Orthostatic Hypotension in Elderly People

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Disclosures: None

A Common Scenario

- Mrs. T is an 80 yo woman with HTN and CAD. She is slowing down in her memory and gait, having difficulty preparing meals. After an overnight rest she arose from bed, took her usual medications (atenolol, HCTZ, and isosorbide), ate breakfast, read the paper, then went to the toilet and strained to defecate. Upon standing she suddenly fell to the floor unconscious. Medics recorded a BP of 90/50 and took her to the hospital. There her SBP ranged 160-185, cardiac exam was normal, she ruled out for an MI, and she had LVH and a normal EF on cardiac echo.

Honolulu Heart Study
Prevalence of OH*

<table>
<thead>
<tr>
<th>Age</th>
<th>Percent of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>71-74</td>
<td>3.4</td>
</tr>
<tr>
<td>75-79</td>
<td>12.7</td>
</tr>
<tr>
<td>80-84</td>
<td>29.1</td>
</tr>
<tr>
<td>85+</td>
<td>42.2</td>
</tr>
</tbody>
</table>

* 3 min stdg

Prevalence of Hypertension

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-34</td>
<td>86%</td>
<td>88%</td>
</tr>
<tr>
<td>25-44</td>
<td>20.9%</td>
<td>20.9%</td>
</tr>
<tr>
<td>45-64</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>65-64</td>
<td>42%</td>
<td>42%</td>
</tr>
<tr>
<td>65-74</td>
<td>57%</td>
<td>57%</td>
</tr>
<tr>
<td>75+</td>
<td>64%</td>
<td>64%</td>
</tr>
</tbody>
</table>

Consequences of Impaired BP Regulation in the Elderly

Orthostatic, postprandial, drug-induced hypotension

Decreased Cerebral Perfusion

- Syncope, falls, and fractures
- Cerebral microangiopathy (leukoaraiosis)
- Cognitive dysfunction and gait disorders
Blood Pressure Equation

Blood Pressure = Heart Rate x Vascular Resistance x Stroke Volume

Effects of Aging =
- Decreased Baroreflex Sensitivity
- Increased Renal Salt and Water Excretion
- Impaired Diastolic Ventricular Filling

Additional Effects of Hypertension on BP Regulation
- Higher BP required for cerebral perfusion
- Abnormal cerebral blood flow regulation
- Reduced baroreflex sensitivity
- Decreased vascular compliance
- Impaired diastolic ventricular filling

BP Variability During Daily Activities

Prevalence of OH by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>% with &gt;20 mmHg drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-59</td>
<td>621</td>
<td>11.6</td>
</tr>
<tr>
<td>60-64</td>
<td>1,617</td>
<td>10.6</td>
</tr>
<tr>
<td>65-69</td>
<td>1,288</td>
<td>12.2</td>
</tr>
<tr>
<td>70-74</td>
<td>982</td>
<td>15.9</td>
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</table>

Prevalence of OH by Level of Supine SBP

<table>
<thead>
<tr>
<th>Supine SBP</th>
<th>N</th>
<th>% with &gt;20 mmHg drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;120</td>
<td>567</td>
<td>2.8</td>
</tr>
<tr>
<td>120-139</td>
<td>1,549</td>
<td>5.2</td>
</tr>
<tr>
<td>140-159</td>
<td>1,362</td>
<td>13.6</td>
</tr>
<tr>
<td>&gt;160</td>
<td>1,030</td>
<td>26.6</td>
</tr>
</tbody>
</table>
**Prevalence of OH by Age if Supine SBP > 160 mmHg**

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>% with &gt; 20 mmHg drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-59</td>
<td>99</td>
<td>28.3</td>
</tr>
<tr>
<td>60-64</td>
<td>309</td>
<td>24.6</td>
</tr>
<tr>
<td>65-69</td>
<td>312</td>
<td>26.3</td>
</tr>
<tr>
<td>70-74</td>
<td>310</td>
<td>28.4</td>
</tr>
</tbody>
</table>

**Postprandial Hypotension**

![Graph showing blood pressure changes during meal and no meal studies.]

**Paradox: The Higher You Are, The Farther You Fall.**

![Graph showing systolic blood pressure change vs. basal systolic blood pressure.]

**Cerebral Microangiopathy (WMH):**
Slow gait, Executive Dysfunction, Depressive Sx.

**Definition of Orthostatic Hypotension (OH)**

- 20 mmHg or greater decline in systolic BP and/or 10 mmHg or greater decline in diastolic BP when changing from a supine to upright position (sitting or standing).
- 1 and/or 3 minute value.
- HR is not a reliable indicator in geriatric patients because of baroreflex impairment.

