

# **Hypertension in the Elderly**

## **Background**

1. Epidemiology of aging population
  - 2010 projections:
    - Age >65 years 40.2 million
    - Age >85 years 6.1 million
2. General information
  - Ages 65-74: 60.9% men and 74.0% women have hypertension
  - Ages 75 & older: 69.2% men and 83.4% women have hypertension
  - Incidence: female>male; black>white
  - Increasing age=increasing HTN risk
  - 80% of HTN in elderly is Isolated Systolic Hypertension (ISH)
  - ISH defined as: SBP  $\geq$ 140 mm Hg and DBP <90 mm Hg

## **Pathophysiology**

1. Pathology of Isolated Systolic Hypertension (ISH)
  - Increased arterial stiffness and decreased elasticity of large arteries results in increased pulse wave velocity and reflected pulse wave returning to thoracic aorta during systole rather than diastole, resulting in increased SBP, decreased DBP, and widened pulse pressure
  - Endothelial dysfunction promoting vasoconstriction due to age-related decline in NO-mediated vasodilation
  - Decrease in beta-2 receptors in arterial wall and increased sodium sensitivity
  - Increased work load on LV causing LVH
  - Reduced early diastolic filling
  - Impaired cardiac reserve
2. Incidence, prevalence
  - ISH is most common subtype of hypertension in elderly
  - Accounts for 87% uncontrolled hypertension in the U.S.
3. Morbidity/ mortality
  - SBP is more important cardiovascular risk factor than DBP in elderly
  - Increased pulse pressure is an independent cardiovascular risk factor
4. Clinical Trials of Hypertension in Older Patients
  - Multiple clinical trials (SHEP, Syst-Eur, Syst-China, SISH, HYVET, meta analysis) have confirmed the efficacy of treatment of HTN in older persons with regard to reductions in CVA, MI, total cardiovascular endpoints, probably overall mortality reduction and possible dementia reduction

## **Diagnostics**

1. Evaluation considerations of older patients
  - Assessment of older patients may be more complicated
  - History taking may require more time
  - History may need to be verified with a family member
  - Altered vision and hearing may present difficulties for the examiner
  - Manifestation of disease may differ in older patients
2. History
  - Catalogue all medications used (prescription, OTC, street drugs and herbal remedies)

- Assess resources and social support
- Assess mental status
- Determine general ability to perform the activities of daily living
- Quantify alcohol ingestion, tobacco use, salt intake, caffeine
- Duration of hypertension and ease of control
- Previously well controlled hypertension now uncontrolled suggests
  - Superimposed secondary hypertension,
  - Interfering substance (alcohol, NSAIDs), or
  - Nonadherence possibly because of finances or dementia
- Abrupt onset of new hypertension associated with declining renal function and pulmonary edema suggests renovascular hypertension
- Hypertension associated with confusion, anorexia, weakness, myalgias, constipation and depression suggests hypothyroidism

### 3. Physical exam

- Vital signs
  - BP, heart rate, height, weight and calculate BMI, check for orthostatic hypotension
- Fundoscopic exam
  - Retinal hemorrhages, cotton wool spots, papilledema
- Neck
  - JVD, carotid bruits, thyromegaly
- Lungs
  - Wheezes, rales
- Heart
  - Cardiac enlargement – displaced PMI past midclavicular line
  - Evidence of LVH – sustained apical impulse
  - Atrial fibrillation – irregularly irregular rate and rhythm
  - Aortic root dilatation – a tambour S2
  - Aortic insufficiency – elevated SBP, wide pulse pressure, diastolic decrescendo murmur over aortic area
  - Heart failure – S3 gallop associated with dyspnea, rales, and tachycardia
- Abdomen
  - Measure waist circumference
  - Palpate liver for size
  - Assessment for enlarged kidneys, enlarged aorta, and ascites
  - Renal artery stenosis - high pitched epigastric systolic-diastolic bruit
  - Abdominal aortic aneurysm - periumbilical bruit
- Extremities
  - Femoral pulsations and bruits, and pedal pulses
  - Peripheral edema may be caused by medications (NSAIDs, dihydropyridine calcium channel blockers), heart failure, decreased albumin, chronic renal insufficiency, chronic venous insufficiency
- Neuro exam
  - Preexisting neurological deficits, including previous strokes
  - Parkinson's disease
  - Dementia

