This publication is designed to complement the presentation titled

Contemporary Management of Hypertension: Applying the Latest Evidence.

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**Needs Statement**

Hypertension is a major risk factor for heart disease, stroke, heart failure, and kidney disease. According to recent estimates from the American Heart Association, nearly 1 in 3 adults in the United States (more than 76 million people) have hypertension. While there have been improvements within the last two decades in blood pressure awareness, treatment, and control, suboptimal blood pressure control continues to lead to significant morbidity and mortality. Only about half of US adults who are aware that they have hypertension have their blood pressure controlled. Nurse practitioners can play a key role in closing this gap by helping patients with hypertension overcome barriers to blood pressure control. Nurse practitioners are uniquely positioned to help patients achieve better blood pressure control by 1) following clinical practice guidelines for the management of hypertension; 2) tailoring hypertension treatment for individual patients based on current evidence; and 3) promoting patient adherence to hypertension treatment regimens. The goal of this activity is to improve the management of hypertension by nurse practitioners, ultimately leading to better blood pressure control and improved outcomes for patients.

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Clinical Assistant Professor of Medicine  
University of North Carolina, Chapel Hill • Chapel Hill, NC

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Mary Ellen E. Roberts, DNP, RN, APNC, FAANP, FAAN, has no conflicts of interest to disclose.
Learning Objectives
Upon completion of this activity, the participant should be able to:

1. Summarize updates to JNC 8 hypertension treatment guidelines and their relevance to helping patients achieve better blood pressure control.

2. Develop safe and effective tailored therapeutic regimens for hypertension (taking into account patient comorbidities, side effect profiles of agents, and appropriate combinations of agents).

3. Use adherence-promoting strategies to empower patients and caregivers and improve outcomes.

Target Audience
This group lecture program has been designed for nurse practitioners involved in the care of patients with hypertension.

Credit Statement
This program is approved for 1.0 contact hour of continuing education (which includes 0.25 hour of pharmacology) by the American Association of Nurse Practitioners. Program ID 1308333.

This program was planned in accordance with AANP CE Standards and Policies and AANP Commercial Support Standards.

The following abbreviations appear in the slides and the pages of this workbook.

ACE: angiotensin-converting enzyme
ACE-I: ACE inhibitor
ABPM: Ambulatory Blood Pressure Measurement
ADA: American Diabetes Association
ARB: angiotensin II receptor blocker
BB: beta blocker
BMI: body mass index
BP: blood pressure
CAD: coronary artery disease
CCB: calcium channel blocker
CHD: coronary heart disease
CHF: chronic heart failure
CKD: chronic kidney disease
CPAP: continuous positive airway pressure
CV: cardiovascular
CVD: cardiovascular disease
DASH: Dietary Approaches to Stop Hypertension
DBP: diastolic blood pressure
ESC: European Society of Cardiology
ESRD: end stage renal disease
GERD: gastroesophageal reflux disease
HBPM: Home Blood Pressure Monitoring
HF: heart failure
HTN: hypertension
ICD: implantable cardioverter defibrillator
JNC: Joint National Committee
JNC 8: The Eighth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure
K: potassium
LVEF: left ventricular ejection fraction
LVH: left ventricular hypertrophy
MI: myocardial infarction
NHANES: National Health and Nutrition Examination Survey
NICE: National Institute for Health and Care Excellence (UK)
NSAIDs: nonsteroidal anti-inflammatory drugs
PMH: past medical history
PSH: past surgical history
RAAS: renin angiotensin aldosterone system
RCTs: randomized clinical trials
SBP: systolic blood pressure
Burden of Hypertension (HTN)

- Approximately 67 million Americans have HTN
  - Equates to ~1 in 3 adults age ≥18 in the US
- Prevalence
  - Higher in men until age 45
  - Similar prevalence for both sexes ages 45-64
  - Higher in women after age 64
- Almost half (47.5%) have uncontrolled BP
  - Black males (~60%) & Mexican American males (~65%) are more likely to have uncontrolled HTN
  - Younger cohort (age 20-39 yrs) more likely to have uncontrolled HTN (~62%) compared to ≥40 yrs (~46%)

BP = blood pressure

Systolic BP Increases with Age: NHANES III

SBP = systolic blood pressure; DBP = diastolic blood pressure;
NHANES = National Health and Nutrition Examination Survey
It Doesn’t Take Much to Have a BIG Impact
Small Reductions in Systolic Blood Pressure (SBP) Can Save Lives

<table>
<thead>
<tr>
<th>Reduction in SBP, mm Hg</th>
<th>% Reduction in Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stroke</td>
</tr>
<tr>
<td>2</td>
<td>-6</td>
</tr>
<tr>
<td>3</td>
<td>-8</td>
</tr>
<tr>
<td>5</td>
<td>-14</td>
</tr>
</tbody>
</table>


Treatment Guidelines for HTN

- 2014 Evidence-based Guideline for the Management of High BP in Adults: Report from the Panel Members Appointed to the Eighth Joint National Committee (JNC 8) published online December 18, 2013

- Writing group started the process in 2008
  - Changes in the development process to ensure the guidelines are based strictly on the best evidence
  - Focused on fewer critical questions
  - Delay was not due to lack of new evidence or controversy; fewer face-to-face meetings


Definition of Hypertension

NORMAL  PREHYPERTENSION  HYPERTENSION
<120/80 mm Hg  120-139/80-89 mm Hg  ≥140/90 mm Hg

Note: JNC 8 did not change this.
The JNC guidelines have used the same threshold (>140/90) to define hypertension since the first report (JNC 1).

