP ~10.

Choosing a Medication

• ABCD’s:
  – **ACE** inhibitors & ARB’s
  – **B**eta blockers
  – **C**alcium channel blockers
  – **D**iuretics
• Other “forgotten” meds:
  – Aldosterone receptor antagonists
  – Central sympatholytics
  – Alpha blockers
  – Direct vasodilators
  – Loop diuretics (better for CKD)
AES Question

Which is true about diuretics?

A. Thiazide diuretics are still 1st line for HTN Rx.
B. Loop diuretics are effective antihypertensives in most pts.
C. Low-moderate dose HCTZ is the best diuretic for HTN tx.
D. Thiazides should not be used in DM.
E. Pts w/↑ LDL should not use thiazides.
Diuretics (Thiazides)

- **Usually the 1st choice antihypertensive med.**
- If pt is on a med from a different class, thiazides are usually the top choice for the 2nd med.
- Reduce morbidity & mortality from CAD.
- In pts with chronic kidney disease (CKD), use **loop diuretic if estimated GFR is below ~ 30** (thiazides less effective).
  - Exception is metolazone (Zaroxolyn).

Thiazide Adverse Effects

- Hypokalemia.
  - Avg ↓ of 0.3-0.4 mmol/L.
  - Dietary Na+ restriction can ↓ thiazide-induced K+ loss).
- Hyponatremia.
- Sexual dysfunction in men.
- Hyperglycemia—mild.
  - Proven beneficial outcomes in DM—NOT contraindicated.
- Hyperlipidemia—mild.
  - Proven beneficial outcomes ↓ CV events risk.
- Hyperuricemia – gout less common.

HCTZ new twist: lip & nonmelanoma skin CA; now possibly melanoma—? d/t photosensitivity.
- Retrospective study, registry data, Denmark.
- Modest risk: 16-20% over baseline
Commonly Used Thiazide Diuretics

- HCTZ 12.5 – 25 mg
- **Chlorthalidone** 12.5-25 mg
  - 12.5 mg chlorthalidone ≈ 25 mg HCTZ.
    - ↓ SBP by 10: 8.6mg chlorthalidone vs 26.4mg HCTZ.
  - Many **outcomes studies** done w/this drug.
  - 1 month chlorthalidone Rx → 1 more day of life.
- **Indapamide** 1.25 – 5 mg: thiazide-like, not thiazide.
  - ↓ fatal stroke 39%, ↓ mortality 21%, ↓ HF 64%.
  - 2.5 mg has ~ effect of ↓ BP as 25-50 mg HCTZ.

ACE Inhibitors

- 1<sup>st</sup> line for most pts.
  - May be less effective in African Americans & elderly, but should not be withheld.
  - Proven morbidity & mortality benefit in multiple clinical situations.

ACEI Adverse Effects

- Dry cough (5 – 20%).
- Reduced GFR.
  - Esp renovascular HTN, HF, polycystic kidney dz, CKD.
- Hyperkalemia (3.3 – 11%).
- Hypotension, dizziness, syncope.
  - More likely in HF, volume depletion (diuretics).
- Angioedema (rare) – Swelling of lips, tongue, mouth, face.
  - May be more common in elderly (?), African Americans (2-4X ↑).

Angiotensin Receptor Blockers

- “ACE inhibitors without the cough.”
- Similar efficacy to ACEI’s (both may be slightly less potent than thiazides, CCB’s).
- Similar side effect profile to ACEI’s.
  - Lower incidence of cough (rare, but occurs).
    - Most pts w/ACEI-induced cough tolerate ARB’s.
  - ~ 1/3 the incidence (already rare) of angioedema.
  - More hypotension than ACEI’s (~2X).
- Olmesartan (Benicar): sprue-like enteropathy.

AES Question

Which is TRUE about renal function & HTN meds?
A. Cr may rise with any anti-HTN med.
B. Cr rises only with ACEI’s.
C. Cr rises more with ACEI’s than with ARB’s.
D. Discontinue ACEI or ARB only when Cr rises >20% (or if GFR falls >20%).
E. Discontinue ACEI or ARB only when Cr rises >50% (or if GFR falls >50%).
What if Creatinine Rises?

- **Renal dysfunction** assoc’d w/antihypertensive tx is independent of med (more common w/ACEI & ARB).
- <30% ↑ in Cr, which then stabilizes, ➔ **hemodynamic** change, **not** damage/structural change.
  - Slight rise in Cr ➔ IG pressure ↓.
  - ACEI/ARB also dilate efferent arteriole, ➔ ↓ IG pressure.
- If Cr ↑ >30%, ➔ **D/C med and other causes** of renal dysfunction should be evaluated (esp RAS).
  - CORAL study calls into question – no outcome benefit of Tx RAS.


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Beta Blockers

- No longer 1st line. Use in:
  - Post-MI (non-intrinsic sympathomimetic)
  - CAD—control of angina
  - HF (metoprolol succinate, carvedilol, bisoprolol)
  - Rate control in A fib
  - **Yes, they can & should be used in DM w/indication.**
  - Other (LVH, migraine, essential tremor).
  - **Less effective in generalized anxiety** (better for performance anx [performance-only soc anx disorder]).
AES Question 5

CCB’s are currently 1st line for most pts w/HTN.

A. True  
B. False  
C. CCR (Credence Clearwater Revival)
CCB Candidates

- **Everybody** (not 1st choice in CKD)
- African Americans
- Elderly
- Angina, incl Prinzmetal’s (amlodipine, felodipine).
- Less reduction of HF than thiazide or ACEI.

Calcium Channel Blockers (CCB)

- Dihydropyridines: use long-acting meds
  - Amlodipine
  - Felodipine
- Non-dihydropyridines:
  - Diltiazem
  - Verapamil
- **Avoid** short-acting dihydropyridines
  - Nifedipine (this is often an incorrect exam answer, esp if another CCB option).
## CCB Comparison

<table>
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<th>HR</th>
<th>Conduction</th>
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</tbody>
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- DHP’s ➔ more peripheral effects.
- Non-DHP’s ➔ more cardiac effects.

