Hypertension 101

Jared Moore, MD, FACP
Assistant Program Director, Internal Medicine Residency
Clinical Assistant Professor of Internal Medicine
Division of General Medicine
The Ohio State University Wexner Medical Center

Objectives

1. Understand differences between JNC-7 and JNC-8
2. Understand the approach to the diagnosis and evaluation of hypertension
3. Recognize when to look for secondary hypertension
4. Understand current recommendations for the management of hypertension

References

- JNC 7
- JNC 8
- Wright et al. Evidence Supporting a Systolic Blood Pressure Goal of Less Than 150 mmHg in Patients Aged 60 Years or Older: The Minority View. Annals of Internal Medicine. Published online January 14, 2014.
<table>
<thead>
<tr>
<th>JNC7</th>
<th>JNC8</th>
<th>JNC7</th>
<th>JNC8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonsystematic review of evidence</td>
<td>Systematic review of randomized control trials only*</td>
<td>5 Classes of medications</td>
<td>4 Classes of medications</td>
</tr>
<tr>
<td>Large range of study designs</td>
<td>Standardized protocol for reviewing RCT’s</td>
<td>Thiazide-type diuretics</td>
<td>Thiazide-type diuretics</td>
</tr>
<tr>
<td>Recommendation s based on consensus</td>
<td>Standardized protocol for making recommendations</td>
<td>ACE inhibitors</td>
<td>ACE inhibitors</td>
</tr>
<tr>
<td></td>
<td>100% consensus if possible</td>
<td>ARBs</td>
<td>ARBs</td>
</tr>
<tr>
<td></td>
<td>2/3 majority for evidence based recommendations</td>
<td>Calcium Channel Blockers</td>
<td>Calcium Channel Blockers</td>
</tr>
<tr>
<td></td>
<td>75% majority for expert opinion</td>
<td>“Beta Blockers”*</td>
<td>Therapy dependent on subgroups</td>
</tr>
<tr>
<td></td>
<td>*In accordance with IOM standards for systematic reviews</td>
<td>Thiazide-type diuretics first line</td>
<td>Nonblack: CCB, ACEi, ARB, Thiazide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black: CCB, Thiazide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CKD: ACEi, ARB</td>
</tr>
</tbody>
</table>

**Objectives**

1. Understand differences between JNC-7 and JNC-8
2. Understand the approach to the diagnosis and evaluation of hypertension
3. Recognize when to look for secondary hypertension
4. Understand current recommendations for the management of hypertension

Adapted from JNC8
Diagnosing Hypertension

- Normal- Recheck in 2 years
  - Systolic: <120 mmHg
  - Diastolic: <80 mmHg

- Prehypertension- Recheck in 1 year
  - Systolic: 120 – 139 mmHg
  - Diastolic: 80 – 89 mmHg

- Stage 1 Hypertension- Confirm within 2 months
  - Systolic: 140 – 159 mmHg
  - Diastolic: 90 – 99 mmHg

- Stage 2 Hypertension- Immediate treatment or within 1 month
  - Systolic: ≥ 160 mmHg
  - Diastolic: ≥ 100 mmHg

Diagnosing Hypertension

- Blood pressure readings should be obtained
  - With patient's feet on the floor
  - After 5 minutes of rest
  - Arm supported at heart level
  - Caffeine, exercise, and smoking avoided 30 minutes prior

Diagnosing Hypertension

- Home blood pressure measures
  - white coat hypertension
  - masked hypertension

- 24 hour ambulatory blood pressure monitoring
  - Systolic Blood Pressure Intervention Trial (SPRINT).
Once the diagnosis is made, evaluate for cardiovascular risk factors:

- Diabetes
- Family history of premature cardiovascular disease
- History of strokes/MI
- Retinopathy
- CKD
- Smoking
- Left ventricular hypertrophy
- Age

New Diagnosis Hypertension:

- 12 Lead ECG
- urinalysis
- blood glucose
- hematocrit
- serum calcium
- serum potassium
- serum creatinine
- lipid profile