Cutoff Values for Hypertension Based on National Guidelines

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong></td>
<td><strong>Stage 1</strong></td>
<td><strong>Grade 1</strong></td>
</tr>
<tr>
<td>SBP 140-159 mm Hg and/or</td>
<td>Clinic BP ≥140/90 mm Hg</td>
<td>Clinic BP: SBP 140-159 mm Hg</td>
</tr>
<tr>
<td>DBP 90-99 mm Hg</td>
<td>and ABPM/HBPM ≥135/85 mm Hg</td>
<td>and/or DBP 90-99 mm Hg</td>
</tr>
<tr>
<td><strong>Stage 2</strong></td>
<td><strong>Stage 2</strong></td>
<td><strong>Grade 2</strong></td>
</tr>
<tr>
<td>SBP ≥160 mm Hg and/or</td>
<td>Clinic BP ≥160/100 mm Hg</td>
<td>SBP 160-179 mm Hg and/or</td>
</tr>
<tr>
<td>DBP ≥100 mm Hg</td>
<td>and ABPM/HBPM ≥150/95 mm Hg</td>
<td>DBP 100-109 mm Hg</td>
</tr>
<tr>
<td><strong>Severe HTN</strong></td>
<td></td>
<td><strong>Grade 3</strong></td>
</tr>
<tr>
<td>Clinic BP: SBP ≥180 mm Hg</td>
<td></td>
<td>SBP ≥180 mm Hg and/or</td>
</tr>
<tr>
<td>Hg or DBP ≥110 mm Hg</td>
<td></td>
<td>DBP ≥110 mm Hg</td>
</tr>
</tbody>
</table>

ABPM = Ambulatory Blood Pressure Measurement; HBPM = Home Blood Pressure Measurement; JNC = Joint National Committee

Critical Questions Answered by JNC-8

- What is the right time to start a medication (to improve outcomes)?
- How low do you go (treatment goals to improve outcomes)?
- Which specific drug classes should you use (to improve outcomes without undue harm related to outcomes)?


Nine Recommendations Offered

- Based on the 3 highest ranking questions related to BP management, there was a total of 9 recommendations.
- Q 1 & 2 (threshold and goal) answered by recommendations #1-5.
- Q 3 (which drug classes to use) answered by recommendations #6-8.
- Recommendation #9 summarizes expert opinion related to questions. Also includes 3 strategies used for HTN treatment used in RCTs.

RCT= randomized clinical trial
First 2 Critical Questions: JNC-8

What is the right time to start a medication (to improve outcomes)?

How low do you go (treatment goals to improve outcomes)?

- Recommendations #1-5 answer these questions.
- **Pearl:** The threshold (BP to start the meds) is the same as the treatment goal for all 5 recommendations.

Recommendation #1: Adults ≥ 60 yrs

- General population age ≥ 60 yrs, threshold to start meds: 150/90 mm Hg based on the highest level of evidence (Grade A).
- Same goal (< 150/90 mm Hg) to ↓ stroke, HF, CHD (moderate-high evidence).
- Setting goal of < 140/90 mm Hg showed no additional benefit, compared to 140-160 mm Hg or 140-149 mm Hg.

Implications for Practice

- If SBP < 140 mm Hg can be achieved without adverse effects or reduced quality of life, then treatment does not necessarily need to be adjusted.
- If you can only get to the SBP goal of < 150 mm Hg, no need to continue to add meds to get to SBP < 140 mm Hg.
- Insufficient evidence to raise the BP target for high risk groups (blacks, those with CVD, stroke, or multiple risk factors).
- Panel members recommended to keep prior goal (< 140/90).
- **Helps simplify guidelines** for easier implementation.

**SBP:** systolic blood pressure; **QOL:** quality of life; **CVD:** cardiovascular disease

Recommendation #2: DBP Adults <60 yrs

- General population age <60 yrs, threshold to start meds: DBP 90 mm Hg based on the highest level of evidence (Grade A for age 30-59).
- Same goal (DBP <90 mm Hg) to ↓cerebrovascular events, HF, overall mortality (High quality evidence).
- Lowering DBP <85 or 80 mm Hg showed no additional benefit, compared to <90 mm Hg.

Recommendation #2 (continued)

- Lowering DBP <85 or 80 mm Hg showed no additional benefit, compared to <90 mm Hg.
- For adults <30 years, panel’s expert opinion to make DBP threshold the same as age 30-59.
- Helps simplify guidelines to facilitate implementation.

Recommendation #3: SBP for Adults <60 yrs

- General population age <60 yrs, threshold to start meds: SBP 140 mm Hg based on the expert opinion.
- Same goal (SBP <140 mm Hg).
- Insufficient evidence to support a specific threshold or goal for <60 yrs.
- Helps simplify guidelines to facilitate implementation.
Recommendation #4: SBP Adults with CKD

- Age ≥18 yrs with chronic kidney disease, SBP threshold to start meds: 140 mm Hg based on the expert opinion.
- Same goal (SBP <140 mm Hg).
- Insufficient evidence to support a lower threshold (or goal) based on mortality or cerebrovascular outcomes. No benefit in slowing progression of kidney disease with lower BP.
- Helps simplify guidelines for ease of implementation.

CKD = chronic kidney disease

Recommendation #5: Adults with DM

- Age ≥18 yrs with diabetes, SBP threshold to start meds: 140/90 mm Hg based on the expert opinion.
- Same goal (BP <140/90 mm Hg).
- Insufficient evidence (including prior ADA recommendation for <140/80) to support a lower threshold (or goal) based on outcomes.
- Helps simplify guidelines for ease of implementation.

