

Postural and postprandial hypotension are common conditions among older adults. They are causes of dizziness, syncope, and falls in older people. These conditions may result in significant morbidity, a decrease in function, and mortality.

Dysregulation of blood pressure in older adults can result in postural and postprandial hypotension.

Routine screening for these conditions is easy to perform and helps to diagnose and manage them appropriately. Management includes a combination of nonpharmacological and pharmacological interventions.

Key words: postural hypotension, postprandial hypotension, management, blood pressure, older adults

Postural and Postprandial Hypotension: Approach to Management

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Introduction

Hemodynamic homeostasis becomes less effective with aging and is associated with a decreased ability to regulate blood pressure. Postural and postprandial hypotension (PH and PPH) are common clinical disorders among the older population and should be considered in the etiology of falls, syncope, and dizziness or in persons who have cerebral or cardiac ischemic symptoms. All individuals with diabetes, hypertension, or Parkinson's disease or who undergo dialysis should be screened for these conditions, which are independent predictors of all cause mortality. A recent study of hospitalized older adults demonstrated that postprandial hypotension (PPH) was more common than postural hypotension (PH).¹

Postural Hypotension

Orthostatic or postural hypotension is a condition in which subjects experience a systolic blood pressure drop of 20 mm Hg or more, or a diastolic blood pressure drop of 10 mm Hg or more, with or without an increase in heart or pulse rate, with or without symptoms, and within 3 minutes after standing (Figure 1).² The prevalence of PH is lowest among community-dwelling older adults (5–30%)^{3–5} and is usually higher among hospitalized individuals (52–69%)^{1,6} and those living in long-term care facilities (50%).⁷

The normal blood pressure response that occurs when an individual moves from a supine to a standing position is a small reduction (<10 mm Hg) in systolic blood pressure and a small increase in diastolic blood pressure (approximately 2.5 mm Hg).⁸ In the supine position,

about 30% of the blood is in the thorax; when the individual stands, about 500–700 mL of blood pools in the lower extremities. This results in a decreased venous return and decreased cardiac output and hypotension, which, in turn, trigger the baroreceptors. Increased sympathetic activity and decreased vagal tone result, which cause an increase in heart rate, stroke volume, and peripheral resistance to resume normalization of blood pressure. During changes in posture, cardiovascular, autonomic, musculoskeletal, renal, and endocrine systems help to maintain blood pressure. With aging and hypertension, baroreflex sensitivity decreases^{9,10} and an increase in vascular stiffness occurs.¹¹ Vascular stiffness has been associated with a reduction of the baroreflex sensitivity.^{12,13} Reduced baroreflex sensitivity is the main mechanism that causes PH.

Clinical Approach

All older patients, especially those who have had falls, syncope, or dizziness, should be screened for PH. In symptomatic PH, the timing of the individual's symptoms will help to determine the timing of standing blood pressure measurements. The standing measurements should be performed in all patients at 1 and 3 minutes (to identify early PH) and if postural symptoms are seen after 3 minutes it is necessary to check after 5–20 minutes (to identify delayed PH).^{14,15} If the patient is unable to stand up, tilt testing can be done to check PH. The heart rate response to postural change can provide important information about the cause of PH. A minimal change in heart rate (<15 bpm) following a change from

a supine to a standing posture in the presence of hypotension indicates baroreceptor reflex impairment, whereas tachycardia (>15 bpm) indicates volume depletion. With aging, baroreceptor sensitivity is impaired, so the absence of cardioacceleration does not rule out volume depletion in an older patient.¹⁶ Postural hypotension is more likely to be present and reproducible in the morning before breakfast than during the rest of the day,^{7,17,18} so it is preferable to evaluate for PH in the morning. Passive head-up tilt testing should be considered for individuals who have had postural symptoms but for whom standing test results were negative or for individuals who have motor impairment, such as those with Parkinson’s disease, spinal cord lesions, or Multiple System Atrophy.¹⁹ Thus, a diagnosis of PH requires repeated blood pressure measurements under standardized conditions.

