Hypertension in the Elderly and the Very Elderly

Ashwin P. Jaikishen MD
Jonathan G. Owen MD
Hypertension in the Elderly

- What is different?
- What must we keep in mind
  - Arterial wall stiffening leading to Isolated Systolic Pressure
  - Assess pulse pressure
  - Impaired baroreflex sensitivity
    - Orthostatic pressure
  - Co-morbidities
  - Renal Function
    - Clearance of medications
  - Cardiac function
- Cognition
- Choice of Medications
Elderly vs Very Elderly
Elderly vs Very Elderly

  - Elderly: age >65
  - Very Elderly: age >80

- JNC VIII:
  - Elderly: age >60
  - Very Elderly: age >80
Contents

• Prevalence of Hypertension
• Definition of Hypertension
• Evaluation and assessment of Hypertension
• Common causes of secondary hypertension
• Categories of hypertension
• Unique aspects of treating hypertension in the elderly
• Review of Critical Papers and Trials
• Evolution of treatment Goals
• Overview of treatment algorithm
• Discussion/ Questions
What is Blood Pressure

Blood pressure is the measurement of force applied to artery walls.
• What numbers indicate Hypertension?
## Joint National Committee (JNC)-7 (2003)

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Normal Blood Pressure</th>
<th>Pre-Hypertension</th>
<th>HTN Stage I</th>
<th>HTN Stage II</th>
<th>Isolated systolic HTN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic</td>
<td>&lt;120</td>
<td>120-139</td>
<td>140-159</td>
<td>&gt;160</td>
<td>&gt;140</td>
</tr>
<tr>
<td>Diastolic</td>
<td>&lt;80</td>
<td>80-89</td>
<td>90-99</td>
<td>&gt;100</td>
<td>&lt;90</td>
</tr>
</tbody>
</table>
JNC VII

• Isolated systolic hypertension is present when the blood pressure is >140/<90

• Isolated diastolic hypertension is present when the blood pressure is <140/>90

– All above definitions apply to adults who are not on any anti-hypertensive medications and not acutely ill.
Prevalence of Hypertension (HTN)

- National Health and Nutrition Examination Survey (NHANES) conducted from 2003 to 2008. Some key points are:
  - Approximately 29 to 31% have adults in the United States have hypertension (~65 million adults)
  - Only 46 to 51% individuals have their BP under control (<140/90)
  - Therefore, hypertension remains the most common risk factor for myocardial infarctions and stroke
Why treat hypertension?

• Cardiovascular disease risk doubles for every 20mmHG rise in systolic and 10mmHG rise in diastolic.

• The Multiple Risk Factor Intervention Trial (MRFIT) was conducted
  – Demonstrated a continuous and graded influence of both systolic and diastolic blood pressure on CHD mortality.
  – Hypertension is a modifiable risk factor
Complications of Untreated Hypertension

- Retinopathy
- Stroke
- Dementia
- LVH
- CHF
- CAD
- Arrhythmias
- Chronic Kidney disease
- Microalbuminuria
Importance of Systolic Hypertension

Importance of Diastolic HTN

Table 22. Accurate Office Blood Pressure Measurement

<table>
<thead>
<tr>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeine, exercise, and smoking should be avoided by the patient ≥30 minutes before measurement</td>
</tr>
<tr>
<td>The patient should be seated quietly for 5 minutes (in a chair, not the examination table) with feet on the floor</td>
</tr>
<tr>
<td>The patient's arm should be supported at heart level</td>
</tr>
<tr>
<td>The auscultatory method is preferred</td>
</tr>
<tr>
<td>Use the correct cuff size for accuracy (cuff bladder encircles at least 80% of the patient's arm)</td>
</tr>
<tr>
<td>Cuff should be inflated to an adequate pressure (approximately 20-30 mm Hg above the systolic pressure) to avoid measurement error from an auscultatory gap and then deflated at a rate of 2 mm Hg per second</td>
</tr>
<tr>
<td>Record systolic (onset of first sound) and diastolic (disappearance of sound) pressures</td>
</tr>
<tr>
<td>Average two or more measurements</td>
</tr>
</tbody>
</table>

Measurement of Blood Pressure
### Common problems that account for inaccurate blood pressure measurement

<table>
<thead>
<tr>
<th>When the patient has</th>
<th>BP can appear higher by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff over clothing</td>
<td>10-40 mmHg</td>
</tr>
<tr>
<td>A full bladder</td>
<td>10-15 mmHg</td>
</tr>
<tr>
<td>A conversation or is talking</td>
<td>10-15 mmHg</td>
</tr>
<tr>
<td>Unsupported arm</td>
<td>10 mmHg</td>
</tr>
<tr>
<td>An unsupported back</td>
<td>5-10 mmHg</td>
</tr>
<tr>
<td>Unsupported feet</td>
<td>5-10 mmHg</td>
</tr>
<tr>
<td>Crossed legs</td>
<td>2-8 mmHg</td>
</tr>
</tbody>
</table>

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Factors affecting blood pressure:

- Age
- Weight
- Heredity
- Time of Day
- Physical Activity
- Emotional Stress
- Certain Foods
- Medications

Typical fluctuation within a day

Blood Pressure (mmHg)

Arising
Arriving at Work
Telephone Conversation
Argument
Leaving Work
Sleep
6AM 12 6PM 12
Morning Afternoon Evening
Typical Variation of a BP Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Systolic pressure (mm Hg)</th>
<th>Diastolic pressure (mm Hg)</th>
<th>Heart rate (beats/min)</th>
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</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>8.31</td>
<td>135</td>
<td>72</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>8.25</td>
<td>144</td>
<td>76</td>
<td>58</td>
</tr>
<tr>
<td>Day 2</td>
<td>8.14</td>
<td>133</td>
<td>73</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>8.08</td>
<td>162</td>
<td>69</td>
<td>59</td>
</tr>
<tr>
<td>Day 3</td>
<td>8.27</td>
<td>155</td>
<td>78</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>8.21</td>
<td>165</td>
<td>74</td>
<td>54</td>
</tr>
<tr>
<td>Day 4</td>
<td>8.15</td>
<td>144</td>
<td>73</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>8.09</td>
<td>156</td>
<td>78</td>
<td>58</td>
</tr>
<tr>
<td>Day 5</td>
<td>8.19</td>
<td>134</td>
<td>79</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>8.13</td>
<td>157</td>
<td>92</td>
<td>57</td>
</tr>
<tr>
<td>Day 6</td>
<td>8.25</td>
<td>163</td>
<td>78</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>8.19</td>
<td>167</td>
<td>75</td>
<td>57</td>
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<tr>
<td>Day 7</td>
<td>8.20</td>
<td>128</td>
<td>69</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>8.14</td>
<td>151</td>
<td>72</td>
<td>60</td>
</tr>
</tbody>
</table>
Home Blood Pressure monitoring

• Ideally four measurements should be taken for 7 days
  • 7 am and 10 am
  • 7pm and 10 pm
  – Discard first days readings
  – Then average the 6 days of readings
  – If average <125- less likely htn
  – If average >135- HTN likely
  – If average is between 125-135- then need ABPM
Hypertension Categories

• White Coat Hypertension
• Masked Hypertension
• Resistant hypertension
Categories of BP Based on Clinic and Ambulatory BP

- **1.** White coat hypertension
- **2.** Sustained hypertension
- **3.** Normal
- **4.** Masked hypertension

ABPM

• Measures BP over 24 hours.
  – q 15-20 minutes during daytime
  – Q 30-60 minutes during sleep
ABPM
Assessment at Initial Visit

• History

• Family history of Hypertension

• Symptoms:
  • Headache or “hypertensive headache”- occurs in the morning, localized to the occipital region.
  • Dizziness, palpitations, fatigue, impotence

• Lifestyle risk factors:
  o Obesity, dyslipidemia, smoking history, diabetes, physical inactivity.
Assessment at Initial Visit

• Secondary HTN risk factors:
  – History of renal disease, obstructive sleep apnea, spells of sweating, palpitations, tremor, symptoms of hyperthyroidism,
  
  – Medicine causing HTN (nsaids, steroids)

• Evidence of Target organ damage:
  – History of TIA/stroke, angina, congestive heart failure
General Physical Examination

- Observe Body habitus and measure weight and height
- Check BP in both arms ideally in supine, sitting, standing
- Pulses in all extremities
- Ankle Brachial Index
- Neck palpated for thyroid gland enlargement
- Fundoscopic examination
  - Retina only tissue where arteries and arterioles can be visualized directly.
  - Arteriolar light reflex, arteriovenous crossing defects, hemorrhages, exudates, +/-papilledema
- Cardiac examination: loud heart sound, S4 gallop, apical impulse
- Vascular bruits
Laboratory Investigations

- **Investigations**
  - CBC
  - CMP or Renal function panel
  - Urine analysis for protein, blood and glucose
  - Urine microscopy
  - Renal ultrasound
  - BNP
  - Ratio of Plasma aldosterone to Renin levels
  - EKG
  - Echo
  - Chest-Xray
  - Thyroid stimulating hormone
  - Fasting lipid profile
Resistant Hypertension

• Failure to achieve a Bp of $<140/90$ in the general population or $<130/90$ in CKD patients when a patient adheres to a maximum tolerated of three anti-hypertensive medications including a diuretic.
  – Present in 5% of patients
Common Causes of Secondary HTN

• Prior to workup of secondary hypertension
  – Check compliance of medications
  – Evaluate cuff size