DM = diabetes mellitus; ADA = American Diabetes Association

Third Critical Question

Which specific drug classes should you use (to improve outcomes without undue harm related to outcomes)?

- Answered by recommendations #6-8
- Pearl: First time race-based therapy is used in the JNC guideline statement. Consistent with the European guidelines to add age/race to treatment guidelines.

Recommendation #6
- General population (nonblacks including those with diabetes).
- ACE-I, ARB, CCB, thiazide-like diuretics (thiazide diuretics, clorthalidone, & indapamide).
- Grade B evidence (moderate amount).
- Comparable outcomes (↓ overall death & improved CV, cerebrovascular, & kidney outcomes; did not improve HF outcomes).

Implications for Practice
- Initially thiazides better than ACE-I or CCB. ACE-I more effective than CCB in improving HF outcomes.
- Yet, more important to get BP down, less important which agent to use. Any of the 4 choices good to start or use as an add-on.
- Did not recommend beta-blockers, vasodilators, aldosterone antagonist, loop diuretics as first line.
- Need to use doses used in RCTs (Table 4 for starting doses, target doses, & # doses/day).

Recommendation #7
- For black adults (with or without DM), use thiazide-like diuretics or CCB.
- Grade B evidence for black population; Grade C evidence for blacks with DM.
- Thiazide better than ACE-I for improved outcomes (cerebrovascular, HF, & combined CV outcomes).
- CCB & diuretic best outcomes; although not as good as ACE-I in preventing HF. CCB better than ACE-I based for stroke outcomes.
- No studies to compare CCB to ACE-I in blacks with diabetes.
Recommendation #8

- For those with chronic kidney disease (with or without proteinuria), use ACE-I or ARB (to improve kidney outcomes), regardless of race or DM.
- Mostly due to kidney outcomes (one study had improved HF outcomes).

Implications for Practice

How to treat black patient with CKD and proteinuria?
- Use ACE-I or ARB to slow ESRD progression.

Same patient without proteinuria?
- Choice less clear. Thiazide, CCB, ACE-I, ARB. If ACE-I or ARB is not used as first line, then should be added on as second line (most need >1 med anyway).

Implications for Practice

How to treat those >75 yrs with CKD
- No evidence to support ACE-I or ARB for first line therapy in this age group with CKD.
- Use thiazide or CCBs, especially if concerned about side effects (hyperkalemia, decreased kidney function).
Recommendation #9

- Main objective for HTN management → attain & maintain BP goal.
- If not to goal in 1 month, then ↑ dose or add on another class of meds.
- Do not use dual RAAS blockade (combo of ACE-I, ARB, or direct renin inhibitor).
- Go to other classes of meds if needed beyond recommendation #6 if contraindications for those classes or need more meds.
- Refer to a HTN specialist if needed.

JNC 8: Management Algorithm

- See workbook appendix

JNC 8: Evidence-Based Dosing

- See workbook appendix
### JNC8: 3 Strategies to Dose Meds

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>one drug, titrate to maximum dose, then add a 2nd drug from another class.</td>
<td>Start one drug &amp; then add 2nd drug before achieving maximum dose of the 1st drug.</td>
<td>Begin with 2 drugs at the same time (either in single pill format or 2 separate pills).</td>
</tr>
<tr>
<td>drug</td>
<td>If goal is not met with the 2nd drug, titrate up to max dose, and add 3rd drug.</td>
<td>If goal not met, titrate both drugs to maximum dose. If goal not met, then select 3rd drug from list (thiazide-like diuretic, CCB, ACE-I, or ARB).</td>
<td>Good strategy if SBP &gt;160 mm Hg &amp;/or DBP &gt;100 mg.</td>
</tr>
<tr>
<td>Avoid</td>
<td>use of combined ACE-I &amp; ARB (for all 3 strategies)</td>
<td>If not to goal, titrate 3rd drug to max dose.</td>
<td>If goal not met, select 3rd drug from list and titrate up to max dose if needed.</td>
</tr>
</tbody>
</table>

Adapted from Table 6, JNC 8, 2014. ACE-I = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; CCB = Calcium Channel Blocker; DBP = diastolic blood pressure, SBP = systolic blood pressure.

### Summary: Goal BP/Initial Therapy

<table>
<thead>
<tr>
<th>Population</th>
<th>Goal BP, mm Hg</th>
<th>Initial Medication Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>General ≥60 yrs</td>
<td>&lt;150/90</td>
<td>Nonblack: thiazide-type diuretic, ACE-I, ARB or CCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Black: thiazide-type diuretic or CCB</td>
</tr>
<tr>
<td>General &lt;60 yrs</td>
<td>&lt;140/90</td>
<td>Nonblack: thiazide-type diuretic, ACE-I, ARB or CCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Black: thiazide-type diuretic or CCB</td>
</tr>
<tr>
<td>Diabetes</td>
<td>&lt;140/90</td>
<td>Thiazide-type diuretic, ACE-I, ARB, or CCB</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>&lt;140/90</td>
<td>ACE-I or ARB</td>
</tr>
</tbody>
</table>

Adapted from Table 6, JNC 8, 2014. ACE-I = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; CCB = Calcium Channel Blocker.

