

ORTHOSTATIC HYPOTENSION (OH) IN OLDER ADULTS

Learning objectives:

- Define orthostatic hypotension (OH) and recognize its prevalence and impact in older adults
- Describe the pathophysiology of OH in older adults
- Describe a clinical approach to evaluating patients with OH
- Outline non-pharmacological and pharmacological management options for OH

Case:

You are a fourth-year clinical clerk/junior resident during your internal medicine CTU rotation. The senior resident asks you to see Mr. H in the emergency department after a fall, accompanied by his daughter. He is an 85-year-old man who lives alone in a retirement home, with a past medical history of hypertension, benign prostatic hypertrophy (BPH), osteoarthritis, glaucoma and type 2 diabetes. He has never smoked and drinks 2-3 glasses of wine per week with dinner. He has a university education and worked as an accountant. His wife passed away 3 years ago and he has 2 supportive children. His medications are blister-packed: perindopril 8 mg daily, amlodipine 10 mg daily, tamsulosin 0.4 mg daily, dutasteride 0.5 mg daily, trazodone 50 mg QHS, furosemide 40 mg daily, extra strength acetaminophen 2 tabs twice daily, metformin 500 mg twice daily and linagliptin 5 mg daily.

He was brought to the emergency department by his daughter after he had a fall at the retirement home. At baseline, he uses a cane and receives assistance with meals, shopping, finances and cleaning but manages his own medications and activities of daily living. Mr. H describes that he felt weak when he was walking back from the dining room and fell in front of his door. He denied any loss of consciousness. He has had 3 falls in the last year, associated with weakness, but not associated with major injuries. He denies any other symptoms, except recently recovered from a cold and was not eating/drinking well for the last week.

You conduct a thorough physical exam. You recall from your geriatric medicine teaching to do postural vitals for an older adult presenting with falls. His supine vitals are: BP 130/75 mmHg, HR 72. Within 30 seconds of standing, his BP is 110/65, HR 90; at 1 minute, BP 105/60, HR 95 and at 3 minutes, BP 101/60, HR 97 (he reports dizziness and asks to sit down).

1. Does Mr. H have orthostatic hypotension (OH)?
2. How common is OH? What are the consequences of OH?
3. Why are older adults more prone to OH?
4. What are the causes of OH?
5. How do you assess a patient for OH?
6. How do you treat OH?

Definition:

Orthostatic hypotension (OH) is defined as a **sustained** reduction of systolic blood pressure (BP) of ≥ 20 mmHg or diastolic blood pressure of ≥ 10 mmHg within 3 minutes of standing.

Prevalence and Impact in Older Adults

The incidence of OH increases exponentially with age. It affects nearly 1/5 of community-dwelling older adults ≥ 65 years and up to 2/3 of those living in long-term care homes and those hospitalized. The presence of OH can impact quality of life and function and is also associated with increased risk of cardiovascular events, falls and mortality.

Pathophysiology of OH in Older Adults

OH in older adults is often **multifactorial**. Older adults are more prone to OH due to:

- Physiological changes that occur with aging
- Increased presence of comorbidities (e.g. diabetes, Parkinson's disease)
- Increased number of medications

Normally, several physiological mechanisms help us maintain our BP when standing upright and respond to drops in BP:

- Lower limb musculature contracts, resulting in increased venous return to the heart.
- The arterial baroreflex is activated, which stimulates afferent nerves in the carotid sinus and aortic arch to decrease parasympathetic tone and increase sympathetic output, which increases heart rate, cardiac output and peripheral vasoconstriction.
- The renin-angiotensin-aldosterone axis is activated, resulting in increased production of vasoactive agents.

Age associated physiological changes contributing to OH

Autonomic nervous system	Cardiovascular system	Increased risk of dehydration
<ul style="list-style-type: none">▪ Impaired sensitivity of alpha-1 adrenergic receptors▪ \downarrow heart rate response▪ \downarrow baroreflex sensitivity▪ General decline in autonomic nervous system function	<ul style="list-style-type: none">▪ Decreased compliance: Stiffer myocardium \rightarrow diastolic dysfunction may precipitate stroke volume reduction▪ Arterial stiffness may contribute to inadequate vasoconstrictive response	<ul style="list-style-type: none">▪ \downarrow total body water content▪ Impaired response to thirst▪ \downarrow Ability of kidneys to maintain adequate intravascular volume in case of reduced fluid intake


 \downarrow intravascular volume + \downarrow stroke volume
+ blunted chronotropic and vasoconstrictive response after standing


Older adults are more prone to OH

Orthostatic Hypotension

In addition to age, several factors affect BP physiology:

