Hypertension Treatment Update

Medstar Health Corporate Pharmacy
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September 19, 2015

WMSHP Fall Seminar

Focused on You
Knowledge and Compassion
Faculty Disclosure

Nothing to disclose

September 1, 2015
Objectives

• Review the definition of hypertension and its risk factors
• Discuss the controversies surrounding JNC 8 guidelines
• Describe non-pharmacologic interventions to treat hypertension
• Discuss appropriate patient-specific pharmacologic options for the treatment of chronic hypertension
• Discuss options for the treatment of hypertensive emergencies
• Discuss the controversies surrounding JNC 8 guidelines
• Review the definition of hypertension and its risk factors
Hypertension Definition

Persistently elevated arterial blood pressure (BP)
Sustained elevation of resting systolic BP, diastolic BP, or both

Systolic (arterial) BP — peak value, achieved during cardiac contraction
Diastolic (arterial) BP — nadir value, after contraction, when the cardiac chambers are filling

Sustained elevation of resting systolic BP, diastolic BP, or both

Persistently elevated arterial blood pressure (BP)
Hypertension is a major independent risk factor for the development of CAD, stroke, and renal failure.
Hypertension

65,123 deaths annually in US attributable to hypertension

377,258 any mention deaths of hypertension (hypertension, a contributing factor)

Circulation 2015; 131:e329-e332
Hypertension Prevalence

For surveillance purposes, the following definition of HBP is most commonly used:

- SBP ≥140 mm Hg or DBP ≥90 mm Hg
- Taking antihypertensive medicine or
- Having been told at least twice by a physician or other health professional that one has HBP

Circulation 2015; 131:e329-e322
Hypertension

• Estimated 80,000,000 US Adults ≥ 20 years old have hypertension

Prevalence 32.6%

• Older Adults ≥ 65

Prevalence 65%

Estimates 80,000,000 US Adults ≥ 20 years old
Age-adjusted prevalence ≥ 20 yo
BP Lowering Benefit

Randomized trials have shown that BP lowering produces rapid reductions in cardiovascular risk. A recent critical appraisal found that:

- All major types of cardiovascular events (stroke, CHD, HF, and CV death) and death by any cause are significantly reduced by BP-lowering treatment.
- Absolute risk reduction substantial; prevention of ≈ 29 major CV events for every 1000 patients treated for 5 years.

(Circ Res. 2015; 116:1058-1073)
Risk Factors
• Age
• Ethnicity
• Family history of hypertension and genetic factors
• Greater weight
• Lower physical activity
• Tobacco use
• Psychological stressors
• Dietary factors (dietary fats, higher sodium intake, lower potassium intake)
• Excessive alcohol intake
Secondary Hypertension

- Renal hypertension
  - Renovascular (atherosclerosis, fibromuscular dysplasia)
  - Parenchymal (chronic kidney disease, polycystic kidney disease, obstructive uropathy)
- Endocrine-metabolic hypertension
  - Primary aldosteronism
  - Cushing syndrome
  - Hyperparathyroidism
  - Hyperthyroidism
  - Other adrenal enzyme deficiencies
  - Pheochromocytoma
  - Acromegaly
  - Obesity and the metabolic syndrome
  - Hyperlipidemia
  - Hypercholesterolemia
- Renal hypertension
  - Renovascular (atherosclerosis, fibromuscular dysplasia)
  - Parenchymal (chronic kidney disease, polycystic kidney disease, obstructive uropathy)
  - Other adrenal enzyme deficiencies
  - Pheochromocytoma
  - Acromegaly
  - Obesity and the metabolic syndrome
Drug-induced or drug-related

- Antidepressants (some, e.g. venlafaxine)
- Cyclosporine, tacrolimus
- Appetite suppressants
- Decongestants
- Cocaine, amphetamine, or alcohol use
- Nonsteroidal anti-inflammatory drugs
- Exogenous corticosteroids, androgens
- Estrogen treatment ("pill hypertension")
Mechanisms

BP equals cardiac output (CO) x total peripheral vascular resistance (TPR)

Pathogenic mechanisms must involve:

- Increased CO
- Increased TPR or
- Both
Mechanisms

Hypertension due to abnormal Na transport

- Na⁺, K⁺-ATPase may pump norepinephrine back into sympathetic neurons (thus inactivating this neurotransmitter); pump inhibition could enhance the effect of norepinephrine, increasing BP.