## Aldosterone Antagonists

- Spironolactone ($4), eplerenone ($120).
- Spironolactone 25-50 mg/day:
  - **Resistant HTN** “secret.”
  - ASCOT: ↓ BP 22/10 in pts already on 3 drugs.
  - ↓ BP also occurs in pts w/normal aldosterone, not just incr levels.
- Evidence: CHF, post-MI.

*Hypertension 2007;49(4):839-45*
Other Antihypertensive Agents

- $\alpha_1$-blockers.
  - Not in monotherapy, except BPH.
- Central $\alpha_2$-blockers (clonidine, guanfacine).
  - The worst for rebound HTN.
  - Useful in CKD.
- Direct vasodilators (hydralazine, minoxidil).
  - Mostly for resistant HTN.
  - Hydralazine in pregnancy.

Medication Adherence

- Fewer daily doses/simplify regimen.
- Low side effects.
- Empowered pts—involve in decisions.
- Detect/work with low health literacy.
  - Stop talking like a doctor!
  - Shame free inquiry.
- More frequent PCP visits.
- Link behavior w/habits.
- Motivational Interviewing.

Erectile Dysfunction

- **Neutral** effect on erectile function: ARBs, ACEI’s, CCBs.
- **Impair** erectile function: Centrally-acting $\alpha_2$-agonists, $\beta$-blockers, diuretics.
- **Contraindicated with PDE-5 inhibitors:**
  - Nitrates (severe hypotension/circulatory collapse).
  - $\alpha_1$-blockers should be used with caution; combination may cause hypotension (tadalafil contraindicated w/$\alpha_1$-blockers).
  - Initiate PDE-5 inhibitor at lowest dose.

Combination Therapy

- **Preferred combinations:**
  - ACEI or ARB + diuretic.
  - ACEI or ARB + CCB.
- Acceptable combinations:
  - Thiazide + most others ($\beta$-blocker, CCB, K-sparing diuretic).
  - $\beta$-blocker + DHP CCB.
- **Do not use 2 RAA blockers** (ACEI, ARB, DRA).
  - ↑ risk AKI, ESRD, hyperK.
  - No benefit.
Resistant HTN

- Persistent HTN despite > 3 drugs.
- Poor adherence most common cause.
- Suboptimal therapy.
  - Typically inadequate diuresis.
    - Move to loop diuretic.
    - Add spironolactone.
- Med interactions.
- 2° HTN.

AES Question
AES Question #6

Which of the following pts should be screened for HTN?

A. 39 yo WF w/BP 128/84 2 years ago
B. 47 yo WM w/BP 1 yr ago of 138/88
C. 58 yo Latino M w/DM2, 3 BP’s >140/90 in last 6 mo
D. 32 yo African American, last BP 3 years ago 122/78.
E. All of the above

USPSTF Recommendations

• Screen adults ≥18 (A).
• Obtain measurements outside the clinical setting to confirm dx before starting Tx.
• HTN is a risk factor for abnormal glc metabolism/DM2.
  – 2008 USPSTF ➜ screen HTNsives for DM.
  – 2015 USPSTF does not explicitly state.

USPSTF: Screening Interval

- Annual screening:
  - 40+ yo.
  - Increased risk for high blood pressure.
    - High-normal blood pressure (130-139 / 85-89).
    - Overweight or obese.
    - African Americans.
- 18 to 39 yo w/normal BP (<130/85 mm Hg) & w/o other risk factors ➔ rescreen q 3 -5 yrs.
- If BP ↑, **confirm** Dx of hypertension with **ABPM**.


Best Practice Recommendations

- Continue to abide by JNC-8 guidelines, as well as ACP/AAFP guidelines for managing BP in pts ≥60 (SOR A).
- Prescribe **medications** for pts with HTN, w/emphasis on CCB, ACEI or ARB, and thiazide diuretics (esp for pts on >1 med) (SOR A).
- Manage hypertension in **special populations**, such as African Americans, Latinos, pts with chronic kidney disease & diabetes, using evidence-based guidelines for optimal treatment (SOR A, B).
References

• JNC-8: JAMA 2014;311(5):507-520
• ASH/ISH: JHypertens 2014;32:3-15
• ACC/AHA 2017-18 BP Guideline: Hypertension 2018;71:1269-1324
• AAFP Statement of non-endorsement of ACC guideline: https://www.aafp.org/patient-care/clinical-recommendations/non-endorsed.html
• JAMA Comparison– https://sites.jamanetwork.com/jnc8/

Contact Information

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Answer Key

• 1: D  
• 2: D  
• 3: A  
• 4: A  
• 5: A  
• 6: B  
• 7: D (Supplemental materials)

Supplemental Material

• JNC 8 controversies  
• Risk factors  
• BP measurement, control  
• Controversies in Tx  
• 2° HTN  
• Non-pharm, meds, & issues  
• Behavior change
JNC-8 Is Here!

3 questions re: adults w/ HTN:
1. Specific BP threshold to begin Rx to improve outcome?
2. Does Rx to specified goal BP improve outcomes?
3. Outcome benefits of specific drug classes?

JNC-8: JAMA 2014;311(5):507-520

JNC-8 Is Here!

• JNC-7: 2003.
• Average guideline utility = 6 years.
• JNC-8: work started 2008; published late 2013.
• Mixed reception.
New HTN Guidelines

- JNC 8: 12/18/13.

Dissent Among the Ranks

- JNC “almost unanimous” on most recommendations.
- Five JNC-8 authors expressed concerns.
- Author of Cochrane review called for retraction.
- Guidelines do not all agree w/each other.
Mnemonic: CV Risk Factors

- Per JNC-7:
  - **A**ge—65 F (or premature menopause), 55 M
  - **B**P (HTN)
  - **C**igarettes (smoking)
  - **D**M
  - **E**xercise lack (physical inactivity)
  - **F**H—65 F, 55 M
  - **G**ood cholesterol too low (HDL-C <40)
  - **H**igh LDL-C
  - **K**idney dz (Microalbuminuria, GFR < 60)
  - **O**besity (BMI > 30)

SPRINT Trial – New BP Goals?!?