- Diurnal variation: BP is lowest overnight and early in the morning
- Meals: food intake increases venous pooling in splanchnic mesenteric vasculature by 300%, resulting in post-prandial drop in BP (exacerbated by large meals, meals that are high in carbohydrates and alcohol intake)
- Ambient temperature: hot environments cause vasodilation, which lowers BP
- Physical activity: also leads to vasodilation, which lowers BP

Causes of OH

<i>Associated with compensatory tachycardia</i>	<i>Lack of compensatory tachycardia</i>
<p>-Dehydration:</p> <ul style="list-style-type: none">▪ From diseases (acute illness, adrenal insufficiency)▪ From drugs (diuretics) <p>-Heart conditions:</p> <ul style="list-style-type: none">▪ low left ventricular ejection fraction▪ aortic stenosis <p>-Drugs:</p> <ul style="list-style-type: none">▪ Anti-hypertensive▪ Anti-anginals (nitroglycerin, calcium-channel blockers)▪ Anti-parkinsonian medications (levodopa)▪ Anti-depressants▪ Anti-psychotics▪ Anti-BPH medications (tamsulosin, terazosin)	<p>-Autonomic dysfunction:</p> <ul style="list-style-type: none">▪ Diabetic autonomic neuropathy▪ B12 deficiency▪ Hypothyroidism▪ Excessive alcohol use▪ Parkinsonism (Parkinson's disease and "Parkinson's plus" conditions e.g. multiple system atrophy, progressive supranuclear palsy, etc.) <p>-Beta-blocker use</p>

Clinical Approach

History: Classic symptoms of OH include light-headedness, dizziness and presyncope. However, studies have shown that the majority of patients do not experience classic symptoms and may report atypical symptoms, such as visual blurring, headache, generalized weakness, fatigue, nausea and abdominal discomfort. Typically, symptoms are brought on by sudden postural changes. There may be associated features of autonomic dysfunction, such as urinary dysfunction and constipation.

Physical exam: Vitals (BP and heart rate) should be measured in the supine position after 5 minutes of rest. Guidelines indicate that vitals should be measured at 1 and 3 minutes of standing. However, studies have shown that the largest drop in BP occurred within the first 30 seconds of standing and OH assessed within 1 minute of standing was associated with higher odds of dizziness and greater risk of long-term adverse outcomes. Therefore, consider measuring BP before 1 minute as well.

Studies have also suggested that the threshold for OH diagnosis for sitting to standing measurements should be a drop in systolic BP ≥ 15 mmHg and diastolic BP ≥ 7 mmHg. Studies suggest that reproducibility of OH measurements is poor, given there are so many factors that affect the measurement.

It is also important to note any clues to underlying etiology of OH, such as evidence of parkinsonism, diabetic neuropathy, volume depletion and cardiac conditions (such as congestive heart failure).

Management of OH

1. **Goals of treatment:** It is important to first establish the goals of treatment with the patient; management should not be directed at achieving specific BP targets, but rather to **improve symptoms, optimize safety** (reduce risk of falls/syncope), maximize functional status and minimize side effects.
2. **Address underlying contributors:** Address volume depletion (such as by giving IV fluid or encouraging oral fluids), treat any acute illness (such as infection, GI bleeding) and reduce/stop any contributory medications (such as diuretics, antihypertensives, urological and psychotropic medications).
3. **Patient education:** Counsel on lifestyle modifications and advise the patient to avoid situations that worsen OH, such as large meals, hot environments, prolonged recumbency, alcohol and dehydration. If there are no contraindications (such as congestive heart failure), counsel on increasing fluid and salt intake.
4. **Non-pharmacological measures:** There is evidence for compression stockings in older adults (at least 30 mmHg of pressure applied to both legs, up to the thighs). They are difficult to put on and take off, and can be uncomfortable, which limits their use. There is evidence in other patient populations (such as those with autonomic failure) for physical counter-maneuvres (actions that involve tensing muscle groups to increase BP prior to positional change, such as handgrip or leg crossing), abdominal compression (with an elastic abdominal binder) and eating smaller, more frequent meals.

SUMMARY

OH is common in older adults & is associated with reduced quality of life, functional limitations, falls and morbidity.

OH is defined as a sustained reduction in systolic BP ≥ 20 mmHg and diastolic BP ≥ 10 mmHg within 3 minutes of standing.

The differential diagnosis of OH includes causes with compensatory tachycardia (dehydration, drugs) and causes without compensatory tachycardia (autonomic dysfunction).

Goals of treatment in OH are to improve symptoms, optimize safety, maximize function and minimize side effects.

Address underlying contributors first, which is often medications in older adults.