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### Pearls for Treating Challenging Cases

- [Image of a heart]

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Issues with Measurement: Tips for Accurate BP Measurement

- Patient in sitting position, at rest, back supported, with the arm at heart level
  - Otherwise + DBP ~6 mm Hg
- Remove constricting clothing on the upper extremity (do not push up clothing)
- No caffeine or tobacco use at least 30 minutes prior to BP measurement
- Patients should have both feet planted on a flat surface
  - Crossing legs + SBP ~2-3 mm Hg
- Use the correct size cuff. Ideal cuff bladder: 80% length and 40% width of arm circumference
  - Cuff too large = falsely low BP; cuff too small = falsely elevated BP
- Patient and clinician should not talk during the measurement (+ BP)
  - 1st visit: take 2 readings (average them), 5 minutes apart
    - Confirm elevated reading in contralateral arm; if one arm consistently higher, use that arm for subsequent measurements (~ 20% of individuals have BP differences >10 mm Hg)

Measuring BP in Special Populations

<table>
<thead>
<tr>
<th>Group of Individuals</th>
<th>Tips for Obtaining Accurate BP Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older adults</td>
<td>• Auscultatory gap is more common</td>
</tr>
<tr>
<td></td>
<td>• Common reason for inaccurate BPs (underestimates SBP)</td>
</tr>
<tr>
<td></td>
<td>• More likely with manual BP measurements</td>
</tr>
<tr>
<td></td>
<td>• Usually associated with vascular disease</td>
</tr>
<tr>
<td>Individuals with obesity</td>
<td>• Common to have short upper arm length relative to upper arm</td>
</tr>
<tr>
<td></td>
<td>• Wrist cuff may be used (as long as you place at heart level</td>
</tr>
<tr>
<td></td>
<td>• Avoid the use of finger cuffs</td>
</tr>
<tr>
<td>Individuals with arrhythmias</td>
<td>• BP varies beat to beat with irregular rhythms</td>
</tr>
<tr>
<td></td>
<td>• Automated devices are inaccurate if only taken in those with</td>
</tr>
<tr>
<td></td>
<td>• Atrial fibrillation; need to measure BP several times, then</td>
</tr>
<tr>
<td></td>
<td>• Frequent bradycardia, deflate cuff more slowly to avoid</td>
</tr>
<tr>
<td></td>
<td>• Underestimating SBP and overestimating DBP</td>
</tr>
</tbody>
</table>

Ruling Out White Coat Hypertension: Home BP Measurement (HBPM)

- Better predictor of cardiovascular risk and/or target organ damage than one-time office readings
- Helps reduce “white coat effect” and determine the presence of “masked hypertension”
- Should be a routine component of BP measurement for monitoring someone with known or suspected HTN
- Use upper arm with an appropriately sized cuff in a seated position—a.m. and p.m. over a 1-week period
- Most patients are suitable for HBPM (if given instructions) except those with atrial fibrillation or other cardiac rhythm disturbances, which make automatic BP monitoring unreliable
- Need about 12 readings to make clinical decisions
- Average usually considered normal if majority of findings are <135 mm Hg and <85 mm Hg

References:
**HBPM (continued)**

- **Protocol for HBPM**
  - Monitor for 5 consecutive days (minimum)
  - Each day perform 3 measurements, 5 minutes apart, in the a.m. and p.m.
  - Toss the first day of measurements and the first measurement each day thereafter
  - Average the remaining measurements
    *Average the second and third measurements of each triplicate set*—this correlates best with ambulatory BP monitoring
  - Bring all recordings to visits with the clinician


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**Issues with Adherence**

- Evaluate adherence to lifestyle modifications as well as medications
- Discuss importance of weight loss
- Use a non-judgmental approach
  - Many patients miss a dose occasionally; does this ever happen to you?
- Consider economic reasons
- Consider ability to understand regimen
  - Health literacy, culture, language barriers
- Once daily regimen may improve adherence
- Simplify regimen:
  - Fixed-dose combinations; long-acting agents


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**Connecting Patients with Clinicians**

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referral to clinician after HTN detected</td>
<td>Essential to include resources for clinician referrals when holding BP screening sessions. Sample resources available on the Million Hearts™ website. Nurse practitioners are ideally positioned to manage patients with HTN.</td>
</tr>
<tr>
<td>Regular communication with clinician</td>
<td>Provide culturally appropriate telephone, web-based, or face-to-face support with a nurse practitioner. Make referrals for community resources (educational classes and/or support groups).</td>
</tr>
<tr>
<td>Feedback loop that uses individualized support and advice</td>
<td>Share and discuss results of self-monitored BP numbers. Assess potential adherence barriers to lifestyle measures and medications (eg, side effects, availability of resources). Obtain insight into variables that may be affecting BP. Set goals for treatment. Make adjustments to treatment regimen.</td>
</tr>
</tbody>
</table>

Need to Rule Out Volume Overload

- Expansion of extracellular volume is a contributing factor for uncontrolled HTN.
  - Relative or absolute
- May not show up as peripheral edema
- 1st step: ↑ low-dose thiazide to higher dose
  - ↑ from 12.5 to 25 mg hydrochlorothiazide
- 2nd step: convert to a more potent diuretic
  - Δ to chlorothalidone 25 mg (instead of hydrochlorothiazide)
- 3rd step:
  - Δ to a loop diuretic if creatinine >1.5 to 1.8 mg/dL
  - or GFR <30 mL/minute
  - If using a short-acting loop diuretic, may need to dose BID.