- Na⁺, K⁺-ATPase may pump norepinephrine back into sympathetic neurons (thus inactivating this neurotransmitter); pump inhibition could enhance the effect of norepinephrine, increasing BP.

- Increased intracellular Na⁺, which makes the cell more sensitive to sympathetic stimulation.

- Increased intracellular Ca²⁺, which makes the cell more sensitive to sympathetic stimulation.

- Increased permeability to Na⁺ is increased because Na transport across the cell wall is abnormal because the Na-K pump (Na⁺, K⁺-ATPase) is defective or inhibited or because Na-K pump (Na⁺, K⁺-ATPase) is defective or inhibited or because...
Renin angiotensin-aldosterone system
Mechanisms

Vasodilatory deficiency or Endothelial Dysfunction

Hypertension may result from a vasodilator deficiency (e.g. bradykinin, nitrous oxide, prostaglandin E1) rather than a vasosconstrictor excess (e.g. endothelin, angiotensin II). Endothelial dysfunction is characterized by an unfavorable balance between vasodilators and vasoconstrictors.

Sympathetic Nervous System Overactivity

Increased adrenergic tone

Hypertension may result from sympathetic nervous system overactivity.
Mechanisms

Aging / Increased arterial stiffness

- Thinning and fragmentation of vascular elastin and increased collagen deposition

Increased arterial stiffness (reduction in elasticity)

↓

↑

SBP
<table>
<thead>
<tr>
<th>Potential Mechanisms of Pathogenesis</th>
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<tbody>
<tr>
<td><strong>Metabolic Syndrome</strong></td>
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<tr>
<td>- Hyperinsulinemia resulting from the</td>
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<td>- Endothelial-derived factors</td>
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<tr>
<td>- Genetic alterations of cell membranes</td>
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<tr>
<td>- Sympathetic nervous system overactivity</td>
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<tr>
<td>- Excess stimulation of the RAS</td>
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<td>- Structural vascular hypertrophy:</td>
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<td>- Endothelial-derived factors</td>
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<td>- Sympathetic nervous system overactivity</td>
</tr>
<tr>
<td>- Excess stimulation of the RAS</td>
</tr>
<tr>
<td>- Functional vascular constriction:</td>
</tr>
</tbody>
</table>

**Increased Peripheral Resistance**

- Sympathetic nervous system overactivity
- Angiotensin aldosterone system (RAS)
- Excess stimulation of the Renin-angiotensin-aldosterone system (RAAS)
- Venous constriction
- Decreased glomerular filtration
- From reduced number of nephrons or sodium intake or renal sodium retention
- Increased fluid volume from excess
- Increased cardiac output

**Increased Cardiac Output**

- Increased total peripheral resistance
- Elevated blood pressure (BP) can result from increased cardiac output and/or peripheral resistance

**Table 19-2**
Symptoms

– For most patients: NONE

– May have findings that indicate hypertension-related target organ damage

Clinical Presentation
Target Organ Damage

- Heart
  - Left ventricular hypertrophy
  - Angina or prior myocardial infarction
  - Prior coronary revascularization
  - Heart failure

- Brain
  - Stroke or transient ischemic attack
  - Chronic kidney disease
  - Peripheral arterial disease

- Retinopathy
What are the current guidelines for the treatment of hypertension?
Recent Hypertension Guideline Statements

- Recent Hypertension Guideline Statements
Treatment

We waited ... and waited ... and waited ... and waited ...