#### 4. Issues in blood pressure measurement in elderly

- Auscultatory gap (AG)
  - A lengthy disappearance of Korotkoff sounds between SBP and DBP
  - AG has diagnostic significance because, if not recognized, it becomes a source of error in BP measurement
  - AG may be associated with increased arterial stiffness and carotid atherosclerosis
  - Missing the AG will produce an underestimation of SBP and overestimation of DBP
  - To avoid incorrect assessment of SBP, estimate SBP by palpation before auscultation
  - To avoid the overestimation of DBP, continue auscultation for at least 10 mm Hg after the first disappearance of the Korotkoff sounds
- Orthostatic hypotension (OH)
  - Defined as a fall of 20 mmHg or more of SBP or 10 mmHg or more of DBP after standing for 3 minutes.
  - Many patients can experience symptoms of cerebral hypoperfusion with smaller decreases in SBP upon standing
  - OH is a risk factor for falls and syncope in elderly
  - OH becomes more common with increasing age
  - Decrease in baroreflex responsiveness and reduction in the cardiovascular response to sympathetic stimuli occur with aging
  - Parkinson's disease, multisystem atrophy, or peripheral neuropathies that are common in elderly affect autonomic system and produce more severe OH
  - There is a direct correlation between the level of supine BP and the degree of BP lowering on standing
  - Checking for varying degrees of OH should form a part of initial evaluation of all elderly patients, even if they are asymptomatic

#### 5. Pseudohypertension

- Pseudohypertension is overestimation of BP when measured noninvasively
- Thought to be secondary to increased arterial wall stiffness
- More common in patients with accelerated atherosclerosis, such as those with end-stage renal failure
- Prevalence of pseudohypertension in the elderly is highly variable among different studies, ranging between 1.7% and 70%
- Osler's sign has been recommended as means to screen potential patients with pseudohypertension
- Osler's sign is considered positive when either the brachial or radial artery is still palpable after the BP cuff has been inflated above systolic pressure
- Studies, however, showed that for general screening, the Osler's sign lacks reliability and has poor predictive value for pseudohypertension
- Therefore, pseudohypertension should be suspected clinically in older patients who lack a correlation between hypertension related end organ damage and the level of BP or when a patient with elevated arm BP experiences signs and symptoms of hypotension induced by antihypertensive medications

## 6. White-Coat Effect and White-Coat Hypertension

- White-coat effect is a transient elevation of BP when the individual is in a medical environment compared to home self-measured BP
- White-coat effect seems to increase with increasing age
- White-coat hypertension (WCH) is defined when an untreated patient has a persistent office BP  $>140/90$  mmHg with an average daytime ambulatory BP  $<135/85$  mmHg
- WCH is more common in the elderly with a prevalence of approximately 15-30%
- WCH should be suspected clinically when the office BP is high and when there is a lack of hypertension-related end organ damage or when patients develop hypotension related side effects from antihypertensive therapy
- Ambulatory Blood Pressure Measurement (ABPM) in conjunction with carefully measured office BPs is the only accurate way to diagnose WCH in a patient

## 7. Reverse White-Coat Effect or Masked Hypertension

- It is the phenomenon in which the office BP is lower than the ambulatory BP
- In one study 21% of older patients studied had lower office than ambulatory systolic blood pressures

## 8. Self-Measured BP (SMBP)

- Useful adjunct to office BP measurement
- Better predictor of cardiovascular risk than office BP in older patients
- Distinguishes sustained hypertension from white-coat effect
- Assesses response to antihypertensive therapy
- Improves patient adherence to treatment
- SMBP of  $135/85$  mmHg is equivalent to an office BP of  $140/90$  mmHg
- Automatic brachial oscillometric devices are the first choice for SMBP
- Device should have demonstrated accuracy in older patients and be validated by the Association for the Advancement of Medical Instrumentation