Liver Function Tests:

- ASH/ISH recommendation

Objectives

1. Understand differences between JNC-7 and JNC-8
2. Understand the approach to the diagnosis and evaluation of hypertension
3. Recognize when to look for secondary hypertension
4. Understand current recommendations for the management of hypertension

When to evaluate for secondary hypertension:

- Age, severity of hypertension, or labs indicate
- BP’s poorly controlled despite appropriate therapy
  - Resistant Hypertension: Uncontrolled BP despite use of 3 medications in different classes with one being a diuretic
- Previously controlled BP’s become uncontrolled
- Sudden onset of hypertension
Etiology of Secondary Hypertension

- Hyperaldosteronism  
  - Potassium is frequently in the normal, low-normal range  
- Obstructive sleep apnea  
- Coarctation of the aorta  
- Cushing syndrome  
- Pheochromocytoma  
- Thyroid/parathyroid disease

43YO male with history of hypertension, hyperlipidemia, Type 2 DM, with previously well controlled hypertension presented after home blood pressure readings of 173/103. He was taking lisinopril and atenolol. He had been on hydrochlorothiazide previously but this was discontinued due to significant hypokalemia.

Labs:
- Sodium: 139mmol/L  
- Potassium: 3.7mmol/L  
- Bicarb: 32mmol/L  
- BUN: 10mg/dL  
- Creatinine: 1.13mg/dL  
- Renin: <0.1ng/mL/hr  
- Aldosterone: 15.5 ng/dL

High suspicion for primary hyperaldosteronism

Objectives

1. Understand differences between JNC-7 and JNC-8
2. Understand the approach to the diagnosis and evaluation of hypertension
3. Recognize when to look for secondary hypertension
4. Understand current recommendations for the management of hypertension

Lifestyle Modification

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>SBP Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain normal body weight: BMI 18.5-24.9kg/m²</td>
<td>5-20 mm Hg/10 kg</td>
</tr>
<tr>
<td>DASH Diet</td>
<td>8-14 mm Hg</td>
</tr>
<tr>
<td>Consume less than 2,400 mg of sodium daily</td>
<td>2-8 mm Hg</td>
</tr>
<tr>
<td>30 minutes of aerobic activity most days of the week</td>
<td>4-9 mm Hg</td>
</tr>
<tr>
<td>No more than 2 alcoholic drinks per day for men and 1 for women</td>
<td>2-4 mm Hg</td>
</tr>
</tbody>
</table>
Hypertension Management

Stage 1 Hypertension: 140-159 / 90-99 mmHg
- Consider starting treatment based on cardiovascular risk factors
- May consider trial of lifestyle modification

Stage 2 Hypertension: ≥160 / ≥100 mmHg
- Initiate treatment
- Consider 2 drug regimen right away

Strength of Recommendation

- Grade A
  - Strong Recommendation- high certainty of substantial benefit
- Grade B
  - Moderate Recommendation- moderate certainty of moderate benefit
- Grade C
  - Weak Recommendation- moderate certainty of a small net benefit
- Grade D
  - Recommendation against- moderate certainty of no benefit or of risk of harm
- Grade E
  - Expert Opinion- Net benefit is unclear but it was important to make a recommendation
- Grade N
  - No recommendation for or against

JNC 8: Strength of Recommendation

<table>
<thead>
<tr>
<th>Recommendation Grade</th>
<th>Number of Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
</tr>
<tr>
<td>N</td>
<td>0</td>
</tr>
</tbody>
</table>

Does my patient have hypertension?
- Yes
- No

Does my patient have chronic kidney disease?
- Yes
- No

Does my patient have >3g proteinuria?
- Yes
- No

Does my patient have diabetes?
- Yes
- No

ACEi or ARB
Goal BP
<140/90

If >18 YO
Goal BP
<140/90

Age, race appropriate BP goals and medications

ACEi or ARB
Goal BP
<140/90

ACEi or ARB
Goal BP
<130/80

18-59 Years Old: Treatment Goal <140/90 mmHg

JNC 8 recommendations 2 and 3

Systolic BP Goals <140 mmHg (Grade E)