FINALLY printed online Nov 2013

BUT - NOT QUITE WHAT WE EXPECTED
Very rigorous criteria for evidence (limited to RCTs, sample size,
duration and outcomes criteria)

Several committee members with drew authorship before the document was released.

JNC members choose to publish their in JAMA. They did not involve major subspecialty groups, e.g. AHA, ACC.

Supporting systematic reviews to be used in guideline development

discontinue their work in developing guidelines to focus on

2013 - National Heart, Lung, and Blood Institute (NHLBI) elected to

2008 - work began

The STORY behind JNC 8
Evidence Supporting a Systolic Blood Pressure Goal of Less Than 150 mm Hg in Patients Aged 60 Years or Older: The Minority View


5/17 authors (29%)

"Insufficient evidence" to increase target SBP to 150 mmHg.

Dissenting Opinion JNC 8
Higher BP goal (SBP increase from 140 to 150) set for age >60: The higher SBP goal would apply to some of the groups at highest cardiovascular disease risk (e.g., AAS, pts with multiple CVD risk factors other than DM or CKD, those with clinical CVD). Other recent guideline groups reviewing similar evidence have systematically reviewed observational studies and RCT data that the panel did not consider. The evidence supporting the panel’s recommendations for other patient categories for SBP target from 140 to 150 mm Hg for ≥ 60 yo was insufficient and inconsistent with the observed epidemiological and observational studies and RCT evidence. Other recent guideline groups reviewing similar evidence have recommended a goal of less than 140 mm Hg, especially in high-risk individuals. The higher SBP goal would not apply to some of the groups at highest cardiovascular disease risk (e.g., AAS, pts with multiple CVD risk factors other than DM or CKD, those with clinical CVD).
Table 1: Comparison of Current Recommendations With JNC7 Guidelines

<table>
<thead>
<tr>
<th>Drug Therapy Recommendations</th>
<th>Lifestyle Recommendations</th>
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<tbody>
<tr>
<td><strong>JNC7</strong></td>
<td><strong>JNC8</strong></td>
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<tr>
<td><strong>Lifestyle modifications</strong></td>
<td><strong>Lifestyle modifications</strong></td>
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<td>- Reduction in cardiovascular risk factors</td>
<td>- Reduction in cardiovascular risk factors</td>
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<td>- Smoking cessation</td>
<td>- Smoking cessation</td>
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<tr>
<td>- Weight loss</td>
<td>- Weight loss</td>
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<tr>
<td>- Physical activity</td>
<td>- Physical activity</td>
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<tr>
<td>- Dietary changes</td>
<td>- Dietary changes</td>
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<tr>
<td>- Sodium intake</td>
<td>- Sodium intake</td>
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<table>
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<th>JNC7</th>
<th>JNC8</th>
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<tr>
<td><strong>Lifestyle Modification</strong></td>
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<td><strong>JNC8</strong></td>
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<tr>
<td>- Clinical trial data</td>
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<tr>
<td>- Randomized controlled trials</td>
<td>- Randomized controlled trials</td>
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<tr>
<td>- Observational studies</td>
<td>- Observational studies</td>
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<tr>
<td>- Systematic review</td>
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</table>

**Key Differences**

- **JNC7** focused on lifestyle modifications as initial therapy before considering pharmacological interventions.
- **JNC8** recommends medicinal treatment as initial therapy for most patients.
- **JNC7** included a comprehensive table of oral antihypertensive drugs in different indications, stroke, and high CVD risk.
- **JNC8** specifies particular antihypertensive medication classes for patients with comorbid indications or diabetes, CKD, heart failure, myocar...
### JNC7 vs JNC8