- **Open label** RCT, 1st pt 11/10; NEJM 11/26/2015.
- NIH funded, “no private funding.”
  - Takeda Pharmaceuticals donated meds; 5% of pts.
  - Most meds generic.
- 9361 pts, 102 sites (⇒ 91.8/site avg).
  - >50 yo.
  - Diabetics EXCLUDED @ onset.
  - **SBP 130-180.**

NEJM 2015;373:2103-16
SPRINT Trial – 2

• Pts w/“increased CV risk.”
  – Clinical or subclinical CV dz—excluding stroke.
  – CKD, GFR 20-60—excluding polycystic kidney dz.
  – 10-yr Framingham risk ≥15%.
  – Age ≥75.
• **DM & prior stroke excluded.**
• Composite endpoint: MI + ACS + stroke + HF + CV death.

NEJM 2015;373:2103-16

SPRINT MIND—Reducing Dementia?

• Periodic MoCA, learning & memory, processing speed testing during SPRINT trial.
  – 90% in ea grp completed testing @ 4 yrs, 60% @ 6 yrs.
  – No difference in dementia (1° outcome).
  – MCI ↓ 3.7/1000 pt yrs ➔ NNT = 292.

SPRINT Trial – **Recommended** Meds

- 1st line = thiazide (chlorthalidone encouraged).
  - Loop diuretic for advanced CKD.
- ACEI or ARB.
  - Azilsartan (Edarbi™) donated by Takeda Pharm.
- Amlodipine recommended CCB.
- β-blocker if CAD.
  - Pre-JNC-8.
- Intensive grp avg 1 more med (2.8 vs 1.8).
  NEJM 2015;373:2103-16

Pitfalls in BP Measurement

- Talking, routine **activities ↑ BP**.
  - Talking.
  - Attending a meeting.
  - Commuting.
- **Improper measurement ➔ falsely ↑ BP:**
  - Cuff too small.
  - Manometer too far above pt.
  CMAJ 1999;122:937-9; Reviewed in BMI 2001;322:908-11
### Effects of Routine Activities on BP

<table>
<thead>
<tr>
<th>Activity</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending meeting</td>
<td>Incr 20</td>
<td>Incr 15</td>
</tr>
<tr>
<td>Commuting to work</td>
<td>Incr 16</td>
<td>Incr 13</td>
</tr>
<tr>
<td>Dressing</td>
<td>Incr 12</td>
<td>Incr 10</td>
</tr>
<tr>
<td>Walking</td>
<td>Incr 12</td>
<td>Incr 6</td>
</tr>
<tr>
<td>Talking on phone</td>
<td>Incr 10</td>
<td>Incr 7</td>
</tr>
<tr>
<td>Eating</td>
<td>Incr 9</td>
<td>Incr 10</td>
</tr>
<tr>
<td>Desk work</td>
<td>Incr 6</td>
<td>Incr 5</td>
</tr>
<tr>
<td>Reading</td>
<td>Incr 2</td>
<td>Incr 2</td>
</tr>
<tr>
<td>Watching TV</td>
<td>Incr 0.3</td>
<td>Incr 1</td>
</tr>
</tbody>
</table>

CMAJ 1999;122:937-9

### Factors That Interfere With BP Measurement

<table>
<thead>
<tr>
<th>Factor</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking</td>
<td>Incr 17</td>
<td>Incr 13</td>
</tr>
<tr>
<td>Acute cold exposure</td>
<td>Incr 11</td>
<td>Incr 8</td>
</tr>
<tr>
<td>Acute ingestion ETOH</td>
<td>Incr 8 for &lt;= 3 hr</td>
<td>Incr 7 for &lt;= 3 hr</td>
</tr>
<tr>
<td><strong>Technique</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt supine</td>
<td>0 – incr 3</td>
<td>Decr 2 – 5</td>
</tr>
<tr>
<td>Pt arm position (for every 10 cm above/below heart)</td>
<td>Decr/incr 8</td>
<td>Decr/incr 8</td>
</tr>
<tr>
<td>Failure to support arm</td>
<td>Incr 2</td>
<td>Incr 2</td>
</tr>
<tr>
<td><strong>Cuff too small</strong></td>
<td>Incr 8</td>
<td>Incr 8</td>
</tr>
<tr>
<td><strong>Measurer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectation bias (incl end digit preference)</td>
<td>Round to nearest 5 or 10</td>
<td>Round to nearest 5 or 10</td>
</tr>
</tbody>
</table>

Reviewed in BMJ 2001;322:908-11
More Factors That Interfere With BP Measurement

<table>
<thead>
<tr>
<th>Factor</th>
<th>SBP increased by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff over clothing</td>
<td>10-40</td>
</tr>
<tr>
<td>Full bladder</td>
<td>10-15</td>
</tr>
<tr>
<td>Conversation or talking</td>
<td>10-15</td>
</tr>
<tr>
<td>Unsupported arm</td>
<td>10</td>
</tr>
<tr>
<td>Unsupported back</td>
<td>5-10</td>
</tr>
<tr>
<td>Unsupported feet</td>
<td>5-10</td>
</tr>
<tr>
<td>Crossed legs</td>
<td>2-8</td>
</tr>
</tbody>
</table>

BP Measurement in Public Places

- One of Schneider’s rules: “Bad information is worse than no information at all.”
- Public BP machines do not give good information.
- Therefore, I tell patients NOT to check their BP’s on pharmacy machines or other public machines. I urge you to do the same.

https://wire.ama-assn.org/delivering-care/3-questions-ask-patients-when-measuring-blood-pressure
Making the Diagnosis of HTN

- **2** or more “properly measured” readings at each of **2** or more visits.
- **Either** SBP >139 or DBP >89 or both.
  - If SBP and DBP fall into different categories, the higher value is used.
- Not acutely ill and not on HTN meds
- Confirm elevated BP in contralateral arm.
- No caffeine, exercise, or smoking for ≥ 30 min before measurement.