Postural hypotension can produce symptoms such as fatigue, lightheadedness, falls, visual blurring, syncope, transient ischemic attack (TIA), neck, lower back pain, calf claudication and angina pectoris. The Orthostatic Grading Scale is a five-item brief self-report scale that inquires about symptoms of orthostatic intolerance due to orthostatic hypotension.²⁰ Clinically differentiating acute (reversible) versus chronic (nonreversible) causes is important and can help in the evaluation and management.¹⁶ Medications, deconditioning, and dehydration are the important reversible causes. In chronic PH, a primary or secondary cause should be sought. Primary causes involve autonomic dysfunction and result in altered hemodynamics with posture, whereas secondary causes usually involve an underlying disease other than autonomic dysfunction. Diabetes and Parkinson’s disease are the major secondary causes (Table 1).

Examination of the cardiovascular and neurological systems helps to identify causes such as venous insufficiency, varicose veins, arrhythmia, congestive heart failure, aortic stenosis, autonomic insufficiency, stroke, and Parkinson’s

Table 1: Causes of Postural and Postprandial Hypotension

Postural Hypotension	Postprandial Hypotension
Acute:	
Medications: alpha blockers, nitrates, tricyclic antidepressants, dopamine agonists, diuretics	Autonomic insufficiency Diabetes mellitus Hypertension
Dehydration	Parkinson’s disease
Prolonged bed rest or deconditioning	Chronic renal failure/dialysis
Chronic:	
Autonomic insufficiency	
Diabetes mellitus	
Parkinson’s disease	
Hypertension	
Chronic renal failure/dialysis	
Aortic stenosis	
Varicose veins	

disease that contribute to PH. Based on examination results, the following tests may be done as needed: blood urea/creatinine levels, blood glucose level, HbA1c, complete blood count, electrocardiography, echocardiography, and computed tomography or magnetic resonance imaging of the head to exclude conditions such as Multiple System Atrophy.

**Management
Nonpharmacological Treatment**

Lifestyle modifications, such as avoiding sudden postural changes and sitting on the edge of the bed for 5 minutes before standing, calf muscle exercises, drinking 2 litres of fluids per day, avoiding hot environments, raising the head of the bed to 15–20 degrees, and using elastic compression stockings are some of the nonpharmacological measures that are helpful in the management of PH (Table 2).¹⁶ Educating the patient and caregivers about these measures is important.

Pharmacological Treatment

Changing, stopping, or decreasing the dose of offending medications that cause PH is a first step in management. In a study on withdrawing medications

in a syncope clinic, the investigators showed that 35% of persons who had a principal diagnosis of orthostatic hypotension and for whom medications were stopped experienced symptom improvement after medication cessation.²¹ If individuals have symptomatic and reproducible PH, they probably require pharmacological management. Medications such as fludrocortisone, midodrine, erythropoietin, and pyridostigmine may be tried. Among these, midodrine hydrochloride has been shown to be effective in a double-blinded crossover trial²² and pyridostigmine in a recent double-blinded randomized crossover study.²³ Midodrine may worsen supine hypertension, whereas the study with pyridostigmine showed no worsening of supine hypertension. Not enough data are available to characterize the consequences of chronic administration of pyridostigmine, so further studies are needed before considering using it clinically over a long time. Dihydroxyphenylserine (DOPS) is a prodrug that is converted to noradrenaline by dopadecarboxylase. Dihydroxyphenylserine improved PH symptoms among individuals assigned to hemodialysis²⁴ and among those with Multiple System

Table 2: Nonpharmacological Management of Postural and Postprandial Hypotension

Postural hypotension

- Drinking 1.5–2 L of fluids
- Avoiding excess alcohol use
- Incorporating more salt in the diet if there are no contraindications
- When waking up in the morning, sitting for 5 minutes at bed before standing up
- Sleeping with the head of the bed elevated 15–20 degrees
- Wearing compression stockings
- Performing leg crossing and calf muscle exercises

Postprandial hypotension

- Avoid alcohol before and after meals
- Eating frequent small meals and avoiding large meals
- Walking after meals
- Wearing abdominal binders

Atrophy and pure autonomic failure.²⁵ In individuals with anemia, erythropoietin can be tried.²⁶

Goals of pharmacological management include decreasing symptoms, increasing standing time, and targeting standing blood pressure or decreasing in blood pressure drop upon standing. If normal standing blood pressure cannot be achieved for some individuals, then treatment should aim for the standing blood pressure, which could preserve the function and quality of life for those individuals.