Interfering Substances

- Common
  - Alcohol
  - NSAIDs (including aspirin) and COX-2 inhibitors
  - Oral contraceptives or hormone replacements
  - Some antidepressants
  - Sympathomimetics (decongestants, diet pills, cocaine)
  - Stimulants (methylphenidate, dexamfetamine, amphetamine, methamphetamine, modafinil)
- Less common
  - Corticosteroids
  - Cyclosporine
  - Erythropoietin
  - Natural licorice
  - Chewing tobacco (some types)
  - MAO inhibitors
  - Dietary and herbal supplements (ginseng, ephedra, ma huang, bitter orange)
  - Tacrolimus


Associated or Contributing Factors

- Older patients
  - Isolated systolic HTN
  - Treatment goals based on age?
- Heavy alcohol intake
  - Only about 30% are still following advice at 3 years
- Obesity
  - Issues of increased sodium and fluid retention
  - Stimulation of sympathetic nervous system and RAAS
  - Higher doses of medications often needed
  - Impact of weight loss
  - Strategies for weight loss
    - Caloric restriction
    - Use of orlistat in some patients
    - Bariatric surgery for morbidly obese individuals

Secondary Hypertension for Those with Chronic Kidney Disease

- Treatment should include:
  - Dietary sodium restriction
  - Loop diuretic
  - ACE-I or ARB helpful
  - Monitor labs within 2 weeks and every 6 months
  - Expect a bump in creatinine and potassium (as long as not >30% serum creatinine or >serum K+ or 5.5 mEq/L)


Secondary Hypertension

- Primary hyperaldosteronism
  - Clues:
    - Fatigue, hypokalemia not responsive to K+ supplementation
    - Many will have normal K+ levels
  - Diagnostic screening: plasma aldosterone/renin ratio
    - Ratio <20 rules out
    - Ratio >20 with an aldosterone level >15 ng/dL suggests primary hyperaldosteronism


Secondary Hypertension

- Obstructive sleep apnea
  - Clues: History of snoring, witnessed apnea, excessive daytime sleepiness
  - Need to make a referral for polysomnography
  - Treatment: CPAP may help improve BP control

- Less common causes of secondary HTN
  - Cushing’s disease
  - Coarctation of the aorta
  - Renal artery stenosis
  - Thyroid disease
  - Hyperparathyroidism
  - Pheochromocytoma

CPAP = continuous positive airway pressure
Case Studies

Case Study #1

• Mrs. B is an uninsured 56-year-old African-American female
• She presents for evaluation/follow-up for hypertension
• PMH: type 2 diabetes, CKD (Stage 2), metabolic syndrome, and GERD
• She does not use tobacco, alcohol, or drugs
• Social history: she is a homemaker and cares for 2 grandchildren in her home
• Vital signs: BP 166/100, P 62, R16, afebrile
• BMI: 38.7 kg/m²
• Physical exam: unremarkable, except for new onset peripheral edema in her lower extremities

PMH = past medical history; GERD = gastroesophageal reflux disease; BMI = body mass index

Case Study #1
(continued)

• No allergies
• Current Medications:
  – Metformin 1000 mg twice daily
  – Glipizide 5 mg daily
  – Nebivolol 2.5 mg daily
  – Omeprazole 20 mg daily
  – Levocarnitine 330 mg daily
Case Study #1 (continued)

- Is her blood pressure controlled?
- What is her goal?
- What changes would you make in the treatment regimen?

Lifestyle Modifications to Prevent and Manage Hypertension

<table>
<thead>
<tr>
<th>Modification</th>
<th>Approximate SBP Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight reduction</td>
<td>5-20 mm Hg/10 kg</td>
</tr>
<tr>
<td>DASH diet</td>
<td>8-14 mm Hg</td>
</tr>
<tr>
<td>Sodium reduction</td>
<td>2-8 mm Hg</td>
</tr>
<tr>
<td>Physical activity</td>
<td>4-9 mm Hg</td>
</tr>
<tr>
<td>Moderate alcohol consumption</td>
<td>2-4 mm Hg (\leq 2 \text{ drinks/day men; } \leq 1 \text{ drinks/day women})</td>
</tr>
</tbody>
</table>

DiSH = Dietary Approaches to Stop Hypertension

Case Study #1 (continued)

- Implement HBPM
- Check labs (electrolytes, especially K, BUN, creatinine)
- Lifestyle changes
  - Weight reduction
  - Reinforce DASH diet
  - Sodium reduction
- Medications
  - Will likely need 1-2 more meds added to lifestyle changes
  - Recommend discontinuing the beta-blocker
  - 1st line medication = add a thiazide-like diuretic (chlorothalidone 25 mg daily)
  - 2nd line medication = CCB (or ACE-I or ARB)
Case Study #1 (continued)

- She returns a month later
- Started walking 10 minutes each evening
- BP 140/90, P 82, R 16
- Peripheral edema has subsided
- Has BP recordings from home from the past 9 days (next slide)

Case Study #1 (continued)

She returns a month later with the following HBPM results:

<table>
<thead>
<tr>
<th>Day</th>
<th>Morning Readings</th>
<th>Evening Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>168/92, 168/90, 153/88</td>
<td>164/79, 160/82, 150/88</td>
</tr>
<tr>
<td>2</td>
<td>154/89, 162/94, 149/90</td>
<td>172/86, 168/88, 154/84</td>
</tr>
<tr>
<td>3</td>
<td>144/83, 140/94, 141/92</td>
<td>164/87, 132/84, 128/82</td>
</tr>
<tr>
<td>4</td>
<td>148/92, 132/84, 126/86</td>
<td>154/86, 142/86, 146/90</td>
</tr>
<tr>
<td>5</td>
<td>134/70, 142/94, 141/91</td>
<td>134/88, 122/84, 128/78</td>
</tr>
<tr>
<td>6</td>
<td>128/78, 122/84, 118/80</td>
<td>146/87, 142/90, 139/82</td>
</tr>
<tr>
<td>7</td>
<td>134/80, 142/90, 143/84</td>
<td>144/85, 112/74, 114/70</td>
</tr>
<tr>
<td>8</td>
<td>144/92, 130/78, 122/82</td>
<td>160/99, 142/94, 140/86</td>
</tr>
<tr>
<td>9</td>
<td>152/86, 132/80, 130/76</td>
<td>157/90, 128/75, 118/80</td>
</tr>
</tbody>
</table>