Classification of BP in Adults

- 2 properly measured readings, ≥2 visits.
- JNC-8 did not address BP classification. ASH/ISH uses JNC-7 classes.
- Pre-HTN: ↓ BP to normal range, **lifestyle**—meds not indicated.
- **No caffeine, exercise, smoking** for ≥ 30 min before measurement.

<table>
<thead>
<tr>
<th>BP Classification</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120</td>
<td>AND  &lt; 80</td>
</tr>
<tr>
<td>Prehypertension/High-normal</td>
<td>120 – 139</td>
<td>OR 80 – 89</td>
</tr>
<tr>
<td>Stage 1 HTN</td>
<td>140 – 159</td>
<td>OR 90 – 99</td>
</tr>
<tr>
<td>Stage 2 HTN</td>
<td>≥ 160</td>
<td>OR  ≥ 100</td>
</tr>
</tbody>
</table>

134/102 ➔ STAGE 2!

**Highest value determines stage**

Scope of the Problem – Control

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aware of HTN</td>
<td>73</td>
<td>68.4</td>
<td>70</td>
<td>78</td>
<td>81</td>
<td></td>
</tr>
<tr>
<td>Treated for HTN</td>
<td>55</td>
<td>53.6</td>
<td>59</td>
<td>68</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>HTN controlled</td>
<td>29</td>
<td>27.4</td>
<td>34</td>
<td>43.5</td>
<td>50</td>
<td>48.3</td>
</tr>
</tbody>
</table>

• We’re finally making some progress.
• ~ half of hypertensive pts still uncontrolled.
• Another study showed 44% of men & 55% of women w/HTN have adequate control.


Evolution

Public domain, Christopher Dombres, CC 0, at https://www.flickr.com/photos/christopherdombres/7350782488
HTN Tools

- [http://millionhearts.hhs.gov/resources/protocols.html](http://millionhearts.hhs.gov/resources/protocols.html)
- **EHR—population management tools.**
- For pts from AHA:
  - [http://mylifecheck.heart.org/](http://mylifecheck.heart.org/)
  - [http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/High-Blood-Pressure-or-Hypertension_UCM_002020_SubHomePage.jsp](http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/High-Blood-Pressure-or-Hypertension_UCM_002020_SubHomePage.jsp)

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Why Should We Treat HTN?

- ↓ BP ➔ **more favorable outcomes** (↓ stroke & major CV events) – regardless of regimen (ACEI + CCB more beneficial per one study).
- ↓ **cardiovascular events** (NNT to prevent 1 death = 11; NNT = 9 if CAD or target organ damage).
- DASH diet proven to ↓ CAD & stroke.
- In unselected population, **outcomes are improved regardless of drug regimen.**

BP Changes & CV Risk

• In people aged 40 – 70, and from BP range 115/75 – 185/115:
  – For every increase of 20 mm Hg in SBP, OR 10 mm Hg in DBP, there is a doubling (2-fold) of the risk for cardiovascular disease.
    • Pre-HTN doubles risk vs normal.
    • Stage 1 doubles risk vs pre-HTN ➔ 4-fold > normal.
    • Stage 2 doubles risk vs stage 1 ➔ 8-fold > normal.

Reducing Health Disparities—2

• **Policy level** (local, state, federal).
  – Consistent care.
  – ? Home BP monitoring w/insurance coverage.
  – Priorities for disparities to be addressed.
  – ↑ community awareness of disparities as pressing health challenges in the U.S.
  – Dual strategy of universal and targeted intervention strategies based on lessons learned (e.g., certain vaccination rates among children).
  – **Allocate resources** in proportion to need.
  – Data collection/reporting.

Why We Work-up HTN

• 3 objectives:
  – Assess lifestyle & identify other cardiovascular risk factors or coexisting disorders that may affect prognosis & guide treatment.
  – Reveal identifiable causes of HTN.
  – Assess presence of target organ damage & cardiovascular disease.
    • Heart, brain, arteries.
    • Kidneys.
    • Eyes.

Target Organ Damage

• Heart:
  – CAD—angina, MI, h/o revascularization.
  – Heart failure.
  – LVH.
• Brain:
  – Stroke, TIA.
  – Dementia.
• Kidney: chronic kidney disease.
  – GFR is a better indicator than serum Cr.
• Eye: retinopathy.
• Vascular: peripheral arterial disease.
Current BP Targets

- JNC-8:
  - <60 y.o.: <140/90.
    - DBP: age 30-59 SOR A; 18-29 E—Expert opinion.
    - SBP: Expert opinion.
  - ≥60 (NO CKD or DM): <150/90. (A).
    - If ≥60 & SBP <140 & well-tolerated → cont Rx.
  - CKD, DM: 140/90 (E).

- American Soc HTN/Int'l Soc HTN:
  - ≥80 y.o.: <150/90.
  - 140/90 for everybody else (incl 60-79).
  - Consider <130/80 if CKD + albuminuria (KDIGO agrees, KDOQI doesn’t).

Algorithm for Tx of HTN—1

1. Dx HTN
2. LIFESTYLE interventions—Continue through algorithm
3. Determine BP goal
JNC 8—BP Goals

Determine BP Goal

- **Age < 60**
  - SBP < 140
  - DBP < 90

- **Age ≥ 60 (NO DM or CKD)**
  - SBP < 150
  - DBP < 90

- **Age ≥ 60 (NO DM or CKD)**
  - (ASH says 150/90 if ≥80, otherwise 140/90, incl 60-79)

BP Goals:
- DM OR CKD: 140/90, regardless of age.
- ≥60 y.o. (ASH/ISH say ≥80): 150/90.
- Everybody else: 140/90.