• Medications
  – Nsaids
  – Steroids
  – Decongestants
  – Poly pharmacy

• Obstructive Sleep apnea
Treatment
Lifestyle Modifications

• Weight reduction to a BMI of 18.5-24.9
• Decrease in daily sodium intake to <2.4g
• Aerobic activity of 30 minutes daily
• Moderation of alcohol consumption
• Smoking cessation
<table>
<thead>
<tr>
<th>Year</th>
<th>Non-Drug Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920s</td>
<td>Strict low-sodium diet</td>
</tr>
<tr>
<td>1929</td>
<td>Lumbar sympathectomy</td>
</tr>
<tr>
<td>1944</td>
<td>Kempner rice diet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Drug Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930s</td>
<td>Veratrum alkaloids</td>
</tr>
<tr>
<td>1940s</td>
<td>Thiocyanates</td>
</tr>
<tr>
<td>1948</td>
<td>Reserpine, phenoxybenzamine</td>
</tr>
<tr>
<td>1950</td>
<td>Ganglion blockers</td>
</tr>
<tr>
<td>1951</td>
<td>Monoamine oxidase inhibitors</td>
</tr>
<tr>
<td>1958</td>
<td>Thiazide diuretics (chlorthiazide)</td>
</tr>
<tr>
<td>1960s</td>
<td>Central $\alpha_2$ receptor agonists, nondihydropyridine calcium channel blockers and $\beta$-blockers</td>
</tr>
<tr>
<td>1970s</td>
<td>ACE inhibitors, $\alpha_1$ receptor blockers</td>
</tr>
<tr>
<td>1980s</td>
<td>Dihydropyridine calcium channel blockers</td>
</tr>
<tr>
<td>1990s</td>
<td>Angiotensin receptor blockers</td>
</tr>
<tr>
<td>2000s</td>
<td>Direct renin inhibitors</td>
</tr>
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</table>
# Antihypertensive classes

<table>
<thead>
<tr>
<th>Class of Drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diuretics</td>
</tr>
<tr>
<td>Blockers of the Renin-Angiotensin system</td>
</tr>
<tr>
<td>Aldosterone antagonist</td>
</tr>
<tr>
<td>Beta- Blockers</td>
</tr>
<tr>
<td>alpha- adrenergic blockers</td>
</tr>
<tr>
<td>Sympatholytics</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
</tr>
<tr>
<td>Direct Vasodilators</td>
</tr>
</tbody>
</table>
Antihypertensive Medications

• Ideally a medicine should decrease the systolic by 12-15mm Hg and the diastolic 8-10mm Hg.
Hypertension in the Elderly
Hypertension in the Elderly
What We Must Keep in Mind

• Arterial wall stiffening leading to Isolated Systolic Pressure
  – Assess Pulse pressure
• Impaired baroreflex sensitivity
  – With aging: nor-epinephrine increases
  – Renin decreases
  – Aldosterone decreases
    • Assess Orthostatic pressure
Hypertension in the Elderly
What We Must Keep in Mind

• Co-morbidities:
  – Renal Function
    • Clearance of medications
  – Cardiac function
  – Renal artery stenosis
  – Obstructive sleep apnea
• Quality of life and cognition
• Poly-Pharmacy
• Sodium intake
Pulse Pressure

**BLOOD PRESSURE**

1. Systolic *(Normal systolic pressure: 120 mm Hg)*
2. Diastolic *(Normal diastolic pressure: 80 mm Hg)*
3. Pulse pressure *(Normal pulse pressure: 40 mm Hg (120 − 80 = 40))*
4. Mean arterial  
   
   *(Mean arterial blood pressure = Diastolic pressure + 1/3 of pulse pressure  
   = 80 + 40/3  
   = 93.3 mm Hg)*
Does the Relation of Blood Pressure to Coronary Heart Disease Risk Change With Aging?

The Framingham Heart Study

Stanley S. Franklin, MD; Martin G. Larson, ScD; Shehzad A. Khan, BS; Nathan D. Wong, PhD; Eric P. Leip, MS; William B. Kannel, MD; Daniel Levy, MD

Background—We examined the relative importance of diastolic (DBP), systolic (SBP) and pulse pressure (PP) as predictors of coronary heart disease (CHD) risk in different age groups of Framingham Heart Study participants.

Methods and Results—We studied 3060 men and 3479 women between 20 and 79 years of age who were free of CHD and were not on antihypertensive drug therapy at baseline. Cox regression adjusted for age, sex, and other risk factors was used to assess the relations of BP indexes to CHD risk over a 20-year follow-up. In the group <50 years of age, DBP was the strongest predictor of CHD risk (hazard ratio [HR] per 10 mm Hg increment, 1.34; 95% CI, 1.18 to 1.51) rather than SBP (HR, 1.14; 95% CI, 1.06 to 1.24) or PP (HR, 1.02; 95% CI, 0.89 to 1.17). In the group 50 to 59 years of age, risks were comparable for all 3 BP indexes. In the older age group, the strongest predictor of CHD risk was PP (HR, 1.24; 95% CI, 1.16 to 1.33). When both SBP and DBP were considered jointly, the former was directly and the latter was inversely related to CHD risk in the oldest age group.

Conclusions—With increasing age, there was a gradual shift from DBP to SBP and then to PP as predictors of CHD risk. In patients <50 years of age, DBP was the strongest predictor. Age 50 to 59 years was a transition period when all 3 BP indexes were comparable predictors, and from 60 years of age on, DBP was negatively related to CHD risk so that PP became superior to SBP. (Circulation. 2001;103:1245-1249.)