Case Study #2

- Mr. C is a 72-year-old Caucasian male
- Presents for evaluation of HF
- PMH: CAD, status post MI 3 years ago, chronic HF (last LVEF 35%)
- PSH: CABG 3 years ago, status post ICD 1 year ago
- Social history: retired/worked as a salesman for 40 years, lives at home with his wife, 2 adult married children, 5 grandchildren
- Vital signs: BP 160/94, P 68, afebrile
- Physical exam: unremarkable, NYHA Class II (only slightly limited with symptoms of fatigue or dyspnea)

CAD = coronary artery disease; MI = myocardial infarction; LVEF = Left ventricular ejection fraction; PSH = past surgical history
ICD = implantable cardioverter defibrillator
Case Study #2 (continued)

- Labs: K 4.0, BUN 14, creatinine 1.6, GFR <60, glucose 90, NA 135
- EKG: sinus rhythm 68/minute, left axis deviation, LVH, old q waves in the inferior leads

Case Study #2 (continued)

- Allergies: ACE-I
- Current medications:
  - HCTZ 25 mg daily
  - Irbesartan 150 mg daily
  - Metoprolol XL 100 mg daily

Case Study #2 (continued)

- What would you consider based on his blood pressure?
- What changes would you make to his treatment regimen?
Case Study #2
(continued)

- Implement HBPM
- Discontinue HCTZ and start furosemide 20 mg daily
- Consider “up-titrating” his BB (target dose 150-200 mg/day), which would help get his BP to goal & improve HF outcomes.

Case Study #2
(continued)

- More than half of his home BP readings met his goal
- Continue treatment plan
- Continue HBPM, but not as frequent
- Consider adding spironolactone, as it will be helpful as an aldosterone antagonist for HTN and chronic HF, but need to monitor K+

Conclusions

- Definition of HTN: unchanged from >140/90
- Base decisions on evidence with documented improvement in health outcomes. Consider individual circumstances, clinician & patient preferences, and tolerability of medications
- Treatment goals: <140/90 for most adults except general patients ≥60 yrs (<150/90) unless diabetes or kidney disease (move them to <140/90 goal)
- Start meds in conjunction with or after a trial of lifestyle changes
- Specific drug classes to use:
  - Most patients will need 3-4 meds from different classes
  - Four key classes of meds: thiazide-like diuretic, ACE-I, ARB, or CCB
  - Use starting doses and target doses that have been established in RCTs

ACE-I = angiotensin-converting enzyme; ARB = angiotensin receptor blocker;
CCB = calcium channel blocker; RCTs = randomized clinical trials.
Additional Resources

Please refer to your workbooks for an extensive list of additional resources.
Appendix 1, Management Algorithm, JNC 8

Figure 2014 Hypertension Guideline Management Algorithm

Adult aged ≥18 years with hypertension
Implement lifestyle interventions (continue throughout management).
Set blood pressure goal and initiate blood pressure lowering medication based on age, diabetes, and chronic kidney disease (CKD).

General population (no diabetes or CKD)

Age ≥60 years
Age <60 years
All ages
Diabetes present
No CKD
All ages
CKD present with or without diabetes

Blood pressure goal SBP <150 mm Hg DBP <90 mm Hg
Blood pressure goal SBP <140 mm Hg DBP <90 mm Hg
Blood pressure goal SBP <140 mm Hg DBP <90 mm Hg
Blood pressure goal SBP <140 mm Hg DBP <90 mm Hg

Nonblack
Black
All races

Initiate thiazide-type diuretic or ACEI or ARB or CCB, alone or in combination.
Initiate thiazide-type diuretic or CCB, alone or in combination.
Initiate ACEI or ARB, alone or in combination with other drug class.

Select a drug treatment titration strategy
A. Maximize first medication before adding second or
B. Add second medication before reaching maximum dose of first medication or
C. Start with 2 medication classes separately or as fixed-dose combination.

At goal blood pressure?

Yes
Reinforce medication and lifestyle adherence.
For strategies A and B, add and titrate thiazide-type diuretic or ACEI or ARB or CCB (use medication class not previously selected and avoid combined use of ACEI and ARB).
For strategy C, titrate doses of initial medications to maximum.

At goal blood pressure?

Yes
Reinforce medication and lifestyle adherence.
Add and titrate thiazide-type diuretic or ACEI or ARB or CCB (use medication class not previously selected and avoid combined use of ACEI and ARB).

At goal blood pressure?

Yes
Reinforce medication and lifestyle adherence.
Add additional medication class (e.g., β-blocker, aldosterone antagonist, or others) and/or refer to physician with expertise in hypertension management.

At goal blood pressure?

Yes
Continue current treatment and monitoring.

No

SBP indicates systolic blood pressure; DBP, diastolic blood pressure; ACEI, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; and CCB, calcium channel blocker.

*ACEIs and ARBs should not be used in combination.