Getting to Yes

- At Goal?
  - No
    - Continue titration/change strategy
    - Lather, rinse, repeat

- Continue current treatment & monitoring.
- You’re done (finally).
Therapeutic Inertia

• Inadequate control = therapeutic inertia + noncompliance.
  – Pt factors (~30%): dz denial, ↓ health literacy, med SE’s/cost/#, Dr-pt relationship ➔ non-adherence.
  – System factors (~20%): ↓ time, ↑ pt c/o, no team approach, no decision support.
  – Physician factors (~50%): pt blaming for nonadherence, overrate quality of our care, underestimate need for intensifying Tx.


Therapeutic Inertia

• Competing demands of pt-centered model vs “clinical myopia.”
  – Pt &/or provider preference to immediate & tangible benefits of nonadherence or inertia, instead of long-term benefits.
• Accuracy of measurement vs taking more time.
• Clinical uncertainty can lead to “appropriate inaction” (is it a true BP?).

BMC Family Practice 2014;15:130
Improving BP Control

• Modules from Johns Hopkins/AMA:
  – http://www.projectredchip.com/skills/
  – https://wire.ama-assn.org/delivering-care/5-barriers-hypertension-control-what-they-are-and-how-address-them

CKD Target Too Low?

• 3 RCT’s in CKD pts. No sig difference between 140/90 and 130/80 in:
  – Decline in GFR or progression to ESRD.
  – CV events.
  – Death.
**Target BP’s: Too Low?**

- **In CKD**, pts w/ SBP 130-139 or DBP 75-89 progressed to CKD at same rate as those w/ SBP <130 or DBP <75.
- **DBP** can go too low (↑progression).
- **Lower BP’s** may be more beneficial if high proteinuria.

![Graph showing progression to ESRD](image)


**DM Targets: How Low to Go?**

- BP goal <130/80 in DM2 appears to reduce **stroke** (RR=0.65), but not:
  - MI.
  - Mortality.
  - Combined CV outcome.
A New Wrinkle…

  - 11 RCT’s, only 4 met inclusion criteria.
  - BP 140-159 / 90-99 (stage 1 HTN).
  - 8900 subjects.
  - 4-5 yrs treatment.
  - **No significant difference** in total mortality, CAD, stroke, total CV events—treated vs untreated.
  - 9% D/C’d tx d/t adverse effects (RR = 4.80).

Are We Causing Waste & Harm?

- Cochrane results apply only to pts w/mild (Stage 1) HTN **AND** no evidence of CV dz (i.e., primary prevention).
- Excluded from analysis:
  - PAD or surgery for PAD.
  - Renal dysfunction (Cr ≥ 1.5 X ULN).
  - Any CAD—MI, PTCA, angina, CABG.
  - Cerebrovascular dz—CVA, TIA, carotid endart.
How Low Should You Go—6/16/14

- 4480 pts w/HTN & CV dz-free (ARIC study).
  - 21.8 yr mean F/U.
  - 1° outcome: incident composite CV events (HF, ischemic stroke, MI, death related to CAD).
  - ↑ SBP $\Rightarrow$ ↑ CV events (HR = 1.46).
  - **NO DIFFERENCE** in SBP 120-139 and <120 groups (HR, 1.00).
  - Adjustment for BP med use or DBP did not significantly affect results.

JAMA Internal Medicine 2014;174:1252-1261

Exercise Lowers BP

- 2019 Meta-analysis:
  - 197 trials of exercise (N=10,461) + 194 trials of meds (29,281).
    - Endurance, resistance, isometric, combo.
  - 56 exercise trials included pts w/HTN, N=3508.
  - No RCT compared meds to exercise.
  - Pts w/HTN: exercise $\Rightarrow$ ↓ BP similar to meds.
    - Combo sl more effective.
    - No outcomes reported.

Other Non-Pharmacologic Treatments

- Smoking cessation.
- Mediterranean diet.
  - ↓ MI, CV mortality, all-cause mortality, CA.
- Red wine
  - ↓ CV mortality.
  - Observational studies.
  - Greatest risk reduction at low-mod intake.
  - I recommend pinot noir from Sonoma County.

Other Non-Pharmacologic Treatments

- Dark chocolate ≥ 70%
  - ↓ CV & all-cause mortality
  - ↓ SBP 5.0 mm Hg.
  - 1 trial suggested benefit in diabetics.
  - ~ 30 – 100 g daily.
- Fiber
  - ↓ SBP by 9.5.
  - Effect may take 8 weeks.
- Exercise – 30 min or more aerobic exercise daily.
Other Non-Pharmacologic Treatments

- Hibiscus tea (Red Zinger, *flor de Jamaica*).
  - 240 ml brewed from bag, or 10 g brewed per day.
  - 7 - 17 mm ↓ SBP.
  - Almost as effective as lisinopril, no hyper-K.
  - Anthocyanins &/or polyphenols.

- Biofeedback – RESPeRATE (rhythmic breathing).
- Deep tissue massage.
- Stress reduction.


CoQ10

- ↓ SBP 12 – 17 mm Hg.
- Effect may be most significant in pts w/low levels.
- Replace to level 2.0.
- 75 – 350 mg daily w/fatty meal.
- Some pts able to D/C meds.
- No outcome studies.

Rule of Tens

- Dr Basile suggests that for every 10 mm Hg of SBP lowering required, you will need 1 drug.
  - E.g., pt w/SBP 160 needs 20 mm lowering ➔ will need 2 drugs.
  - I still don’t always start with 2, but it may be wise to advise pt early on that 1 med might not be enough.

