Hypertension Management: Medical Management and Emerging Interventional Therapy

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Outline

Medical Management
- Updated recommendations (JNC 8)
- Resistant HTN

Interventional Therapy
- Renal Artery Denervation
- Arteriovenous Coupling
2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults
Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8)

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JNC 8-Questions guiding the evidence review

1. In adults with hypertension, does initiating antihypertensive pharmacologic therapy at specific BP thresholds improve health outcomes?

2. In adults with hypertension, does treatment with antihypertensive pharmacologic therapy to a specified BP goal lead to improvements in health outcomes?

3. In adults with hypertension, do various antihypertensive drugs or drug classes differ in comparative benefits and harms on specific health outcomes?
Recommendation 1
In the general population aged 60 years or older, initiate pharmacologic treatment to lower BP at systolic blood pressure (SBP) of 150 mm Hg or higher or diastolic blood pressure (DBP) of 90 mm Hg or higher and treat to a goal SBP lower than 150 mm Hg and goal DBP lower than 90 mm Hg.

Strong Recommendation - Grade A

- Stroke, heart failure, and coronary heart disease
Recommendation 2
In the general population younger than 60 years, initiate pharma-
cologic treatment to lower BP at DBP of 90 mm Hg or higher and
treat to a goal DBP of lower than 90 mm Hg.
For ages 30 through 59 years, Strong Recommendation – Grade A
For ages 18 through 29 years, Expert Opinion – Grade E

↓ Stroke, heart failure, and overall mortality
Recommendation 3
In the general population younger than 60 years, initiate pharmacologic treatment to lower BP at SBP of 140 mm Hg or higher and treat to a goal SBP of lower than 140 mm Hg.
Expert Opinion – Grade E
Recommendation 4
In the population aged 18 years or older with CKD, initiate pharmacologic treatment to lower BP at SBP of 140 mm Hg or higher or DBP of 90 mm Hg or higher and treat to goal SBP of lower than 140 mm Hg and goal DBP lower than 90 mm Hg.*

*Expert Opinion – Grade E

Previous goal was < 130/80

*Applies to adults < 70yr with GFR < 60, or any age with albuminuria (>30mg alb/g creat)
Recommendation 5
In the population aged 18 years or older with diabetes, initiate pharmacologic treatment to lower BP at SBP of 140 mm Hg or higher or DBP of 90 mm Hg or higher and treat to a goal SBP of lower than 140 mm Hg and goal DBP lower than 90 mm Hg.

*Expert Opinion – Grade E*

Previous goal was < 130/80
Recommendation 6

In the general nonblack population, including those with diabetes, initial antihypertensive treatment should include a thiazide-type diuretic, calcium channel blocker (CCB), angiotensin-converting enzyme inhibitor (ACEI), or angiotensin receptor blocker (ARB).

Moderate Recommendation – Grade B
**Recommendation 7**

In the general black population, including those with diabetes, initial antihypertensive treatment should include a thiazide-type diuretic or CCB.

*For general black population: Moderate Recommendation – Grade B*

*For black patients with diabetes: Weak Recommendation – Grade C*
Recommendation 8

In the population aged 18 years or older with CKD and hypertension, initial (or add-on) antihypertensive treatment should include an ACEI or ARB to improve kidney outcomes. This applies to all CKD patients with hypertension regardless of race or diabetes status.

*Moderate Recommendation – Grade B*
Recommendation 9

The main objective of hypertension treatment is to attain and maintain goal BP. If goal BP is not reached within a month of treatment, increase the dose of the initial drug or add a second drug from one of the classes in recommendation 6 (thiazide-type diuretic, CCB, ACEI, or ARB). The clinician should continue to assess BP and adjust the treatment regimen until goal BP is reached. If goal BP cannot be reached with 2 drugs, add and titrate a third drug from the list provided. Do not use an ACEI and an ARB together in the same patient. If goal BP cannot be reached using the drugs in recommendation 6 because of a contraindication or the need to use more than 3 drugs to reach goal BP, anti-hypertensive drugs from other classes can be used. Referral to a hypertension specialist may be indicated for patients in whom goal BP cannot be attained using the above strategy or for the management of complicated patients for whom additional clinical consultation is needed.

*Expert Opinion – Grade E*
JNC 8-APPLYING THE GUIDELINES
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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) vs. Diabetes or CKD present

- **Age ≥60 years**
  - Blood pressure goal: SBP <150 mm Hg, DBP <90 mm Hg

- **Age <60 years**
  - Blood pressure goal: SBP <140 mm Hg, DBP <90 mm Hg

- **All ages**
  - Diabetes present
    - No CKD
  - Diabetes or CKD present

- **All ages**
  - CKD present with or without diabetes

- **Nonblack**
  - Initiate thiazide-type diuretic or ACEI or ARB or CCB, alone or in combination.