- No trials comparing other systolic BP goals to the goal of <140 mmHg
- Current standard of treatment
- In diastolic BP trials, many of those who reached diastolic BP goal of <90 mmHg also had systolic pressures <140 mmHg

Diastolic BP Goal <90 mmHg

30-59YO (Grade A)

18-29YO (Grade E)

- BP goal <90 mmHg non-inferior to goals <85 mmHg or <80 mmHg

Hypertension Management JNC8

- 18-59 Years Old
  - Treatment Goal: <140/90 mmHg
- >60 Years Old
  - Treatment Goal: <140-150**/90 mmHg
- >80 Years Old
  - Treatment Goal: <150/90 mmHg

Hypertension Management

JNC8

- 18-59 Years Old
  - Treatment Goal: <140/90 mmHg

- >60 Years Old
  - Treatment Goal: <140-150**/90 mmHg

- >80 Years Old
  - Treatment Goal: <150/90 mmHg

>60 Years Old Treatment Goal: <140-150**/90 mmHg

SBP Goal <150 mmHg: if <140 mmHg and tolerating, no need to change

JNC 8

SBP Goal <140 mmHg
American Society of Hypertension (ASH)
International Society of Hypertension (ISH)
American College of Cardiology (ACC)
American Heart Association (AHA)
European Society of Hypertension
European Society of Cardiology
Canadian Hypertension Education Program
London National Institute for Health and Clinical Excellence

>60 Years Old Treatment Goal: <140-150**/90 mmHg

<150/90 mmHg (Grade A)
- Few trials
- No difference in outcomes
  - <140 mmHg vs 140-149 mmHg
  - <140 vs 140-160 mmHg
- No evidence to support more aggressive goal

<140/90 mmHg
- Trials are underpowered and not generalizable
- Improvements in cardiovascular disease rates likely due, in part, to BP control
- Slippery Slope
- No evidence of harm with lower BP target

Hypertension Management
JNC8

- 18-59 Years Old
  - Treatment Goal: <140/90 mmHg

- >60 Years Old
  - Treatment Goal: <140-150**/90 mmHg

- >80 Years Old (Grade E)
  - Treatment Goal: <150/90 mmHg
### Hypertension Management JNC8

#### Black Patients
- First Line: (Grade B)
  - Calcium Channel Blockers
  - Thiazide Type Diuretic
- Second Line
  - ACE inhibitor**
  - ARB

**51% higher rate of strokes in black patients on ACEI as first line therapy compared to CCB in ALLHAT

#### Non-Black Patients
- First Line (Grade B)
  - Calcium Channel Blockers
  - Thiazide Type Diuretic
  - ACE inhibitor
  - ARB

*Beta Blockers Not Recommended in JNC8

---

#### Hypertension Management JNC8

- DM >18 years old *without* CKD
- Goal BP <140/90 mmHg (Grade E)

---

#### Hypertension Management JNC8

**Black Patients**
- First Line: (Grade C)
  - Calcium Channel Blockers
  - Thiazide Type Diuretic
- Second Line
  - ACE inhibitor
  - ARB

**Non-Black Patients**
- First Line: (Grade B)
  - Calcium Channel Blockers
  - Thiazide Type Diuretic
  - ACE inhibitor
  - ARB

*Beta Blockers Not Recommended in JNC8
Does my patient have hypertension?
No
Yes

Does my patient have chronic kidney disease?
Yes

Does my patient have >3g proteinuria?
No
Yes

ACEi or ARB
Goal BP <130/80

Age, race appropriate BP goals and medications

If >18 YO Goal BP <140/90

ACEi or ARB
Goal BP <140/90

ACEi or ARB
Goal BP <130/80

History of stroke, heart failure, or other conditions which may modify treatment goals and medications need to be considered separately


Hypertension Management
JNC8

CKD Defined:
GFR <60mL/min/1.73m²
OR
Albuminuria:
>30mg of albumin/g of creatinine

CKD: 18-70 Years Old**

• Treatment Goal:
  <140/90 mmHg (Grade E)

Black Patient aged 18-70YO with CKD and hypertension

• With Proteinuria (Grade E)
  • ACEi
  • ARB
• Without Proteinuria (Grade E)
  • CCB
  • Thiazide Type Diuretic
  • ACEi
  • ARB

**Insufficient evidence to make recommendations for patients >70 YO
Does my patient have hypertension?

Yes

Does my patient have chronic kidney disease?