<table>
<thead>
<tr>
<th>JNC7 vs JNC8</th>
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</tr>
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<tbody>
<tr>
<td>RCT, Randomized Controlled Trial</td>
<td>JNC, Joint National Committee; CVD, Cardiovascular Disease; ARB, Angiotensin Receptor Blocker; CCB, Calcium Channel Blocker; CIC, Chronic Kidney Disease; ACEI, Angiotensin-Converting Enzyme Inhibitor</td>
</tr>
<tr>
<td><strong>Any organization should be referred to the public organizations and federal agencies; no official sponsorship by any organization should be inferred.</strong></td>
<td><strong>Reviewing by experts including those affiliated with professional and coordinating committee, a coalition of 39 major professional, public health, and patient evaluation components, secondary hypertension, adherence, and patient education.</strong></td>
</tr>
<tr>
<td>Evidence review of RCTs addressed a limited number of questions; prior to publication</td>
<td>Evidence review and expert opinion to recommend resistant hypertension, and hypertension in special populations. Based on literature review and expert opinion</td>
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<tr>
<td><strong>Scope of topics</strong></td>
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<td><strong>Review process</strong></td>
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<td>Group</td>
<td>General</td>
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<td>Goal Blood Pressure</td>
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<tr>
<td>AHA/ACC</td>
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<td>&lt;80 yr: &lt;150/90</td>
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<td>&lt;140/85</td>
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<td>≤140/90</td>
</tr>
</tbody>
</table>

*ADA: < 140/80 or lower
**KDIGO: ≤140/90 w/o albuminuria
≤130/80 if ≥30 mg/24hr
| A (Strong) | 2. Lower sodium intake.  
|           | - Follow the AHA Diet:  
|           |   - DASH diet pattern, the USDA Food Pattern, or  
|           |   - Achieve this pattern by following plans such as the  
|           |   - Including diabetes mellitus (including diabetes mellitus).  
|           | b. Appropriately adjust dietary patterns and nutrition therapy for other medical conditions as necessary.  
|           | a. Adjust this dietary pattern to appropriate calorie  
|           |   - Adapt diet pattern to appropriate calorie  
|           |   - Beverages and red meats.  
|           |   - Alcohol and limits intake of sugar, sugar-sweetened  
|           |   - Products, poultry, fish, legumes, nonhydrogenated vegetable oils  
|           |   - Vegetables, fruits, and whole grains, includes low-fat dairy  
|           |   - Consume a dietary pattern that emphasizes intake of  
|           | BP - Advise adults who would benefit from BP lowering to:  

Management to Reduce CV Risk
2013 ACC/AHA Guideline on Lifestyle
• Consume no more than 2400 mg of sodium/day

• Further reduction of sodium intake to 1500 mg/d can result in even greater reduction in BP

• Even without achieving these goals, reducing sodium intake by at least 1000 mg/d lowers BP

2013 ACC/AHA Guideline on Lifestyle Management to Reduce CV Risk - Sodium
Population-wide sodium reduction remains a critically important component of public health efforts to promote cardiovascular health and prevent cardiovascular disease and will remain a priority for the American Heart Association.

Circulation. 2014;129:e660-e679
In this modeling study, 1.65 million deaths from cardiovascular causes that occurred in 2010 were attributed to sodium consumption above a reference level of 2.0 g per day.

Global Sodium Consumption and Death

"NEJM Papers Add to Ongoing Salt Debate"

CONCLUSIONS

An estimated sodium intake between 3 g per day and 6 g per day was associated with a lower risk of death and cardiovascular events than was either a higher or lower estimated level of intake. As compared with an estimated potassium excretion that was less than 1.50 g per day, higher potassium excretion was associated with a lower risk of death and cardiovascular events than was either.

Mortality and Cardiovascular Events

Urinary Sodium and Potassium

Excretion

"NEJM 2014; 371:7:624-634"

"NEJM 2014; 371:7:612-623"

Cardiovascular events with a lower risk of death and with a lower risk of death and cardiac events was associated with a higher potassium excretion level.
Many studies confirm and expand the association between excess sodium intake and disease. Many but not all utilized more rigorous scientific methods... but are published in journals with less scientific impact and generate little publicity.