Drug Related Causes of HTN

- Nonadherence
- Inadequate doses
- Inappropriate combinations
- Oral contraceptives (less now w/low dose OCP's)
- NSAID’s, COX-2 inhibitors
- Sympathomimetics (decongestants, anorectics)
- Caffeine
- Venlafaxine, bupropion, TCA’s
- Cocaine, amphetamines, other illicit drugs
- Adrenal steroid hormones
- Cyclosporine, tacrolimus
- Erythropoietin
- Licorice (including some chewing tobacco)
- Some OTC supplements and medicines (e.g., ephedra, ma huang, bitter orange, ginseng)
Whom to Screen for 2° HTN

- **Severe or resistant** HTN (uncontrolled on 3 meds of different classes).
- **Malignant HTN** (severe HTN + signs of end-organ damage).
- An **acute rise** in blood pressure over a previously stable value.
- Age **<30** years in non-obese, non-black patients with a confirmed negative family history of and no other risk factors (e.g., obesity) for hypertension.
- Proven age of **onset before puberty**.

*Mnemonics – Screening for 2° HTN*

- **Bad, Fast, & Young**
  - Severe or malignant HTN
  - Sudden/acute rise in BP
  - Age < 30, esp before puberty
Additional Clues to 2° HTN

- Hypokalemia—aldosteronism.
  - Don’t just automatically assume it’s due to diuretic.
- ↑ Cr, abnormal UA – renal dz.
- Snoring, fatigue, daytime somnolence – sleep apnea.

Screening Tests for 2° HTN

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Test</th>
</tr>
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<tbody>
<tr>
<td>CKD</td>
<td>eGFR</td>
</tr>
<tr>
<td>Coarctation of aorta</td>
<td>CT angio</td>
</tr>
<tr>
<td>Cushing’s, glucocorticoid excess</td>
<td>Hx, dexamethasone suppression test</td>
</tr>
<tr>
<td>Drugs</td>
<td>Hx, drug screening</td>
</tr>
<tr>
<td>Pheochromocytoma (RARE)</td>
<td>24-hr urinary metanephrine and normetanephrine</td>
</tr>
<tr>
<td>Primary aldosteronism and other mineralocorticoid excess states</td>
<td>Plasma renin &amp; aldosterone, ? 24-hr urinary aldosterone level</td>
</tr>
<tr>
<td>Renovascular HTN</td>
<td>Doppler flow study, CT Angio, MRA</td>
</tr>
<tr>
<td>Sleep apnea</td>
<td>Sleep study with O2 saturation</td>
</tr>
<tr>
<td>Thyroid/parathyroid disease</td>
<td>TSH; PTH</td>
</tr>
</tbody>
</table>

JNC 7, JNC 8
Clinical Clues to Renovascular HTN

• Acute elevation in the plasma creatinine (>30%) after starting ACEI or ARB.
• Systolic-diastolic abdominal bruit that lateralizes to one side.
• And more….

Clinical Clues to Renovascular HTN—2

• Severe HTN w/4 A’s (Age, Atherosclerosis, Atrophic kidney, Acute pulmonary edema).
  – Onset of stage II HTN (BP ≥160/100) after age 55.
  – Moderate to severe HTN in pts w/diffuse atherosclerosis, esp > age 50.
  – Moderate to severe HTN in pt with unexplained atrophic kidney or renal asymmetry of >1.5 cm.
  – Moderate to severe HTN in patients with recurrent episodes of acute (flash) pulmonary edema or otherwise unexplained heart failure.
Imaging in Eval of RAS

- Duplex doppler U/S:
  - Sens = 75-85%; spec = 90-92%.
  - PPV = 60-84%; NPV = 94.6%.
  - Operator-dependent; difficult in obese pts.
- CT Angiography:
  - 94-95% sens; 93-97% spec.
  - 71% PPV; 99% NPV.
- MRA:
  - 90-100% sens; 71-98% spec.
  - 75% PPV; 98% NPV.

---

Imaging in Eval of RAS—2

- Digital subtraction angio is gold standard.
- Noninvasive tests are poor at:
  - Detecting fibromuscular dysplasia (RAS in women, esp younger).
  - Low probability population (Bayes’ theorem).
- Not sure after CORAL if we should be checking.
Can We Cure Renovascular HTN?

- **CORAL Trial—NEJM 1/2014:**
  - No ↓ CV/renal outcomes with stenting vs optimal medical Tx.
  - BP 2.3 mm lower w/stenting.
  - 43 month mean F/U.
- **Should we evaluate for RAS if specific treatment doesn’t help?**
  - 11% restenosis.
  - 1-15% complication rate.

Other Non-Pharmacologic Treatments

- **Smoking cessation.**
- **Mediterranean diet.**
  - ↓ MI, CV mortality, all-cause mortality, CA.
- **Red wine**
  - ↓ CV mortality.
  - Observational studies.
  - Greatest risk reduction at low-mod intake.
  - I recommend pinot noir from Sonoma County.
Other Non-Pharmacologic Treatments

- Exercise – 30 min or more aerobic exercise daily.
- Dark chocolate ≥ 70%
  - ↓ CV & all-cause mortality
  - ↓ SBP 5.0 mm Hg.
  - 1 trial suggested benefit in diabetics.
  - ~ 30 – 100 g daily.
- Fiber
  - ↓ SBP by 9.5.
  - Effect may take 8 weeks.

Choice of Initial HTN Med

- **JNC-8:**
  - CKD: ACEI or ARB, +/- other.
  - Afr-Am: thiazide, CCB.
  - Non-Afr-Am: thiazide, ACEI or ARB, CCB.
  - DM w/o CKD: same as non-Afr-Am.

- **ASH/ISH:**
  - CKD: ARB or ACEI.
  - Afr-Am: CCB, thiazide.
  - Non-Afr-Am:
    - <60: ACEI or ARB.
    - ≥60: CCB, thiazide.
  - DM: ARB or ACEI.
    - CCB, thiaz OK in Afr-Am.
  - CAD: β-blocker + ARB or ACEI.
  - Stroke: ACEI or ARB.
  - HF: ACEI/ARB + β-B + diuretic + spironolactone
Demographic Considerations

- **Elderly & African-Americans** respond best to thiazide diuretics or CCB’s.
  - Less responsive to ACEI or ARB—**still give if compelling indication**.
  - ACEI/ARB responsiveness improves if given diuretic.
  - Still use β-blocker after MI.
- African-Americans may respond better to Na⁺ restriction.
- Young pts may respond better to ACEI’s & beta-blockers.