Key Words: blood pressure □ hypertension □ pulse pressure □ coronary disease
Pulse pressure is an independent risk factor for coronary heart disease

In the Framingham study of 1924 men and women followed for 20 years a higher pulse pressure (PP) at any level of systolic blood pressure (SBP) was an independent risk factor for coronary heart disease (CHD). Hazard ratios were determined from level of PP within SBP groups; hazard ratios were set to a reference value of 1.0 for SBP of 130 mmHg and PP of 50 mmHg. All estimates were adjusted for age, sex, body mass index, cigarettes smoked per day, glucose intolerance, and total cholesterol/HDL.

Significance of Pulse Pressure in the Elderly

- Increased pulse pressure was associated with worse cardiac outcomes
  - MRFIT trial
  - NHANES
  - SHEP
  - Syst-Eur

- Increased Pulse Pressure associated with Increased risk of development of DM
  - Case-J Trial

- Increased Pulse Pressure associated with progression of CKD
  - RENAAL trial
Evolution of Treatment Goals
Recommendation 1 in JNC VIII

• 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
Recommendation 1 in JNC VIII

• Treating to SBP<150
  – Reduces
    • Strokes, heart failure, CAD
  – Reviewed
    • HYVET, Sys-EUR, SHEP, JATOS, VALISH, CARDIO-SIS
      • In 2 of those trials, the average tx BP was 143-144
  – Panel agreed that the evidence was strong to support SBP <150, but did not agree to raise the goal to 150 in high risk groups
    – Black persons, CVD, stroke
      » Felt more evidence was needed
Trials for Blood pressure goal

- SHEP (1991)
- Syst-Euro (1999)
- JATOS (2008)
- HYVET (2008)
- VALISH (2010)
- JNC VIII (2014)
- SPRINT (2015)
Effect of Treating Isolated Systolic Hypertension on the Risk of Developing Various Types and Subtypes of Stroke
The Systolic Hypertension in the Elderly Program (SHEP)
SHEP

• SHEP trail in 1991 included 4376 elderly pts (mean age 72)
  – Pts randomized to treatment with chlorthalidone vs placebo
    • Entry criteria SBP>160, DBP<90
    • AGE >60
    • Intervention: to lower Bp by atleast 20mmHg
  – Results:
    – Active arm BP ~143/68 vs placebo arm 155/72
      • 36 % Reduction in fatal and nonfatal stroke in tx arm
      • 25% reduction in CAD
      • 13% reduction in total mortality, reduction in TIA, & CHF
SYST-EUR 1999

- 4695 patients
  - Average age 70
  - Inclusion: SBP 160-219. DBP <95. Age >59
  - 3 months placebo followed by randomization to active treatment with nitrendipine/enalapril/hctz to achieve SBP goal <150
  - Results
    - Treatment arm had 42% fewer total strokes, 44% fewer non-fatal strokes
    - 27% fewer non-fatal cardiac endpoints
    - Subset of Syst-Eur revealed antihypertensive tx lowered the incidence of dementia compared to placebo
  - Trial stopped early due to significant reduction in treatment group
Principal Results of the Japanese Trial to Assess Optimal Systolic Blood Pressure in Elderly Hypertensive Patients (JATOS)

JATOS Study Group*

The benefits of lowering a systolic blood pressure below 140 mmHg in elderly hypertension remain controversial. This study is a prospective, randomized, open-label study with blinded assessment of endpoints to compare the 2-year effect of strict treatment to maintain systolic blood pressure below 140 mmHg with that of mild treatment to maintain systolic blood pressure below 160 but at or above 140 mmHg in elderly hypertensive patients. Patients with essential hypertension (65-85 years old, with a pretreatment systolic blood pressure of above 160 mmHg) were randomly assigned to receive strict treatment \( n=2,212 \) or mild treatment \( n=2,206 \). The baseline drug was efonidipine hydrochloride, a long-acting calcium antagonist. The primary endpoint was the combined incidence of cardiovascular disease and renal failure, and the secondary endpoints were total deaths and any safety problems. Although final blood pressures (systolic/diastolic) were significantly lower in the strict-treatment group compared with the mild-treatment group (135.9/74.8 vs. 145.6/78.1 mmHg; \( p<0.001 \)), the incidence of the primary endpoint was similar in the two groups \( (86 \text{ patients in each group}; \ p=0.99) \). Total deaths were 54 in the strict-treatment group vs. 42 in the mild-treatment group \( (p=0.22) \), and treatment was withdrawn because of adverse events in 36 patients in each group \( (p=0.99) \). An interaction between age and treatment for the primary endpoints \( (p=0.03) \) was seen. Complex clinical features associated with aging seem to have obscured the difference in effect between the two treatments. Further studies are needed to assess the optimal treatment strategy for hypertension in the elderly. *(Hyper-

tens Res 2008; 31: 2115–2127)*
Treatment of Hypertension in Patients 80 Years of Age or Older