"Given the best estimates that the addition of sodium to food is causing hundreds of millions of people to have hypertension and millions of people to die and become disabled, the WHL urges scientists to use high quality research methods and to be conservative in promoting controversial findings, especially those based on weak research methods." From the World Hypertension League Executive Committee: Is Reducing Dietary Sodium Controversial? A Perspective With Flawed Research Methods That Is Controversial? Is It the Conduct of Studies or the Statement From the World Hypertension League.
Physical Activity

In general advise adults to engage in aerobic physical activity to lower BP: 3 to 4 sessions a week, lasting an average 40 minutes per session, and involving moderate-to-vigorous intensity.
JNC 8 Figure 2014 Hypertension Guideline Management Algorithm
At goal blood pressure?

Yes

Reinforce medication and lifestyle adherence.

No

Add additional medication class (e.g., -blocker, Aldosterone antagonist, or others).

At goal blood pressure?

Yes

Reinforce medication and lifestyle adherence.

No

Add diuretic 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.

No

For strategy C, titrate doses of initial medications to maximum.

At goal blood pressure?

Yes

Reinforce medication and lifestyle adherence.

No

Continue current treatment and monitor.
JNC8 Initial Drug Choice

Nonblack, including DM

- Thiazide diuretic or
- Calcium channel blocker (CCB)

Black, including DM

- Thiazide diuretic or
- Calcium channel blocker (CCB)

•

- ARB (angiotensin receptor blocker)
- ACEI (angiotensin converting enzyme inhibitor) or
- Calcium channel blocker (CCB) or
- Thiazide diuretic or

Black, including DM

- Calcium channel blocker (CCB) or
- Thiazide diuretic or

Nonblack, including DM
Age > 18 yo with CKD* and HTN (regardless of race or diabetes)

- Initial (or add-on) therapy should include an ACEI or ARB
- Blacks w/ or w/o proteinuria
- No evidence for RAS-blockers
- Diuretic is an option for initial therapy
- Age ≥ 75 yo

* Chronic Kidney Disease

JNC8 Initial Drug Choice
Reassess treatment monthly

- Consider referral to HTN specialist
- Use drugs from other classes
  - Goal BP not reached with 3 drugs
    - Avoid ACEI/ARB combination (type diuretic, CCB, ACEI, ARB)
  - If goal not reached with 2 drugs, add and titrate
    - Consider 2-drug for $SBP < 160$ or $DBP < 100$
    - Increase dose of initial drug or add drug from one of the recommended classes
- Reassess treatment monthly

JNC8 Subsequent Management
<table>
<thead>
<tr>
<th>Treatment</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tr>
<td>ACE/ARB</td>
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<td>BB</td>
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<td>Thiazide</td>
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</table>

**Table. Comparison of Hypertension Guidelines**

- A: ASH/ISH 13
- B: ESH/ESC 11
- C: CHP 14
- D: NCJ 22
- E: Variable
Drug Therapy Comparison

Note especially changes regarding BB use and recommendations for DM.
<table>
<thead>
<tr>
<th>No. of Doses per Day</th>
<th>Medication</th>
<th>Target Dose</th>
<th>Initial Daily Dose, mg</th>
<th>Initial Daily Dose, mg</th>
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<tbody>
<tr>
<td>1</td>
<td>Irbesartan</td>
<td>300</td>
<td>75</td>
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<td>1</td>
<td>160-320</td>
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<td>1</td>
<td>Losartan</td>
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<td>Angiotensin receptor blockers</td>
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<td>2</td>
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Table 4: Evidence-Based Dosing for Antihypertensive Drugs
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<tr>
<td>Indapamide</td>
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<td>5 mg</td>
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<tr>
<td>Nifedipine</td>
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<td>100 mg</td>
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<tr>
<td>Metoprolol</td>
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<td>50 mg</td>
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<tr>
<td>Atenolol</td>
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<td>100 mg</td>
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*Note: Doses are in milligrams.*
Hypertension with CAD

- A lower target BP (<130/80 mm Hg) may be appropriate in some individuals with CAD, previous MI, stroke or transient ischemic attack, or CAD risk equivalents in individuals with CAD, previous MI, stroke or CAD risk equivalents.