## 9. Ambulatory BP Monitoring (ABPM)

- An accurate and unbiased method of monitoring BP while the subject is engaged in his or her regular daily activities including sleeping
- Clinical indications for ABPM include
  - Assessment of white-coat hypertension
  - Borderline hypertension with or without target organ damage
  - Evaluation of patients refractory to antihypertensive therapy
  - Diagnosis of nocturnal hypertension
  - Episodic hypertension
  - Hypotension associated with antihypertensive therapy
  - Autonomic dysfunction

## Therapeutics

### 1. Goals of therapy

- To reduce cardiovascular and renal morbidity and mortality
- To achieve JNC-7 goal BPs
  - $<140/90$  mmHg in general population
  - $<130/80$  mm Hg in patients with diabetes or renal disease
- No specific target BPs established for patients older than 65 years
- Major clinical trials in elderly have not achieved JNC-7 goal SBPs

- SHEP data showed that excessive decrease of DBP to <75 mmHg had paradoxical increase in CVD risk
  - In the absence of specific established goal BPs for elderly, target BPs should be patient-centered and individualized based on life expectancy, functional status and comorbid diseases
2. Lifestyle modifications
- Overview
  - Special issues in geriatrics
    - Reduced salt intake may alter taste perception in the elderly resulting in decreased food intake
    - Partial substitution of carbohydrate in DASH diet with either protein or monounsaturated fat can further
      - Reduce BP
      - Improve lipids
      - Reduce CVD risk
3. Drug therapy
- Principles of therapy
  - Combine with lifestyle modifications
  - Initiate drug therapy if
    - Stage 1 HTN and LM failed to lower BP to goal
    - Stage 1 HTN with DM, end organ damage, or severe underlying dz
    - Stage 2 HTN
  - Start low doses (one-half the recommended doses for adults)
  - Increase dose slowly until the BP goal is reached
  - Most patients will require 2 or more antihypertensive agents
  - Monitor medication compliance, side effects, and serum electrolytes
  - Consider low-dose aspirin therapy only when BP is controlled
  - Promote tobacco avoidance or cessation vigorously
4. Evidence Based Choice of Drugs to treat ISH in Elderly
- Thiazides as first-line agents
    - Most effective first-line therapy for treatment of ISH in elderly
    - Primary drug type used in SHEP trial
    - Significantly attenuate arterial wave reflections, and decrease SBP and pulse pressure than other antihypertensive agents
    - Significantly improved all cardiovascular outcomes compared to BB, ACEI, CCB, alpha-blockers, and ARB
  - Calcium channel blockers
    - Also reasonable first-line drugs for the treatment of ISH in elderly
    - Primary drug type used in 2 of the 3 major clinical trials (Syst-Eur and Syst-China) in elderly
    - Decreased SBP and pulse pressure as effectively as thiazide diuretics
    - Improved all cardiovascular outcomes, and vascular and Alzheimer's dementia
  - Beta blockers
    - Not to be used as first-line therapy for patients >60 yo
    - Should not be used to treat hypertension in patients >60 yo unless have another compelling indication, such as heart failure or ischemic heart disease
    - Not as effective as other agents at reducing major adverse outcomes