Postprandial Hypotension

Postprandial hypotension (PPH) is a condition in which there is a systolic blood pressure drop of 20 mm Hg in a supine/sitting position within 120 minutes after eating a meal.^{27,28} PPH occurs more often than PH, and infrequently together with PH, among older adults.²⁹ In their study of 85 frail hospitalized older adults, Vloet *et al.* found that 67% had PPH and 52% had PH.¹ Studies from long-term care facilities had shown the prevalence of PPH at 24–36%.^{30,31}

Splanchnic dilatation after a meal is the most important factor for PPH.³² Sympathetic activity after a meal should increase two to three times to prevent PPH.³³ An inadequate postprandial increase in cardiac output can be due to an impairment of baroreflex function and

inadequate compensation of the sympathetic nervous system.²⁸ An increased release of vasodilatory gastrointestinal peptide-like calcitonin gene-related peptide (CGRP) may play a role in the pathogenesis of PPH.³⁴ PPH is also related to the rate of glucose entry into the duodenum.³⁵ PPH is seen more commonly in among individuals with diabetes,³⁶ hypertension,³⁷ with Parkinson's disease,³⁸ and those assigned to dialysis (see Table 1).³⁹

Blood pressure should be checked before the meal in the lying position after 5 minutes of rest. Blood pressure should be checked at 15, 30, 60, 75, 90, and 120 minutes in the lying position. In 15% of individuals with PPH, the blood pressure drop is seen 15 minutes after eating; in 70%, it is seen within 30–60 minutes. In the remaining 15%, the blood pressure drop is seen 75–120 minutes after eating. A higher prevalence of PPH is seen after breakfast; therefore, the evaluation of PPH is preferable before and after breakfast.^{40,41} Ambulatory blood pressure monitoring is helpful in diagnosing PPH.⁴² The symptoms associated with PPH include sleepiness, nausea, headache, TIA, and chest pain.¹

Management

Nonpharmacological Treatment

The patient should be informed about the risk of falling and of syncope within

15–120 minutes after taking meals. Alcoholic beverages should be avoided before and after meals. Meal size and composition should be adjusted and frequent small meals encouraged.⁴³ Walking exercise after a meal may help to reduce PPH.⁴⁴ Abdominal binders may also help to reduce meal-induced hypotension (see Table 2).

Pharmacological Treatment

Caffeine helps to reduce the postprandial drop in blood pressure through an effect on the adenosine receptor. Similarly alpha-glucosidase inhibitors such as acarbose and voglibose have been helpful in treating PPH in individuals with diabetes.

By releasing glucagon-like peptides, these medications slow gastric emptying and prevent vasodilatory gastrointestinal peptide-like neurotensin (see Table 3).^{36,45}

Chronic Disease and Its Effects on Postural and Postprandial Blood Pressure Changes

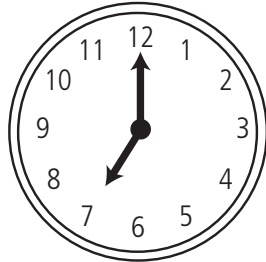
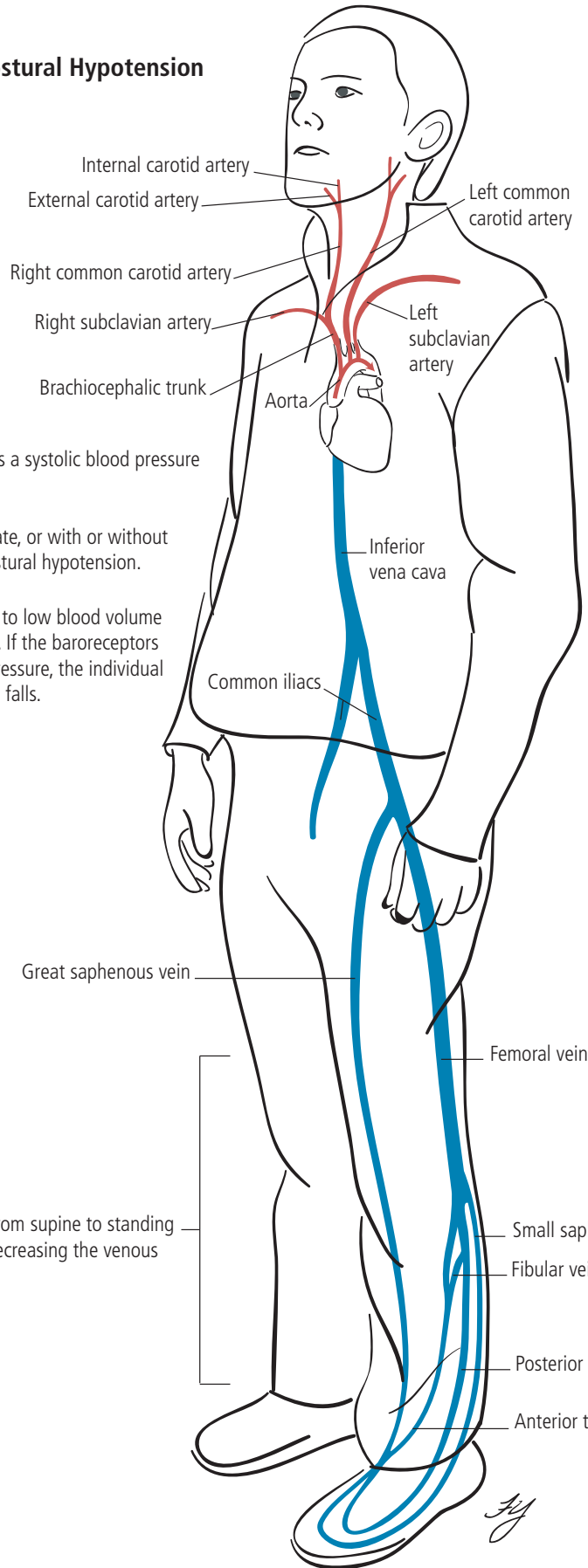
Hypertension