- **Black**
  - Initiate thiazide-type diuretic or CCB, alone or in combination.

- **All races**
  - Initiate ACEI or ARB, alone or in combination with other drug class.
JNC 8-APPLYING THE GUIDELINES

General population

- Nonblack
  - Initiate thiazide-type diuretic or ACEI or ARB or CCB, alone or in combination.
- Black
  - Initiate thiazide-type diuretic or CCB, alone or in combination.

Diabetes or CKD present

- All races
  - 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.
Use appropriate doses

<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>
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<tbody>
<tr>
<td>ACE inhibitors</td>
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<tr>
<td>Captopril</td>
<td>50</td>
<td>150-200</td>
<td>2</td>
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<td>Enalapril</td>
<td>5</td>
<td>20</td>
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<tr>
<td>Lisinopril</td>
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<td>Angiotensin receptor blockers</td>
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<td>Eprosartan</td>
<td>400</td>
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<tr>
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<td>ß-Blockers</td>
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<td>Atenolol</td>
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<tr>
<td>Metoprolol</td>
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<td>100-200</td>
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<tr>
<td>Calcium channel blockers</td>
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<td>Amlodipine</td>
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<td>Diltiazem extended release</td>
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<tr>
<td>Nitrendipine</td>
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<td>Thiazide-type diuretics</td>
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<tr>
<td>Indapamide</td>
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</tr>
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</table>
Evaluate response

At goal blood pressure?

Yes

No

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

No

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

No

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

No

At goal blood pressure?

Yes

Continue current treatment and monitoring.⁵
Definition of Refractory (Resistant) / Uncontrolled BP

- When BP cannot be reduced to target level even when using an optimal 3-drug regime including a diuretic in a compliant patient

Prevalence of Uncontrolled Hypertension

Prevalence difficult to estimate

General population: Low
Specialized HT clinics: High
*Clinical trials: 30-50%

*(ALLHAT, CONVINCE, LIFE, INSIGHT: BP not reduced to target levels of >140/90 in 30-50%)

Hypertension Res 2006; 29: S 59-60
Causes for Uncontrolled BP

- Potentially correctable factors
- Secondary hypertension
- True refractory hypertension
Causes: Correctable factors

- **Patient related**: compliance, salt intake, unhealthy lifestyle (alcohol, obesity), other drugs

- **Doctor related**: suboptimal dosage, irrational regimens, drug interactions

- **Office related**: improper cuff size, white coat hypertension (Ambulatory, Home Recordings)

- **Volume overload**: excess salt, drug induced, inadequate diuretics, worsening renal function
24 h Ambulatory BP Monitoring to Exclude White Coat Hypertension
Searching for Secondary HTN:

- Renal, renovascular
- Coarct, aortoarteritis
- Pheochromocytoma
- Primary aldosteronism
- Hypo- and hyperthyroidism
- Obstructive sleep apnea
Investigations in a Patient With Uncontrolled BP

- Assess renal function, thyroid function, K, Na
- Investigations for secondary causes
  - Renal ultrasound, Doppler
  - CT, MRA, aortography (renal angio)
  - Tests for hyperaldosteronism, pheochromocytoma or other conditions as needed
  - Polysomnography
CT Angiography in a Patient with Secondary HT

Bilateral Atherosclerotic RAS with Functioning Lt. Kidney
Coarctation of Aorta Diagnosed on Angiography
Emerging interventional therapy

- Arteriovenous Coupling
  - percutaneous creation of an arteriovenous fistula at the level of the external iliac artery
  - adds a low-resistance, high-compliance venous segment to the central arterial tree to lower systemic arterial pressure
Rox Coupler
Rox Coupler
83 patients with resistant HTN on at least 3 meds randomized to coupler implant (44) or usual care (39)

- Mean office SBP reduced by 26.9mmHg in implant group vs 3.7mmHg in med arm (p<0.0001)
- Mean 24hr SPB reduced by 13.5mmHg in implant group vs 0.5mmHg in med arm (p<0.0001)
Limitations

- No sham implant arm
- Compliance was not measured in med arm
- 1/3 of patients developed unilateral LE edema within 9 mo
- Caused by iliac vein stenosis and was treated with venoplasty +/- venous stenting.
Questions?