- The >140/90-mm Hg BP target is reasonable for the secondary prevention of cardiovascular events.

Hypertension with CAD

– Chronic Stable Angina

Patients with hypertension and chronic stable angina should be treated with a regimen that includes:

• β-blocker in patients with a history of prior MI

• An ACE inhibitor or ARB if there is prior MI

• A thiazide or thiazide-like diuretic

The combination of a β-blocker, an ACE inhibitor or ARB, and a thiazide or thiazide-like diuretic should also be considered in the absence of a prior MI, LV systolic dysfunction, diabetes mellitus, or proteinuric CKD.

Hypertension with CAD – Chronic Stable Angina

If β-blockers are contraindicated or produce intolerable side effects, a nondihydropyridine CCB (such as diltiazem or verapamil) may be substituted, but not if there is LV dysfunction.

If either the angina or the hypertension remains uncontrolled, add a long-acting dihydropyridine CCB can be added to the basic regimen of β-blocker, ACE inhibitor, and thiazide or thiazide-like diuretic.

Increased risk of significant bradyarrhythmias and HF caution in patients with symptomatic CAD and hypertension.

β-blocker plus nondihydropyridine should be used with p-blocker plus nondihydropyridine, should be used with:

Hypertension with Acute Coronary Syndrome (ACS)

- Initial therapy a short-acting β1-selective β-blocker without intrinsic sympathomimetic activity (metoprolol tartrate or bisoprolol) if no contraindications to beta blockers.

- For patients with severe hypertension or ongoing ischemia, an intravenous β-blocker (esmolol).

- If contraindications to a β-blocker or intolerable side effects, a nondihydropyridine CCB such as verapamil or diltiazem may be substituted for patients with ongoing ischemia if LV dysfunction or HF is not present.

- For hemodynamically unstable patients or when decompensated HF exists, the initiation of β-blocker therapy should be delayed until stabilization has been achieved.

- For patients with ongoing ischemia if LV dysfunction or HF is not present.


ACS - Acute Coronary Syndrome
Hyper tension with
Hypertension with ACS

- Consider nitrates to lower BP or to relieve ongoing ischemia or pulmonary congestion.
  - Avoid in patients with suspected right ventricular infarction.

- For lower risk ACS patients with preserved LV ejection fraction and no diabetes mellitus, ACE inhibitors can be considered a first-line agent for BP control.
  - Add an ACE inhibitor or an ARB if the patient has DM, LV dysfunction or HF, or if the patient has an anterior MI, if HTN persists, or if evidence of LV dysfunction or HF.
  - For lower risk ACS patients with preserved LV ejection fraction and no diabetes mellitus, ACE inhibitors can be considered a first-line agent for BP control.

- Avoid in patients with suspected right ventricular infarction.
- Consider nitrates to lower BP or to relieve ongoing ischemia or pulmonary congestion.
Hypertension with ACS

- Aldosterone antagonists are indicated for patients who are already receiving β-blockers and ACE inhibitors after MI and have LV dysfunction and either HF or diabetes mellitus.

- A thiazide or thiazide-type diuretic may be added in selected patients with persistent hypertension not controlled with a β-blocker, an ACE inhibitor, and an aldosterone antagonist with a p-blocker, an ACE inhibitor, and an aldosterone antagonist.

- Loop diuretics are preferred over thiazide and thiazide-type diuretics for patients with ACS who have HF (NYHA class III) or for patients with CKD and an estimated glomerular filtration rate <30 mL/min.