Nigel S. Beckett, M.B., Ch.B., Ruth Peters, Ph.D., Astrid E. Fletcher, Ph.D., Jan A. Staessen, M.D., Ph.D., Lisheng Liu, M.D., Dan Dumitrascu, M.D., Vassil Stoyanovsky, M.D., Riitta L. Antikainen, M.D., Ph.D., Yuri Nikitin, M.D., Craig Anderson, M.D., Ph.D., Alli Belhani, M.D., Françoise Forette, M.D., Chakravarthi Rajkumar, M.D., Ph.D., Lutgarde Thijs, M.Sc., Winston Banya, M.Sc., and Christopher J. Bulpitt, M.D., for the HYVET Study Group*
HYVET

**A** Fatal or Nonfatal Stroke

<table>
<thead>
<tr>
<th></th>
<th>Follow-up (yr)</th>
<th>Placebo group</th>
<th>Active-treatment group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. at Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo group</td>
<td>1912</td>
<td>1484</td>
<td>807</td>
</tr>
<tr>
<td>Active-treatment group</td>
<td>1557</td>
<td>873</td>
<td>417</td>
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</tbody>
</table>

**B** Death from Any Cause

<table>
<thead>
<tr>
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<th>Follow-up (yr)</th>
<th>Placebo group</th>
<th>Active-treatment group</th>
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<tbody>
<tr>
<td>No. at Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo group</td>
<td>1912</td>
<td>1492</td>
<td>814</td>
</tr>
<tr>
<td>Active-treatment group</td>
<td>1933</td>
<td>877</td>
<td>420</td>
</tr>
</tbody>
</table>

**C** Death from Cardiovascular Causes

<table>
<thead>
<tr>
<th></th>
<th>Follow-up (yr)</th>
<th>Placebo group</th>
<th>Active-treatment group</th>
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<td>420</td>
</tr>
</tbody>
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**D** Death from Stroke

<table>
<thead>
<tr>
<th></th>
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<th>Placebo group</th>
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<td>420</td>
</tr>
</tbody>
</table>
Target Blood Pressure for Treatment of Isolated Systolic Hypertension in the Elderly

Valsartan in Elderly Isolated Systolic Hypertension Study

Toshio Ogihara, Takao Saruta, Hiromi Rakugi, Hiroaki Matsuoka, Kazuaki Shimamoto, Kazuyuki Shimada, Yutaka Imai, Kenjiro Kikuchi, Sadayoshi Ito, Tanenao Eto, Genjiro Kimura, Tsutomu Imaizumi, Shuichi Takishita, Hirotugu Ueshima, for the Valsartan in Elderly Isolated Systolic Hypertension Study Group

Abstract—In this prospective, randomized, open-label, blinded end point study, we aimed to establish whether strict blood pressure control (<140 mm Hg) is superior to moderate blood pressure control (≥140 mm Hg to <150 mm Hg) in reducing cardiovascular mortality and morbidity in elderly patients with isolated systolic hypertension. We divided 3260 patients aged 70 to 84 years with isolated systolic hypertension (sitting blood pressure 160 to 199 mm Hg) into 2 groups, according to strict or moderate blood pressure treatment. A composite of cardiovascular events was evaluated for ≥2 years. The strict control (1545 patients) and moderate control (1534 patients) groups were well matched (mean age: 76.1 years; mean blood pressure: 169.5/81.5 mm Hg). Median follow-up was 3.07 years. At 3 years, blood pressure reached 136.6/74.8 mm Hg and 142.0/76.5 mm Hg, respectively. The blood pressure difference between the 2 groups was 5.4/1.7 mm Hg. The overall rate of the primary composite end point was 10.6 per 1000 patient-years in the strict control group and 12.0 per 1000 patient-years in the moderate control group (hazard ratio: 0.89; [95% CI: 0.60 to 1.34]; P=0.38). In summary, blood pressure targets of <140 mm Hg are safely achievable in relatively healthy patients ≥70 years of age with isolated systolic hypertension, although our trial was underpowered to definitively determine whether strict control was superior to less stringent blood pressure targets. (Hypertension. 2010;56:196-202.)

Key Words: isolated systolic hypertension ■ elderly ■ blood pressure ■ prognosis ■ valsartan

A Report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents

Developed in Collaboration With the American Academy of Neurology, American Geriatrics Society, American Society for Preventive Cardiology, American Society of Hypertension, American Society of Nephrology, Association of Black Cardiologists, and European Society of Hypertension

Writing Committee Members

Wilbert S. Aronow, MD, FACC, Co-Chair*
Jerome L. Fleg, MD, FACC, Co-Chair†
Carl J. Pepine, MD, MACC, Co-Chair*
Nancy T. Artinian, PhD, RN, FAHA‡
George Bakris, MD, FASN
Alan S. Brown, MD, FACC, FAHA‡
Keith C. Ferdinand, MD, FACC§
Mary Ann Forecia, MD, FACP∥
William H. Frishman, MD, FACC*
Cheryl Jaigobin, MD¶
John B. Kostis, MD, FACC
Giuseppe Mancia, MD#
Suzanne Oparil, MD, FACC
Eduardo Ortiz, MD, MPH†
Efrain Reisin, MD, FASN**
Michael W. Rich, MD, FACC††
Douglas D. Schocken, MD, FACC, FAHA‡‡
Michael A. Weber, MD, FACC §§
Deborah J. Wesley, RN, BSN||