If blood pressure fails to be maintained at goal, reenter the algorithm where appropriate based on the current individual therapeutic plan.

Appendix 2, Table 4, JNC 8

<table>
<thead>
<tr>
<th>Antihypertensive Medication</th>
<th>Initial Daily Dose, mg</th>
<th>Target Dose in RCTs reviewed, mg</th>
<th>No. of Doses per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE inhibitors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captopril</td>
<td>50</td>
<td>150-200</td>
<td>2</td>
</tr>
<tr>
<td>Enalapril</td>
<td>5</td>
<td>20</td>
<td>1-2</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>10</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Angiotensin receptor blockers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eprosartan</td>
<td>400</td>
<td>600-800</td>
<td>1-2</td>
</tr>
<tr>
<td>Candesartan</td>
<td>4</td>
<td>12-32</td>
<td>1</td>
</tr>
<tr>
<td>Losartan</td>
<td>50</td>
<td>100</td>
<td>1-2</td>
</tr>
<tr>
<td>Valsoartan</td>
<td>40-80</td>
<td>160-320</td>
<td>1</td>
</tr>
<tr>
<td>Irbesartan</td>
<td>75</td>
<td>300</td>
<td>1</td>
</tr>
<tr>
<td>B-Blockers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atenolol</td>
<td>25-50</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>50</td>
<td>100-200</td>
<td>1-2</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amlodipine</td>
<td>2.5</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Diltiazem extended release</td>
<td>120-180</td>
<td>360</td>
<td>1</td>
</tr>
<tr>
<td>Nitrendipine</td>
<td>10</td>
<td>20</td>
<td>1-2</td>
</tr>
<tr>
<td>Thiazide-type diuretics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bendrofluomethiazide</td>
<td>5</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Chlorothalidone</td>
<td>12.5</td>
<td>12.5-25</td>
<td>1</td>
</tr>
<tr>
<td>Hydrochlorothiazide</td>
<td>12.5-25</td>
<td>25-100</td>
<td>1-2</td>
</tr>
<tr>
<td>Indapamide</td>
<td>1.25</td>
<td>1.25-2.5</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbreviations: ACE, angiotensin-converting enzyme; RCT, randomized controlled trial.

*Current recommended evidence-based dose that balances efficacy and safety is 25-50 mg daily.

Appendix 3, Table 5, JNC 8

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Start one drug, titrate to maximum dose, and then add a second drug</td>
<td>If goal BP is not achieved with the initial drug, titrate the dose of the initial drug up to the maximum recommended dose to achieve goal BP. If goal BP is not achieved with the use of one drug despite titration to the maximum recommended dose, add a second drug from the list (thiazide-type diuretic, CCB, ACEI, or ARB) and titrate up to the maximum recommended dose of the second drug to achieve goal BP. If goal BP is not achieved with 2 drugs, select a third drug from the list (thiazide-type diuretic, CCB, ACEI, or ARB), avoiding the combined use of ACEI and ARB. Titrate the third drug up to the maximum recommended dose to achieve goal BP.</td>
</tr>
<tr>
<td>B</td>
<td>Start one drug and then add a second drug before achieving maximum dose of the initial drug</td>
<td>If goal BP is not achieved with 2 drugs, select a third drug from the list (thiazide-type diuretic, CCB, ACEI, or ARB), avoiding the combined use of ACEI and ARB. Titrate the third drug up to the maximum recommended dose to achieve goal BP.</td>
</tr>
<tr>
<td>C</td>
<td>Begin with 2 drugs at the same time, either as 2 separate pills or as a single pill combination</td>
<td>Initiate therapy with 2 drugs simultaneously, either as 2 separate drugs or as a single pill combination.</td>
</tr>
</tbody>
</table>

Abbreviations: ACEI, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; DBP, diastolic blood pressure; SBP, systolic blood pressure.
Resources

Many online resources are available to clinicians who treat patients with cardiovascular conditions.

Resources from the National Institutes of Health (NIH)

National Heart, Lung, and Blood Institute (NHLBI)
www.nih.gov/index.htm
- Offers a wide variety of resources for clinicians and patients.

JNC 8 Guidelines

Other National Resources

Million Hearts*
http://millionhearts.hhs.gov/aboutths/blood_pressure.html
- Million Hearts® is a national initiative that was launched by the Department of Health and Human Services in September 2011 to prevent 1 million heart attacks and strokes by 2017.
- Sample HTN protocols and custom protocol templates available November 2013.

Centers for Disease Control and Prevention
http://www.cdc.gov

Agency for Healthcare Research and Quality
http://www.ahrq.gov
- Sign up for weekly evidence-based practice email updates.

Institute of Medicine of the National Academies
http://www.iom.edu

Additional Cardiology Resources

American College of Cardiology
www.acc.org
American Heart Association
www.americanheart.org
Heart Rhythm Society (previously NASPE)
http://www.hrsonline.org
Heart Failure Society of America
http://www.hfsa.org
American Association of Heart Failure Nurses
http://www.aahfn.org
Preventive Cardiovascular Nursing Association
www.pcna.net
WomenHeart®
http://www.womenheart.org


REFERENCES

- Million Hearts® is a national initiative that was launched by the Department of Health and Human Services in September 2011 to prevent 1 million heart attacks and strokes by 2017.
- Sample HTN protocols and custom protocol templates available November 2013.
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Please provide information on the right.