Yes

Does my patient have diabetes?

Yes

No

Does my patient have >3g proteinuria?

Yes

No

ACEi or ARB

Goal BP <140/90

ACEi or ARB

Goal BP <130/80

If >18 YO

Goal BP <140/90

Age, race appropriate BP goals and medications

History of stroke, heart failure, or other conditions which may modify treatment goals and medications need to be considered separately


Hypertension Management

- CKD: 18-70 Years Old and >3 gram proteinuria
  - Goal BP <130/80 mmHg
  - Improvement in renal outcomes only

Additional Thoughts

- No data on RAAS blockade in patients >75 years old and higher risk of kidney injury
- No studies showing benefit of direct renin inhibitors
- Do not combine ACE inhibitors and ARBs
Additional Thoughts

- Thiazide Type Diuretics- chlorthalidone is most studied in the class, longer duration of action vs HCTZ
- Simplicity 3 Trial- Renal denervation for resistant hypertension. Stopped in January.
- Sprint Trial: ongoing trial evaluating cardiovascular outcomes for systolic BP goals <120 versus <140 in patients >50 years old

Conclusion

Lifestyle Modification

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>SBP Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain normal body weight: BMI 18.5-24.9kg/m^2</td>
<td>5-20 mm Hg/10 kg</td>
</tr>
<tr>
<td>DASH Diet</td>
<td>8-14 mm Hg</td>
</tr>
<tr>
<td>Consume less than 2,400 mg of sodium daily</td>
<td>2-8 mm Hg</td>
</tr>
<tr>
<td>30 minutes of aerobic activity most days of the week</td>
<td>4-9 mm Hg</td>
</tr>
<tr>
<td>No more than 2 alcoholic drinks per day for men and 1 for women</td>
<td>2-4 mm Hg</td>
</tr>
</tbody>
</table>

Case 1

A 43YO black male presents for evaluation of hypertension after being told his blood pressure was high at the dentist’s office. In your office, you confirm an elevated BP of 152/94. The patient has a BMI of 29.2kg/m², he rarely exercises, and his father had an MI at age 51. Laboratory testing reveals that he has dyslipidemia, an A1C of 6.1, and an estimated GFR of 53mL/min/1.73m². He has no proteinuria. He had a normal EKG. After recommending lifestyle modification, what would be your next step in managing this patient with suspected hypertension?

1. May be reasonable to give him a trial of lifestyle modification alone for 2-3 months
   a. Home blood pressure monitoring: alert sooner if BP >160/100
   b. Recheck GFR prior to next office visit
   c. Initiate treatment next visit if home BP’s are elevated or evidence of CKD

2. Initiate treatment right away
   a. Elevated BP on repeat measures, metabolic syndrome, and significant family history
   b. Reduce treatment at a later time if lifestyle modifications are effective
   c. Without proteinuria: CCB, Thiazide diuretic, ACEi, or ARB would be appropriate

Case 2

A 28YO white male presents to establish care. He was diagnosed with diabetes last year and is on metformin. His blood pressure in your office is 174/102 and he states he frequently has headaches. His BMI is 38kg/m². What should be the next steps in evaluation and management?

1. Initiate treatment with 2 antihypertensive medications
   a. Patient is potentially symptomatic from hypertension
   b. Medications: CCB, ACEi, ARB, Thiazide type diuretic

2. Home BP monitoring

3. Initiate work-up for secondary hypertension
   a. High suspicion for OSA