*American College of Cardiology Foundation Representative; †National Heart, Lung, and Blood Institute; ‡American Heart Association Representative; §Association of Black Cardiologists Representative; ||American College of Physicians Representative; ¶American Academy of Neurology Representative; §§European Society of Hypertension Representative; **American Society of Nephrology Representative; ††American Geriatrics Society Representative; §§American Society for Preventive Cardiology Representative; §§§American Society of Hypertension Representative; |||ACCF Task Force on Clinical Expert Consensus Documents Representative. Authors with no symbol by their name were included to provide additional content expertise apart from organizational representation.
### ACCF/AHA 2011 Expert Consensus Document on Hypertension in the Elderly

#### Table 1. Trials of Antihypertensive Treatment in the Elderly

<table>
<thead>
<tr>
<th>Trial Name (Reference)</th>
<th>N</th>
<th>Age Range (y)</th>
<th>Mean Age (y)</th>
<th>Drug(s)</th>
<th>% Risk Reduction</th>
<th>Response to Therapy Same Above Mean Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCOMPLISH (8)</td>
<td>11,506</td>
<td>≥55</td>
<td>68</td>
<td>(Benazepril amlodipine) versus (benazepril + HCTZ)</td>
<td>16, NR</td>
<td>Yes</td>
</tr>
<tr>
<td>ALLHAT (9)</td>
<td>33,357</td>
<td>≥55</td>
<td>67</td>
<td>Amlodipine versus chlorthalidone</td>
<td>7, No difference</td>
<td>Yes</td>
</tr>
<tr>
<td>ANIBP 2 (10)</td>
<td>6,083</td>
<td>65-64</td>
<td>72</td>
<td>Amlodipine versus chlorthalidone</td>
<td>1, 15*</td>
<td>No</td>
</tr>
<tr>
<td>Cope and Warrender (11)</td>
<td>8,84</td>
<td>60-79</td>
<td>68</td>
<td>Amlodipine + bendroflurazide</td>
<td>42*</td>
<td>Stroke only</td>
</tr>
<tr>
<td>EMPER (12)</td>
<td>6,40</td>
<td>≥60</td>
<td>72</td>
<td>HCTZ + triamterene + methyldopa</td>
<td>36, 20</td>
<td>NR</td>
</tr>
<tr>
<td>HYPERT (4)</td>
<td>3,484</td>
<td>80-105</td>
<td>84</td>
<td>Indapamide + perindopril</td>
<td>30, 64*</td>
<td>Yes$</td>
</tr>
<tr>
<td>INVEST (23)</td>
<td>22,576</td>
<td>≥50</td>
<td>66</td>
<td>Verapamil versus atenolol</td>
<td>11, 12</td>
<td>No</td>
</tr>
<tr>
<td>LIFE (14)</td>
<td>9,193</td>
<td>55-80</td>
<td>67</td>
<td>Losartan versus atenol</td>
<td>25*</td>
<td>NR</td>
</tr>
<tr>
<td>MRC (15)</td>
<td>4,396</td>
<td>65-74</td>
<td>70</td>
<td>Atenolol + HCTZ or amiloride</td>
<td>25*</td>
<td>Yes$</td>
</tr>
<tr>
<td>SHEP (16)</td>
<td>4,736</td>
<td>≥60</td>
<td>72</td>
<td>Captopril</td>
<td>36*</td>
<td>9</td>
</tr>
<tr>
<td>STONE (17)</td>
<td>1,632</td>
<td>60-79</td>
<td>67</td>
<td>Nifedipine</td>
<td>57*</td>
<td>20</td>
</tr>
<tr>
<td>STOPHIN (18)</td>
<td>1,627</td>
<td>70-84</td>
<td>76</td>
<td>Atenolol + HCTZ or amiloride or nifedipine</td>
<td>47, 13</td>
<td>Yes$</td>
</tr>
<tr>
<td>System-China (19)</td>
<td>2,394</td>
<td>≥60</td>
<td>67</td>
<td>Nitrendipine captopril + HCTZ</td>
<td>38*</td>
<td>30*</td>
</tr>
<tr>
<td>System-I (20)</td>
<td>4,696</td>
<td>≥60</td>
<td>70</td>
<td>Nitrendipine</td>
<td>42, 26</td>
<td>NR</td>
</tr>
<tr>
<td>VALUE (21)</td>
<td>15,245</td>
<td>≥50</td>
<td>67</td>
<td>Amlodipine versus valsartan</td>
<td>15, 11</td>
<td>NR</td>
</tr>
</tbody>
</table>

*Statistically significant; p<0.05 years of age; HR<0.85, >70 years of age, HR>0.79; Specific data not reported: ≥70 years of age, RR<1.06, >70 years of age, RR<0.93.