Name: __________________________

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City: __________________ State: ______ Zip: ______

Home Phone: ____________________________

Work/Company Name: __________________________

Work Address: ____________________________

City: __________________ State: ______ Zip: ______

Work Phone: ____________________________ Cell Phone: ________________

Preferred Email: ____________________________

Please Indicate Preferred Mailing Address: ☐ Work ☐ Home

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NP CLINICAL PRACTICE SETTING: (check all that apply)
☐ College Health
☐ Community-Based
☐ Primary Care
☐ Correctional/Prison Facility
☐ Emergency Room/ Urgent Care
☐ Employee/ Occupational Health
☐ Health Department
☐ Home Health Care
☐ Hospice/Palliative Care
☐ Hospital Critical Care

Hospital Inpatient Other
Hospital Outpatient Clinic
Indian Health Service
Long-Term Care Facility
Managed Care
Migrant Health Clinic
Military/DoD
Private NP Practice
Private Physician Practice

Psychiatric/Mental Health Facility
Rehabilitation Facility
Retail-Based Clinic
Retail Health Clinic
School Health
VA Facility
None
Other

States of NP Licensure: (list all) __________________________

ARE YOU ACTIVELY PRACTICING AS AN NP?
☐ Yes, # years practiced as an NP __________________________
☐ No, currently looking for NP position

☐ Year last practiced as an NP __________________________

☐ No, retired

☐ Year last practiced as an NP __________________________

☐ No, other

☐ Year last practiced as an NP __________________________

TYPE OF PRACTICE ROLES PERFORMED: (check all that apply)
☐ Administration
☐ Clinical Practice
☐ Faculty
☐ Research

OTHER APN: ☐ CNA ☐ CNM ☐ CNS

NP CERTIFICATION ORGANIZATION: (check all that apply)
☐ AANPCP ☐ ANCC ☐ NCC ☐ ONCC ☐ PNCB

CLINICAL SUBSPECIALTY OF EMPLOYMENT:
(check all that apply)
☐ Allergy/Immunology
☐ Cardiovascular
☐ Complementary
☐ Dermatology
☐ Emergency
☐ Endocrinology
☐ Gastroenterology
☐ HIV/AIDS

☐ Infectious Disease
☐ Nephrology
☐ Neurology
☐ Occupational Health
☐ Oncology
☐ Orthopedics
☐ Otolaryngology
☐ Pain Management

☐ Palliative
☐ Respiratory/Pulmonology
☐ Rheumatology
☐ School Health
☐ Sports Medicine
☐ Urology
☐ Wound Care

☐ Other

NP SPECIALTY: (first, mark X for one main specialty, then mark ✓ all additional applicable specialties)
☐ Acute Care
☐ Gerontological
☐ Pediatric
☐ Adult
☐ Neonatal
☐ Psychiatric/Mental Health
☐ Family
☐ Oncology
☐ Women's Health

TOTAL NP PRACTICE HOURS PER WEEK:
☐ 40+ ☐ 32-39 ☐ 24-31 ☐ 16-23 ☐ 8-15 ☐ 1-7 ☐ N/A

DO YOU SERVE AS A PRECEPTOR: ☐ Yes ☐ No

AANP promotes excellence in NP practice, education and research; shapes the future of health care through advancing health policy; and builds a positive image of the NP role as leader in the national and global health care community.

(continue application on back)
**DEMOGRAPHIC INFORMATION**

( utilizing federal classifications for ethnicity and race)

<table>
<thead>
<tr>
<th>GENDER: □ Female □ Male</th>
<th>YEAR OF BIRTH: __________</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETHNICITY: □ Hispanic □ Non-hispanic</td>
<td></td>
</tr>
<tr>
<td>RACE: □ American Indian/Alaskan Native □ Asian</td>
<td></td>
</tr>
<tr>
<td>□ Black/African American</td>
<td></td>
</tr>
<tr>
<td>□ Native Hawaiian/Other Pacific Islander □ White</td>
<td></td>
</tr>
</tbody>
</table>

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- NP ($125) - A graduate of an NP program who maintains certification as an NP. NP members receive a $10 discount if they are a member of an AANP NP Organization
- ASSOCIATE ($125) - A person other than an NP who supports the objectives of AANP and the NP profession
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  - □ Doctorate  □ Post-Master's  □ Master's  □ Bachelor's
  - □ Bachelor's with Certificate  □ Associate's with Certificate
  - □ Diploma with Certificate

- YEAR OF PROGRAM COMPLETION: _______________

**PAYMENT INFORMATION**

**MEMBERSHIP DUES:**

- □ NP ($125) ............................................. $ __________
- □ NP with NP Organization discount ($115) .............. $ __________

Provide the name of your AANP NP Organization.
(SEE orglist.aanp.org for a list of current NP Organization members.)

**Organization:**

- □ Associate ($125) ...................................... $ __________
- □ Career Starter ($95) .................................. $ __________
- □ Post-Master's Student ($95) .......................... $ __________
- □ Retired ($55) ................................................ $ __________
- □ NP Student ($55) ............................................ $ __________

*NP Student and Post-Master's Student members must complete the verification of current college enrollment below.

- □ hereby attest, subject to verification, that I am a student at:

  - Name of Institution: _____________________________
  - City & State: _____________________________
  - Signature: _____________________________

**AANP POLITICAL ACTION COMMITTEE**

- □ Optional contribution to AANP PAC .................. $ __________

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- □ PLEASE CHARGE TO MY CREDIT CARD: □ VISA □ MasterCard □ American Express

  - Card #: _____________________________
  - Expiration Date: __________________ Billing ZIP Code: __________________
  - Cardholder Name: _____________________________
  - Signature: _____________________________

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