Thiazide Contraindications

- Drug allergy.
  - RARE crossover w/sulfa.
- Anything else (gout, hypoK, h/o arrhythmia, etc) is a caution, not absolute contraindication.
- Notable thiazide issues:
  - **Erectile dysfunction**.
  - ↓ excretion of **lithium** → risk of toxicity.
Oddball ACEI Side Effects

- **Angioedema** (rare).
  - Swelling of lips, tongue, mouth, face.
  - May be more common in elderly (?), African Americans (2-4 X ↑).
- [Skin rash (can occur w/most meds).
- Dysgeusia (taste disturbance) – esp captopril.
- Neutropenia (rarer).]

ARB Controversies

- **Olmesartan** (Benicar): sprue-like enteropathy.
- **Less ↓ in mortality & CV events than ACEI**; maybe ↑ in some studies?
- [Risk of cancer?]
  - 2010 meta-analysis: 8% ↑ CA, 25% ↑ lung CA; but no ↑ CA deaths. NB: 85% telmisartan.
  - 2 subsequent meta-analyses found no ↑ — at least one heavily industry sponsored.
  - 1 FDA member argued w/decision to deny ↑ risk.]

References:

Dual RAS Blockade?

- Do NOT combine ACEI and ARB or either with direct renin inhibitor (aliskiren).
  - ↑ risk AKI, ESRD, hyperK.
  - No benefit.


Hot News 5/14: ARB’s Less Effective?

- Meta-analysis of 35 RCT’s in DM.
  - 23 ACEI trials: 32,827 pts.
  - 13 ARB trials: 23,867 pts.
  - Minimum 12 mo.
  - ACEI’s ↓ all-cause mortality (RR=0.87), CV mortality (0.83), CV events (0.86), MI (0.79), HF (0.81).
  - ARB’s ↓ HF (0.70), nothing else.
  - Neither ↓ stroke risk.

Beta Blockers – 2

- Alpha + beta blockers
  - Carvedilol
    - HF.
  - Labetolol
    - Hypertensive emergencies.
    - Pregnancy – preexisting HTN or pre-eclampsia (unlabeled).
    - May be better at ↓ BP than β-blockers.

β-Blocker Adverse Effects

- AV block.
- Bronchospasm.
- Increased PAD symptoms.
- CHF exacerbation if given in acute stage.
- CNS – overstated, but probably more common in elderly.
  - Fatigue – NNH = 57.
  - Depression – no significant increase.
- Sexual dysfunction – NNH = 199.
β-Blocker Adverse Effects – 2

- Reduced stroke prevention & mortality benefit, may ↑ stroke, esp > age 60, esp atenolol.
- Impaired glc tolerance; ↑ risk of new DM.
  - Vasodilating β-blockers like carvedilol appear OK.
  - Effect may be temporary.
  - Still given to post-MI diabetics (caution if labile).
- Adverse lipid effects (labetolol may be least likely).

Lancet 2004;364:1684-9; CMAJ 2006;174:1737-42

β-blocker Contraindications

- Active bronchospasm
- Severe bradycardia
- Heart block > 1° (if no pacemaker)
- Pulmonary edema
- Hypotension with or without shock
- Overt heart failure should be brought under medical control 1st
- Most pts w/MI d/t cocaine should not be treated with beta blockers (risk of coronary artery spasm)
### Common/Significant Drug Interactions With β-Blockers

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effects</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amiodarone</strong></td>
<td>Cardiac arrest</td>
<td>Extreme caution</td>
</tr>
<tr>
<td>Antidiabetic agents</td>
<td>HTN, [poss ↓ glc]</td>
<td>Monitor</td>
</tr>
<tr>
<td>Rate-sparing CCB (diltiazem, verapamil)</td>
<td>Brady, CHF, hypotension</td>
<td>Avoid (few clinical issues, however)</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Worsening bradycardia</td>
<td>Monitor: OK in angina + low EF (? benefit)</td>
</tr>
<tr>
<td>Epinephrine, sympathomimetics</td>
<td>HTN crisis</td>
<td>Avoid if possible</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>↑ lido level</td>
<td>↓ lido dose (NOT listed in ACLS protocol)</td>
</tr>
</tbody>
</table>

Equation of death: $A + B = C$

### CCB Adverse Effects

- **Edema**
  - More likely w/DHP’s
- **Dizziness**
- **HA**
  - BUT: Verapamil may be used in migraine prophylaxis.

- Reflex tachycardia – DHP’s
- Non-DHP (verapamil, diltiazem) SE’s:
  - Bradycardia
  - AV block
  - CHF exacerbation
- **Constipation**— esp verapamil
Alpha-Adrenergic Blockers

• Prazosin, terazosin, doxazosin.
  – Not for initial monotherapy, except sometimes men w/BPH, esp if low-mod CV risk.
    • ↑ CV events, CHF vs thiazide—but no control (untreated) group.
  – Orthostatic hypotension & syncope, esp 1st dose (give at hs til stable dose).
  – May enhance hypotensive effects of PDE-5 drugs for erectile dysfunction (sildenafil, vardenafil, tadalafil).
  – Prazosin used in PTSD.