AC (angiotensin-converting enzyme) inhibitors; ACCOMPLISH, Amlodipine Versus Captopril for Endpoint Reduction in Hypertension in the Elderly; ALLHAT, Amlodipine Versus Chlorthalidone in Elderly Hypertension Treatment; ANIBP, Amlodipine Versus Chlorthalidone in Elderly Hypertension Treatment; Cope and Warrender, Captopril versus Amlodipine in Elderly Hypertensive Patients; EMPER, European Working Party on High Blood Pressure in the Elderly; HYPERT, Indapamide vs Perindopril in Elderly Hypertensive Patients; INVEST, International Verapamil SU/Trandolapril Study; LIFE, Losartan Intervention for Endpoint Reduction in Hypertension; MRC, Medical Research Council; N, number of assigned patients; NR, not reported; SHEP, Systolic Hypertension in the Elderly Program; STONE, Shanghai Trail of Nifedipine for the Elderly; STOPHIN, Swedish Trial in Old Patients with Hypertension; System-China, Sytolic Hypertension in China; System-I, Sytolic Hypertension in Europe; VALUE, Val-sartan Long-term Use Evaluation.
• Age 55 – 79
  – Target SBP<140
  – Achieve values <140

• Age >80
  – Target SBP < 140
  – Achieve values 140-145 if tolerated
A Randomized Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group*
## SPRINT

### Table 2. Primary and Secondary Outcomes and Renal Outcomes.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intensive Treatment</th>
<th>Standard Treatment</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants</td>
<td>(N = 4,678)</td>
<td>(N = 4,683)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary outcome†</td>
<td>243 (5.2)</td>
<td>319 (6.8)</td>
<td>0.75 (0.64–0.89)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Secondary outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>97 (2.1)</td>
<td>116 (2.5)</td>
<td>0.83 (0.64–1.09)</td>
<td>0.19</td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
<td>40 (0.9)</td>
<td>40 (0.9)</td>
<td>1.00 (0.64–1.55)</td>
<td>0.99</td>
</tr>
<tr>
<td>Stroke</td>
<td>62 (1.3)</td>
<td>70 (1.5)</td>
<td>0.89 (0.63–1.25)</td>
<td>0.50</td>
</tr>
<tr>
<td>Heart failure</td>
<td>62 (1.3)</td>
<td>100 (2.1)</td>
<td>0.62 (0.45–0.84)</td>
<td>0.002</td>
</tr>
<tr>
<td>Death from cardiovascular causes</td>
<td>37 (0.8)</td>
<td>65 (1.4)</td>
<td>0.57 (0.38–0.85)</td>
<td>0.005</td>
</tr>
<tr>
<td>Death from any cause</td>
<td>155 (3.3)</td>
<td>210 (4.5)</td>
<td>0.73 (0.60–0.90)</td>
<td>0.003</td>
</tr>
<tr>
<td>Primary outcome or death</td>
<td>332 (7.1)</td>
<td>423 (9.0)</td>
<td>0.78 (0.67–0.90)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Participants with CKD at baseline</td>
<td>(N = 1,330)</td>
<td>(N = 1,316)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite renal outcome‡</td>
<td>14 (1.1)</td>
<td>15 (1.1)</td>
<td>0.89 (0.42–1.87)</td>
<td>0.76</td>
</tr>
<tr>
<td>≥50% reduction in estimated GFR‡</td>
<td>10 (0.8)</td>
<td>11 (0.8)</td>
<td>0.87 (0.36–2.07)</td>
<td>0.75</td>
</tr>
<tr>
<td>Long-term dialysis</td>
<td>6 (0.5)</td>
<td>10 (0.8)</td>
<td>0.57 (0.19–1.54)</td>
<td>0.27</td>
</tr>
<tr>
<td>Kidney transplantation</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incident albuminuria¶</td>
<td>49/526 (9.3)</td>
<td>59/500 (11.8)</td>
<td>0.72 (0.48–1.07)</td>
<td>0.11</td>
</tr>
<tr>
<td>Participants without CKD at baseline</td>
<td>(N = 3,332)</td>
<td>(N = 3,345)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥30% reduction in estimated GFR to &lt;60 ml/min/1.73 m²‡</td>
<td>127 (3.8)</td>
<td>37 (1.1)</td>
<td>3.49 (2.44–5.10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Incident albuminuria¶</td>
<td>110/1,769 (6.2)</td>
<td>135/1,831 (7.4)</td>
<td>0.81 (0.63–1.04)</td>
<td>0.10</td>
</tr>
</tbody>
</table>
### Table 3. Serious Adverse Events, Conditions of Interest, and Monitored Clinical Events.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intensive Treatment (N = 4678)</th>
<th>Standard Treatment (N = 4683)</th>
<th>Hazard Ratio</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>no. of patients (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious adverse event*</td>
<td>1793 (38.3)</td>
<td>1736 (37.1)</td>
<td>1.04</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Conditions of interest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious adverse event only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypotension</td>
<td>110 (2.4)</td>
<td>66 (1.4)</td>
<td>1.67</td>
<td>0.001</td>
</tr>
<tr>
<td>Syncope</td>
<td>107 (2.3)</td>
<td>80 (1.7)</td>
<td>1.33</td>
<td>0.05</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>87 (1.9)</td>
<td>73 (1.6)</td>
<td>1.19</td>
<td>0.28</td>
</tr>
<tr>
<td>Electrolyte abnormality</td>
<td>144 (3.1)</td>
<td>107 (2.3)</td>
<td>1.35</td>
<td>0.02</td>
</tr>
<tr>
<td>Injurious fall†</td>
<td>105 (2.2)</td>
<td>110 (2.3)</td>
<td>0.95</td>
<td>0.71</td>
</tr>
<tr>
<td>Acute kidney injury or acute renal failure‡</td>
<td>193 (4.1)</td>
<td>117 (2.5)</td>
<td>1.66</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Emergency department visit or serious adverse event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypotension</td>
<td>158 (3.4)</td>
<td>93 (2.0)</td>
<td>1.70</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Syncope</td>
<td>163 (3.5)</td>
<td>113 (2.4)</td>
<td>1.44</td>
<td>0.003</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>104 (2.2)</td>
<td>83 (1.8)</td>
<td>1.25</td>
<td>0.13</td>
</tr>
<tr>
<td>Electrolyte abnormality</td>
<td>177 (3.8)</td>
<td>129 (2.8)</td>
<td>1.38</td>
<td>0.006</td>
</tr>
<tr>
<td>Injurious fall†</td>
<td>334 (7.1)</td>
<td>332 (7.1)</td>
<td>1.00</td>
<td>0.97</td>
</tr>
<tr>
<td>Acute kidney injury or acute renal failure‡</td>
<td>204 (4.4)</td>
<td>120 (2.6)</td>
<td>1.71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Monitored clinical events</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adverse laboratory measure‡</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum sodium &lt;130 mmol/liter</td>
<td>180 (3.8)</td>
<td>100 (2.1)</td>
<td>1.76</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Serum sodium &gt;150 mmol/liter</td>
<td>6 (0.1)</td>
<td>0</td>
<td></td>
<td>0.02</td>
</tr>
<tr>
<td>Serum potassium &lt;3.0 mmol/liter</td>
<td>114 (2.4)</td>
<td>74 (1.6)</td>
<td>1.50</td>
<td>0.006</td>
</tr>
<tr>
<td>Serum potassium &gt;5.5 mmol/liter</td>
<td>176 (3.8)</td>
<td>171 (3.7)</td>
<td>1.00</td>
<td>0.97</td>
</tr>
<tr>
<td><strong>Orthostatic hypotension‡</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>777 (16.6)</td>
<td>857 (18.3)</td>
<td>0.88</td>
<td>0.01</td>
</tr>
<tr>
<td>With dizziness</td>
<td>62 (1.3)</td>
<td>71 (1.5)</td>
<td>0.85</td>
<td>0.35</td>
</tr>
</tbody>
</table>
Frailty is a clinical syndrome including: weakness, low energy, slowed walking speed, decreased physical activity, and weight loss.