Postural Hypotension with Hypertension

The Epicardian study pointed out that among older adults with adequate control of hypertension, the prevalence of PH is low.⁴⁶ Another prospective study of older adults with hypertension has demonstrated an improvement in postural blood pressure changes with antihypertensive medications.⁴⁷

Vasodilators (alpha-adrenoceptor antagonists), diuretics, and certain calcium channel blockers such as nifedipine can exacerbate postural blood pressure changes, whereas beta-blockers with intrinsic sympathomimetic activity, angiotensin-converting enzyme inhibitors, and angiotensin-receptor antagonists are less likely to worsen postural changes.⁴⁸ For individuals who experience PH with hypertension, management should aim for adequate treatment of hypertension and avoidance of antihypertensive medications that cause PH.

Figure 1: Clinical Signs of Postural Hypotension



Testing for signs of postural hypotension is best seen in the morning before breakfast.

Vascular stiffness with age can limit the responsiveness of the baroreceptors.

Within 3 minutes of standing, if there is a systolic blood pressure drop ≥ 20 mm Hg, or a diastolic blood pressure drop ≥ 10 mm Hg, with or without an increase in heart or pulse rate, or with or without symptoms, the individual may have postural hypotension.

The prevalence of baroreflex sensitivity to low blood volume and cardiac output decreases with age. If the baroreceptors are not triggered to normalize blood pressure, the individual may experience dizziness, syncope, and falls.

When an individual changes position from supine to standing blood pools in the lower extremities, decreasing the venous blood volume returning to the heart.

Postural and Postprandial Hypotension

Postprandial Hypotension with Hypertension

Studies have shown that the occurrence of PPH is seen among individuals with systolic hypertension.^{37,49} In essential hypertensive patients, PPH is also associated with asymptomatic cerebrovascular damage.⁵⁰ Adequate treatment of hypertension and avoidance of diuretics and nitrates can help to reduce the postprandial blood pressure drop.

Diabetes

Diabetic autonomic neuropathy can cause PH and PPH. One study found that the overall prevalence of PH was 1% in all diabetics and 23% in patients with autonomic neuropathy.⁵¹ The prevalence of PPH was 30–40% in those with type 2 diabetes. In more than 10% of persons with long-term type 2 diabetes mellitus, PPH and PH can coex-

ist.³⁶ Strict diabetic control has been shown to improve diabetic autonomic neuropathy,⁵² which, in turn, may improve PH and PPH. Subcutaneous recombinant human erythropoietin 25 IU/kg body weight three times weekly with 300 mg daily of oral ferrous sulfate has been shown to have some benefit in the treatment of PH in patients with diabetic autonomic neuropathy with normochromic, normocytic anemia.^{53,54} Alpha-glucosidase inhibitors such as acarbose and voglibose have been helpful to treat PPH in individuals with diabetes.^{36,45}