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5. **Pharmacological options:** Pharmacological therapy is typically added to non-pharmacological measures. They are more often used in patients with primary autonomic dysfunction, who tend to be younger and have fewer comorbidities than older adults with OH. The most common options include:
- *Midodrine*: Alpha-agonist, indicated for symptomatic OH. Max dose 10 mg TID. First dose should usually be taken 1 hour before rising and last dose 4 hours before bedtime to avoid supine hypertension. Monitor for urinary retention and supine hypertension. Avoid in liver disease, severe heart disease, acute kidney injury, thyrotoxicosis and pheochromocytoma.
 - *Fludrocortisone*: Synthetic mineralocorticoid, used off-label for OH. Promotes renal sodium uptake to expand plasma volume. Max dose 0.4 mg/day. Monitor for hypokalemia, edema and supine hypertension. Avoid in heart or kidney failure.

Follow-up Questions

- Does Mr. H have OH? What other questions should you ask on history? What should also be checked on the physical exam?
- What could be contributing to Mr. H's OH?
- How will you manage this problem? What advice should you give Mr. H on discharge?

Resolution of the Case

Mr. H's blood pressure drop meets the criteria for OH. There were no other specific symptoms on history. On physical exam, Mr. H had evidence of volume depletion and mild peripheral neuropathy. Based on your comprehensive assessment, you identify several potential factors contributing to Mr. H's orthostatic hypotension: volume depletion (poor oral intake recently), medications (perindopril, amlodipine, tamsulosin, dutasteride, furosemide and trazodone), diabetes (potential autonomic dysfunction) and aging physiology.

You discussed with Mr. H his goals of treatment, and he voices that he wants to improve his symptoms as they impact his ability to go for his daily walks and make him fearful of falling. You decide to hold his furosemide dose in hospital until he is eating and drinking well. You note he does not have a history of congestive heart failure and ask why he's on furosemide; he recalls being started on it a couple years ago due to leg swelling when he injured his knee and no longer has swelling. You stop the furosemide and also suggest lowering his amlodipine dose. You advise him to see his family doctor in 1-2 weeks to reassess his antihypertensive medications. You counsel him on maintaining adequate fluid intake and avoiding factors that worsen OH. Mr. H's postural drop in BP improves during his hospital stay, but he is deconditioned and therefore transferred to rehab. You suggested considering a trial of compression stockings at rehab to see if he's able to tolerate them.

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References:

1. Freeman R. Neurogenic Orthostatic Hypotension. *NEJM*. 2008; 358;6: 615-624.
2. Frith J, Parry SW. New Horizons in orthostatic hypotension. *Age and Ageing*. 2017; 46: 168–174.
3. Freeman R, Wieling W, Axelrod FB, et al. Consensus statement on the definition of orthostatic hypotension, neurally mediated syncope and the postural tachycardia syndrome. *Clin Auton Res*. 2011;21:69–72.
4. MacDonald MJ, Klair A, Khoury L, Molnar FJ. 4D-AID: A practical approach to the assessment of orthostatic hypotension in older patients. *CGS JOURNAL OF CME*. 2016; 6(1).
5. Madden KM. Orthostatic Hypotension Screening in Older Adults Taking Antihypertensive Agents. *Geriatrics & Aging*. 2009;12(5):254-258.
6. Ricci F, De Caterina R, Fedorowski A. Orthostatic Hypotension: Epidemiology, Prognosis, and Treatment. *Journal of the American College of Cardiology*. 2015;66(7): 848-60.
7. Shaw BH, Garland EM, Black BK, et al. Optimal diagnostic thresholds for diagnosis of orthostatic hypotension with a 'sit-to-stand test'. *J Hypertens*. 2017;35(5):1019–25.
8. Klair A, MacDonald MJ, Molnar FJ, Khoury L. Treatment of orthostatic hypotension in older patients: the geriatric perspective. *CGS JOURNAL OF CME*. 2017;7(1).
9. Grant, M. Treatment of Orthostatic Hypotension: Preserving Function and Quality of Life. *Geriatrics & Aging*. 2003;6(7):32-36.
10. Mills PB, Fung CK, Travlos A, Krassioukov A. Nonpharmacologic management of orthostatic hypotension: a systematic review. *Arch Phys Med Rehabil*. 2015;96:366–375 e366.
11. Magkas, N, Tsioufis, C, Thomopoulos, C, et al. Orthostatic hypotension: From pathophysiology to clinical applications and therapeutic considerations. *J Clin Hypertens*. 2019; 21: 546– 554. <https://doi.org/10.1111/jch.13521> Orthostatic hypotension: From pathophysiology to clinical applications and therapeutic considerations

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