It is a chronic progressive condition that develops along a spectrum of severity resulting in a heightened vulnerability to adverse outcomes that manifest in the face of stressors.

Frail older adults are more likely to have delayed recovery from illness and/or are more likely to fall; to develop greater functional impairment, including becoming disabled or dependent; or to die.
From: Treatment With Multiple Blood Pressure Medications, Achieved Blood Pressure, and Mortality in Older Nursing Home Residents: The PARTAGE Study

Recommendation 1 in JNC VIII

- Corollary Recommendation
  - In the general population aged 60 years or older, if pharmacologic treatment for high BP results in lower achieved SBP (for example, <140 mm Hg) and treatment is not associated with adverse effects on health or quality of life, treatment does not need to be adjusted.
  - *Expert Opinion – Grade E*
Strategies to Treat Hypertension

• Important to note that is the amount of reduction in blood pressure that is important than the specific drug (2007 AHA statement on BP in IHD, 2013 ESH/ESC guidelines)

• Initial Regimen should include initiating:
  – Calcium channel blocker/ thiazide diuretic/ acei
Strategies to Treat Hypertension

• Initial use of calcium channel blocker (Syst-Eut trial, STOP Hypertension 2, Syst-China trial, Accomplish Trial) unless a compelling indication exists for use of an ACEI.

• Second medication added is usually an ACEI (Accomplish Trial)

• Third medication added on is usually chlorthalidone. (ALLHAT trial)

• If a fourth medication is required, we will workup causes of secondary hypertension and start the patient on Carvedilol (Gemini, Comet, COLA II)

• Fifth step Refer to a hypertension specialist
Conclusions

• We must treat Hypertension
• Confirm patient has hypertension
• Evaluate pulse pressure, orthostatics, assess frailty

• The lower the better?
  • Avoid complications/ adverse effects
  • Discuss with patient and Individualize treatment

• Difficult scenarios
  – Unclear goal of Systolic blood pressure in ESRD patients
  – Different systolic targets in patients with widened pulse pressure?

• Maintain Blood pressure log
• Literature: HYVET, 2011 Consensus guidelines, SPRINT
  • CHEP has already included SPRINT in their guidelines

• ACC/AHA will release their new guidelines soon!!