- A thiazide or thiazide-type diuretic may be added in patients who already receiving β-blockers and ACE inhibitors after MI and have LV dysfunction and either HF or diabetes mellitus.

- Aldosterone antagonists are indicated for patients who are already receiving β-blockers and ACE inhibitors after MI and have LV dysfunction and either HF or diabetes mellitus.
Blood pressure exceeds 180/110 mm Hg

Urgency — acutely elevated blood pressure with evidence of new or progressing target-organ damage; may be asymptomatic (severe asymptomatic hypertension)

Emergency — acutely elevated blood pressure with evidence of new or immediately progressing target-organ damage

Blood pressure exceeds 180/110-120 mm Hg

Hypertensive Emergency or Urgency

September 1, 2015
• Unstable angina
• Dissecting aortic aneurysm
• Edema
• Acute left ventricular failure with pulmonary edema
• Intracerebral hemorrhage
• Encephalopathy

Acute Target Organ Damage
There is a lack of trial evidence that patients with severe hypertension (without crisis) benefit from acute lowering of blood pressure. Precipitous BP lowering may be associated with risk of CV accidents, MI, or acute renal failure.

There is a lack of trial evidence that patients with severe hypertension (without crisis) benefit from acute lowering of blood pressure.
Optimize or restart maintenance therapy

- Administer rapid acting oral agent judiciously

Preferred

- Optimize or restart maintenance therapy

Hypertensive Urgency - Urgency - Treatment
• Captopril 12.5 mg – 25 mg every 1-2 hours

• Clonidine 0.1-0.2 mg orally x 1, may follow with 0.05 to 0.1 mg doses every 1 to 2 hours to a maximum dose of 0.6 to 0.7 mg if needed.

• Labetalol 200 mg – 400 mg orally every 2-3 hours

Hypertensive Urgency - Treatment
Initiate therapy with parenteral agent

Initial goal - MAP reduction by no more than 25% within minutes to hours. (More aggressive reduction may lead to end-organ ischemia)