Chronic Renal Disease Requiring Dialysis

Postdialytic PH is seen among hemodialysis patients.³⁹ One study showed that an inflatable abdominal band helped to improve postdialytic PH.⁵⁵ L-DOPS

helps to treat PH,²⁴ and in anemic hemodialysis patients, erythropoietin can be useful to treat PH. Postprandial hypotension is seen commonly with the intake of food during dialysis.⁵⁶

Parkinson's Disease

Postural hypotension was found in 11–25% and PPH in 40–54% of individuals with Parkinson's disease.^{38,57} Levodopa and dopaminergic agonists can cause PH. Dopamine agonist therapy can cause acute PH.⁵⁸ A small study showed that levodopa therapy did not worsen PH or PPH occurring in older adults with Parkinson's disease.⁵⁹ Postural hypotension that is associated with a significant increase in heart rate is likely due to an anti-parkinsonian drug, whereas PH without a significant heart rate increase is probably due to autonomic failure due to Parkinson's disease.

Table 3: Pharmacological Management of Postural and Postprandial Hypotension

Drug	Mechanism of Action	Dose	Side Effects
Postural hypotension			
Fludrocortisone	Increases blood volume	0.1–0.6 mg/d	Edema, hypokalemia, heart failure
Midodrine	Vasoconstrictor	2.5–10 mg t.i.d.	Supine hypertension, dysuria, pruritus
Erythropoietin	Increases blood volume	25 IU/kg body weight, three times weekly	Hypertension, thrombosis
Pyridostigmine	Cholinergic	60 mg/d	Diarrhea, abdominal pain
L-DOPS	Adrenergic	400 mg/d	Hypertension, headache, neuroleptic malignant syndrome
Postprandial hypotension			
Caffeine	Adenosine receptor antagonist	250 mg/d (2 cups/d), 30 min before meals	Diarrhea, tremor, sleep disorders, tachycardia
Octreotide	Somatostatin analogue	25–50 µg, 30 min before meal	Diarrhea, nausea, alopecia
Acarbose	Alpha-glucosidase inhibitor, improves gastrointestinal mobility	25–100 mg t.i.d.	Abdominal pain, diarrhea, flatulence
Voglibose	Alpha-glucosidase inhibitor, improves gastrointestinal mobility	0.2–0.5 mg t.i.d.	Abdominal pain, diarrhea, flatulence

Caution: Physicians/Health Professionals are suggested to check Canadian Drug Reference for Health Professionals or appropriate resources for detailed information about these medications, side effect profile, and appropriate doses in different conditions.

Outcomes

Falls and Syncope

In a study of older adults with a mean age of 80 years, PPH was significantly higher in the syncope/falls group than in the control group (23 versus 9%; $p = .03$).⁴² In another study, half of the older adults with unexplained syncope had PPH.⁶⁰ In long-term care residents with recurrent falls, PH was associated with a twofold increase in subsequent falls.⁶¹ In a randomized study on the value of assessing falls, the investigators found that PH was the primary cause in 16% of subjects and a contributing cause in 26%.⁶²

Conclusion

Postural and postprandial hypotension are commonly seen among frail older adults and accompany the different medical conditions commonly seen in this population. Hence, the measurement of blood pressure with change in position and after meals should be part of the assessment for all older adults. Because of the common mechanisms of these conditions, there is a possibility of them occurring together. Both PH and PPH are independent predictors of all-cause mortality in older adults.^{63,64} Appropriate management of these conditions can reduce the risk of morbidity (syncope, falls, decreased function) and mortality.



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Key Points

Postural hypotension (PH) and postprandial hypotension (PPH) are common clinical disorders among the older population and should be considered in the etiology of falls, syncope, and dizziness or in persons who have cerebral or cardiac ischemic symptoms.

Studies have shown that both PH and PPH are independent predictors of all-cause mortality in older adults.

Symptoms of PH include fatigue, lightheadedness, falls, visual blurring, syncope, transient ischemic attack, neck and lower back pain, calf claudication, and angina pectoris.

Changing, stopping, or decreasing the dose of offending medications that cause PH is a first step in management.

PPH, is a condition in which there is a systolic blood pressure drop of 20 mm Hg in a supine position within 120 minutes after eating a meal, occurs more often than PH among older adults.

Among older adults with adequate control of hypertension, the prevalence of PH is low.

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Postural and Postrandial Hypotension

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