**Is OH Dangerous?**

- Independent predictor of all-cause and cardiovascular mortality.
- Associated with recurrent falls in previous fallers living in the NH.
- Marker for physical frailty.
OH Frequency & Recurrent Falls

Causes of OH

- Systemic
  - Hypertension
  - Dehydration
  - Deconditioning
  - Adrenocortical insufficiency
- Drugs
  - Antipsychotics
  - MAOs & tricyclics
  - Antihypertensives (acute doses)
  - Vasodilators (NTG)
  - L-Dopa
  - BBs, CCB’s, etc.

Acute Effect of a Diuretic on Orthostatic BP

The effect of HCTZ and mild volume contraction on BP response to tilt in healthy young and elderly subjects.

Orthostatic Hypotension is Reduced By Chronic Antihypertensive Therapy


Masuo et al. AJH 1996; 9: 263-8
Causes of OH

- CNS Disorders
  - Multiple Systems Atrophy
  - Parkinson’s Disease
  - Multiple Strokes
  - Myelopathy
  - Brain stem lesions
  - Lewy Body Dementia

- Autonomic Neuropathy
  - Diabetes Mellitus
  - Amyloidosis
  - Tabes Dorsalis
  - Paraneoplastic
  - Alcohol
  - Nutritional
  - Pure Autonomic Failure

The Butler

- Mr. B is an 83 yo former butler admitted to the hospital after a fall in his apartment. He had a Hx of mild dementia, weight loss, and restless legs. He developed delirium at night in the hospital and was given haloperidol. He became severely agitated, experienced visual hallucinations, and fell when getting out of bed to go to the toilet.

The Butler’s Physical Exam

- Supine BP 142/75, HR 76,
- Sitting BP 102/72, HR 80.
- Standing BP 85/-, HR 79.
- Marked lower extremity rigidity, no tremor
- Disoriented, unable to recall 3 objects.

The Butler’s Diagnosis?

- Lewy Body Dementia
  - Cognitive impairment
  - Visual Hallucinations
  - Parkinsonian features
  - Orthostatic Hypotension
  - Sensitivity to antipsychotics
  - Hx of movement disorders
- Treatment: Salt and fluids, fludrocortisone, midodrine, thigh-high stockings, elevate bed

Evaluation of OH

- **Symptoms:** Postural dizziness, falls, or syncope; oral intake; sweating, incontinence, headache, diarrhea, constipation, impotence, poor night vision.
- **History:** Hypertension, Diabetes, Cancer, Stroke, Parkinson’s Disease, Arrhythmias, Medications & Alcohol.

Evaluation of OH - 2

- **Physical Exam:** BP & P supine, 1 & 3 min standing; pupils, skin, cardiovascular and neurological exams.
- **Labs:** Hematocrit, Electrolytes, Glucose, Protein Electrophoresis, Vitamin B12, RPR
- **Special tests:** cortisol, brain imaging, tilt with plasma norepinephrine levels, heart rate variability during deep breathing & Valsalva, sweat tests.
Nonpharmacologic Treatment

- Stop unnecessary hypotensive medications
- Avoid warm environments
- Avoid straining activity
- Squatting, leg crossing
- Increase salt intake
- Waist-high compression stockings
- Sleeping in the head-up position

Counteracting Effect of Supine Leg Resistance Exercise on Systolic OH in Older Adults (Galizia et al, JAGS, 2013)

- 42 pts > 65 with OA & OH w/i 3 min.
- Exercise: After 10 min bed rest, 10 extensions of ankle, knee, hips within 25 seconds against a resistance band.
- Stood after 10 repetitions.
- BP and HR recorded at 1,3,5 min.

Results

- **Control** - Mean SBP fell by 27 mm Hg immediately on standing from supine to standing position
- **Exercise** - Mean SBP fell by only 10 mm Hg (significant difference)
- During next 5 minutes, return to baseline BP occurred more slowly in control group
- 67% control group reported OH symptoms compared to 38% of exercise group

Pharmacologic Treatments

- Fludrocortisone
- Midodrine
- Nonsteroidal Anti-inflammatory Drugs
- Caffeine
- Erythropoietin
- Clonidine
- Yohimbine
- Beta-blockers with intrinsic sympathetic activity

Approach to BP Dysregulation

Mr. T revisited

- Why is she slowing down? Possibly frontal, subcortical cerebral microvascular disease affecting executive function and gait.
- Why did she faint? Hypotensive responses to volume contraction, posture change, medications, a meal, and Valsalva during defecation.
- Is she hypertensive? Yes, highly variable BP is a feature of HTN in the elderly.
- Should she be treated for hypertension? Yes, but monitor for OH/PPH & avoid volume contraction.
Summary

- Aging and hypertension impair BP regulation and increase the risk of orthostatic, post-prandial, and drug-induced hypotension.
- The careful treatment of hypertension may improve BP regulation.
- Measure BP during usual daily activities.
- Evaluate patients for autonomic failure.
- Start with non-pharmacologic therapy.