Central Sympatholytic Agents (α-2 Agonists)

• Clonidine, guanfacine.
  – Dry mouth, constipation, sedation (anticholinergic).
  – Can cause bradycardia, heart block.
  – Rebound HTN upon withdrawal (most meds can).
    – Useful in CKD.
• Methyldopa
  – Can be used in pregnancy (off-label).
  – Rare lupus-like syndrome.
  – Rare hemolytic anemia.
  – Can cause hepatitis, esp in pts with liver dz.
Central Sympatholytic Agents

- Clonidine
  - Dry mouth, constipation, sedation (anticholinergic).
  - Can cause bradycardia, heart block.
  - Rebound HTN upon withdrawal (most agents can).
- Guanfacine (Tenex™) ~ clonidine w/less rash, abd pain, & milder rebound HTN.
- Methyldopa
  - Can be used in pregnancy.
  - Rare lupus-like syndrome.
  - Rare hemolytic anemia.
  - Can cause hepatitis, esp in pts with liver dz.

Direct Vasodilators

- Mainly for resistant HTN.
  - Hydralazine
    - Can be used in pregnancy (off-label).
    - ANA + lupus-like syndrome.
    - HA, tachycardia (caution in angina/CAD).
    - May be useful for CHF in African-Americans (unlabeled).
  - Minoxidil
    - Hirsutism.
    - Edema.
    - Pericardial effusion (3% w/tamponade, 3% w/o).
    - EKG changes (T wave changes in 60%!!).
White-Coat HTN

• Up to 20-35% of HTN pts.
  – 37-44% of resistant HTN pts.
• Slightly greater risk for CV events than normotensives, less than hypertensives.
• **High risk for developing sustained HTN.**
• Ambulatory BP monitoring:
  – 24-hr average BP ≥ 138/85.
  – At equivalent office BP, those w/higher ABP have higher risk.

AES Question
AES Question 7

Evidence-based approaches to health behavior change include:

A. Cognitive-behavioral strategies.
B. A group component when dealing w/ pt of different culture from yours.
C. Motivational interviewing.
D. All of the above.
E. None of the above—don’t you know NOTHING works?

Evidence-Based Behavior Change

• Cognitive-behavioral strategies.
  – How pt thinks about self, behaviors ➔ modify lifestyle.
    • Goal setting, feedback on progress toward goals.
    • Provide strategies for self-monitoring.
    • F/U plan—freq, in-person/phone/email ➔ assess/reinforce.

• Cultural & social context:
  – Include a group component (can also have indiv).
  – Sensitive to cultural beliefs, values, language, literacy, customs.

• Target one behavior at a time.
Evidence-Based Behavior Change

  - Goal setting.
  - Provide feedback on progress toward goals.
  - Provide strategies for self-monitoring.
  - F/U plan—freq, in-person/phone/email → assess/reinforce progress.
  - Strategies to build self-efficacy.
  - Motivational interviewing.
  - 2 or more of above strategies.
- **Target one behavior at a time.**

Evidence-Based Behavior Change—2

- Processes/strategies:
  - Individual- or group-based.
  - Individual sessions to assess stage of behavior change & make plan to achieve goals.
    - Prochaska stages of change model.
- **Cultural** & social context:
  - Include a group component (can also have indiv).
  - Tailor messages & counseling strategies to be sensitive to cultural beliefs, values, language, literacy, and customs of target population.
Stages of Change Model (Prochaska)

- Precontemplation
- Contemplation
- Preparation
- Action
- Maintenance

- **Success is getting to the next stage** – not the end!

Strategies by Stage

- Precontemplation: raise **awareness**.
- Contemplation: explore **barriers**.
- Preparation: reinforce **commitment**, overcome obstacles.
- Action: increase **self-efficacy**.
Strategies by Stage

• Precontemplation
  – Raise awareness
  – Raise doubt
• Contemplation
  – Self-reevaluation
    • Explore barriers
    • Explore concerns

Strategies by Stage – 2

• Preparation
  – Self-liberation
    • Assess strength of/reinforce commitment
    • Build coping behaviors
    • Work on strategies to overcome obstacles
• Action
  – Increase self-efficacy
    • Stimulus control
    • Reaffirm commitment
    • Intrinsic attributions for success
Strategies by Stage – 3

• Maintenance
  – Provide information
  – Reinforce successes
  – Normalize backsliding/relapse
  – Crisis management
  – Empathy

Counseling Pts in 15 Min

• Motivational Interviewing (shown to ↑ adherence).
  – Elicit &/or identify “change talk” from pt, not from you.
    • Ambivalence (“…but…”) ➔ change talk.
    • “How would this change be healthy for you?”
  – Intention to change.
    • “I can see you are feeling stuck. What is going to have to change?”
    • “What do you think you might be able to do?”

Curr Hypertens Rep 201517:94
Motivational Interviewing—2

• **Conviction & confidence:**
  – “How **convinced** are you that this would be a good/healthy thing for you to do?”
  – “How **confident** are you that you can do it?”

• 0-10 scale:
  – Why a 7, not a 4?
  – What would make it a 7 instead of a 4?

• Next steps

Communication As Strategy

• 2019: small FP offices—relationships count!
  – Pt adherence ID’d as major challenge in managing HTN.
  – High performing providers (↑ % BP control) characteristics:
    • Active engagement, active listening.
    • Consider pt context.
    • Actionable recommendations.

Family Practice 2019, https://doi-org.ucsf.idm.oclc.org/10.1093/fampra/cmz004;
USPSTF Recommendations

• Adults w/o known HTN, DM, CV dz:
  – Clinicians may choose to selectively counsel patients rather than incorporate counseling into the care of all adults in the general population (C—offer or provide service selectively).

• Overweight or obese w/additional risk factors:
  – Offer or refer to intensive behavioral counseling interventions to promote a healthful diet and physical activity for CVD prevention (B—offer or provide service).

http://www.uspreventiveservicestaskforce.org/BrowseRec/Index

Practice Recommendations

• It’s all about the **outcomes**.
• Thiazides still 1st choice. Remember chlorthalidone!
• Watch your drugs & combos.
• **BP goal remains 140/90 for most per AAFP.**
• Systemic & personal approaches to disparities in care.
• Slight differences in BP management vs JNC-7.
  – β-blockers not 1st line.
Questions