Subsequent reduction toward 160/100-110 within next 2-6 hours

Hypertensive Emergency Treatment
<table>
<thead>
<tr>
<th>Hypertensive Emergencies</th>
<th>Drug</th>
<th>Dose</th>
<th>Adverse Effects</th>
<th>Special Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicardipine</td>
<td>5–15 mg/h IV</td>
<td>Tachycardia, headache, flushing, local phlebitis</td>
<td>Most hypertensive emergencies, except acute heart failure</td>
<td>Should be used cautiously in patients with myocardial ischemia</td>
</tr>
<tr>
<td>Nitroprusside</td>
<td>0.25–10 mcg/kg/min IV (maximum dose for 10 min only)</td>
<td>Nausea, vomiting, agitation, muscle twitching, sweating, thiocyanate and cyanide toxicity</td>
<td>Most hypertensive emergencies</td>
<td>Should be used cautiously in patients with high intracranial pressure or azotemia</td>
</tr>
<tr>
<td>Drug</td>
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<td>Effects</td>
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<tr>
<td>Esmolol</td>
<td>Most hypertensive emergencies, except acute left ventricular failure</td>
<td>Hypotension, nausea, heart block, tingling, burning in scalp, vomiting, scalp hyperesthesia</td>
<td>500 mcg/kg/min IV infusion; may increase infusion by 50 mcg/kg/min intervals no more frequently than every 4 min to max 300 mcg/kg/min then up to 3 doses 10 min by 40 mg, 2 min, followed by 20 mg IV bolus over 2 min, if needed</td>
<td>Esomolol</td>
</tr>
<tr>
<td>Labetalol</td>
<td>Aortic dissection, perioperatively</td>
<td>Hypotension, nausea</td>
<td>20 mg IV bolus over 2 min, followed q 10 min by 40 mg, then up to 3 doses of 80 mg, or 0.5–2 mg/min IV infusion</td>
<td>Labetalol</td>
</tr>
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<tr>
<td>Hydralazine</td>
<td>5-10 mg, repeat in</td>
<td>Tachycardia, flushing, headache, hypertension, aggravation of vomiting</td>
<td>Eclampsia (not a first line agent for other hypertensive populations with patient failure ventricular failure in acute left MI avoided in acute should be</td>
<td></td>
</tr>
<tr>
<td>Enaliprilat</td>
<td>1.25 – 5 mg every 6</td>
<td>Precipitous fall in BP,variable response in high-renin states, precipitous fall in BP</td>
<td>Eclampsia (not a first line agent for other hypertensive populations with patient failure ventricular failure in acute left MI avoided in acute should be</td>
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<tr>
<td><strong>Fenoldopam</strong>&lt;br&gt;0.1–0.3 mcg/kg/min IV infusion; maximum dose 1.6 mcg/kg/min</td>
<td><strong>Tachycardia, headache, nausea,</strong> <strong>hypokalemia,</strong> <strong>elevation of intraocular pressure in patients with glaucoma</strong></td>
<td>Most hypertensive emergencies except acute myocardial ischemia, coronary ischemia, heart failure; caution with hypertension; should be used cautiously in patients with myocardial ischemia.</td>
<td>Most hypertensive emergencies except acute myocardial ischemia or detected intracranial hypertension.</td>
</tr>
<tr>
<td><strong>Clevidipine</strong>&lt;br&gt;1–2 mg/hr (132 mg/hr max)</td>
<td><strong>Headache,</strong> <strong>nausea,</strong> <strong>tachycardia,</strong> <strong>hypertriglyceridemia</strong></td>
<td>Most hypertensive emergencies except acute heart failure; caution with coronary ischemia; contraindicated in soy or egg allergy or defective lipid metabolism.</td>
<td>Clevidipine, most hypertensive emergencies.</td>
</tr>
<tr>
<td><strong>Fenoldopam</strong>&lt;br&gt;0.1–0.3 mcg/kg/min IV infusion; maximum dose 1.6 mcg/kg/min</td>
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<td>Clevidipine, most hypertensive emergencies.</td>
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To wrap up:

Some questions for discussion.
A 62 year old African-American male with a 5 year history of diabetes records a BP of 156/94 during an office visit. An elevated blood pressure was recorded on his previous 2 office visits as well. The patient is overweight but the exam is otherwise normal. Labs show normal renal function and well-controlled diabetes on metformin.

Case 1
Question 1

What goal BP is most appropriate for this patient per JNC 8 and ASH/ISH?

1. >140/85 mmHg
2. >140/90 mmHg
3. >140/80 mmHg
4. >140/80 mmHg
5. >140/85 mmHg

•
Question 2

What is the drug of choice for initial therapy?

A. Hydrochlorothiazide
B. Hydralazine
C. Lisinopril
D. Atenolol
Question 3

• What is your recommendation for sodium intake for this patient?

A. 500 mg day
B. 1500 mg day
C. 3000 mg day
D. 6000 mg day
In the general nonblack population, including those with diabetes, initial antihypertensive treatment should include:

- A. Thiazide-type diuretic
- B. Calcium channel blocker
- C. ACEI/ARB
- D. Beta-blocker
- E. A, B, or C only
- F. Any of the above
Question 5

True/ False

JNC8 target BP goals for the general population differ from ASH/ISH targets for which age group(s)?

A. all age groups
B. 60 years old or younger
C. 61-80 years old
D. older than 80
Selected References

- An Effective Approach to High Blood Pressure Control: A Science Advisory From the AHA, ACC, and CDC. JACC 2014; 63:1230–8 (Hypertension online November 15, 2013.)
- 2014 JAMA. 2014; 311(5):507–520 (published online December 18, 2013)
- 2014 Evidence-Based Guidelines for the Management of High Blood Pressure in Adults (JNC8).