- ACEIs, ARBs, BBs, alpha-blockers, combined alpha-/beta-blockers, direct vasodilators are second-line agents unless there is a compelling indication
  - Choose a second-line agent with a mechanism of action complimentary to first-line medication
  - Avoid centrally acting drugs (clonidine, methyldopa, reserpine) in elderly patients due to their side effect profile
  - Reasonable evidence-based combinations with additive effect include
    - Diuretic and ACEI combination
    - Diuretic and ARB combination
    - Diuretic and BB combination
    - Dihydropyridine CCB and ACEI combination
    - Dihydropyridine CCB and ARB combination
    - Dihydropyridine CCB and BB combination
5. Drug choices based on compelling indications
- Heart failure
    - Diuretics, BB, ACEI, ARB, aldosterone antagonists
  - Post MI
    - BB, ACEI, aldosterone antagonists
  - High risk of coronary disease
    - Diuretics, BB, ACEI, CCB
  - Diabetes
    - Diuretics, ACEI, ARB, BB, CCB
  - Chronic kidney disease
    - ACEI, ARB
  - Recurrent stroke prevention
    - Diuretics, ACEI

## References

1. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, U.S. Department of Health and Human Services (JNC 7 Express)  
<http://www.nhlbi.nih.gov/guidelines/hypertension/>
2. Mechanisms, Pathophysiology, and therapy of arterial stiffness. Zieman, S.J., Melenovsky, V., Kass, D.A. *Arterioscler. Thromb Vasc Biol.* 2005; 25, 932-43.  
<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=search&DB=pubmed>
3. Predominance of isolated systolic hypertension among middle-aged and elderly US hypertensives: Analysis based on NHANES III. Franklin, S.S., Jacobs, M.J., Wong, N.D. et al. *Hypertension.* 2001; 37, 869-74.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=11244010&query\\_hl=6&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=11244010&query_hl=6&itool=pubmed_docsum)
4. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension: Final results of the systolic hypertension in the elderly program (SHEP): SHEP Cooperative Research Group. *JAMA* 1991; 265, 3255-64.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=2046107&query\\_hl=8&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=2046107&query_hl=8&itool=pubmed_docsum)
5. Randomized double-blind comparison of placebo and active treatment for older patients with isolated systolic hypertension: the Systolic Hypertension in Europe (Syst-Eur) Trial Investigators. Strassen, J.A., Fagard, R., Thijs, L. et al, *Lancet.*

- 1997; 350, 757-64.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=9297994&query\\_hl=15&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=9297994&query_hl=15&itool=pubmed_docsum)
6. Comparison of active treatment and placebo in older Chinese patients with isolated systolic hypertension: the Systolic Hypertension in China (Syst-China) Collaborative Group. *J. Hypertens.* 1998; 16, 1823-29.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=9869017&query\\_hl=17&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=9869017&query_hl=17&itool=pubmed_DocSum)
  7. Risk of treated and untreated isolated systolic hypertension in the elderly: meta-analysis of outcome trials. Staessan, J.A., Gasowski, J., Wang, J.G. et al. *Lancet.* 2000; 355, 865-72.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=10752701&query\\_hl=19&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=10752701&query_hl=19&itool=pubmed_docsum)
  8. One-year study of felodipine or placebo for stage 1 isolated systolic hypertension: the Stage 1 Systolic Hypertension (SISH) Study Group. Black, H.R., Elliot, W.J., Weber, M.A. et al. *Hypertension.* 2001; 38, 1118-1123.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=11711508&query\\_hl=24&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=11711508&query_hl=24&itool=pubmed_docsum)
  9. Results of the pilot study for the hypertension in the very elderly trial: the Hypertension in the Very Elderly Trial (HYVET) Working Group. Bulpitt, C.J., Beckett, N.S., Cooke, J. J. *Hypertens.* 2003; 21, 2409-17.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list\\_uids=14654762&query\\_hl=26&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list_uids=14654762&query_hl=26&itool=pubmed_docsum)
  10. Moser M. Hypertension treatment and the prevention of coronary heart disease in the elderly. *Am Fam Physician* 1999 Mar 1;59(5):1248-56.  
<http://www.aafp.org/afp/990301ap/1248.html> Accessed 6.22.2006

### **Evidence-Based Inquiry**

1. Should beta-blockers be used as first-line therapy for older patients with hypertension?
2. What are appropriate treatment goals for hypertension in the very elderly (> 80 years)?

### **PURLs**

1. When Not To Use Beta-blockers In Seniors With Hypertension

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