ORIGINAL INVESTIGATION

Orthostatic Hypotension in Acute Geriatric Ward

Is It a Consistent Finding?

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Background: Orthostatic hypotension (OH) is a common finding among older patients. We designed a study to examine the prevalence and consistency of OH during the day.

Methods: A total of 502 inpatients (241 men and 261 women) with a mean age of 81.6 years were included in the study. Orthostatic tests were performed 3 times during the day, 30 minutes after meals. In 13 patients only 2 sets of measurements were obtained, and they were omitted from some of the calculations. Orthostatic hypotension was defined as a fall of at least 20 mm Hg in systolic blood pressure and/or 10 mm Hg in diastolic blood pressure on assuming an upright posture.

Results: Three hundred thirty-two (67.9%) of 489 patients experienced OH at least once during the day. Of these, 170 patients (34.8% of the 489) had OH at least twice (persistent OH) and 162 patients (33.1%) experienced OH only once (variable OH). Diastolic OH was more prevalent than systolic OH (57.3% vs 43.4%; $P<.001$). The intraindividual consistency of OH was low ($\kappa=0.2$). Orthostatic hypotension was observed less frequently during the evening than during the morning and afternoon ($P<.05$ vs morning and $P=.003$ vs afternoon). The difference between meals' constituents (light vs heavy meals) did not affect the prevalence of OH.

Conclusions: Orthostatic hypotension is very common in the elderly, and diastolic OH is more common than systolic OH. The prevalence of OH is the lowest during the evening, and meals do not increase the prevalence of OH. The intraindividual consistency of OH during the day is poor. Thus, in elderly patients, more attention should be paid to diastolic OH and the diagnosis should be based on repeated measurements.

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ORTHOSTATIC hypotension (OH) is a relatively common finding among the elderly, occurring in 5% to 50% of those patients.[1-13] Because of age-related physiologic changes in the cardiovascular system and a blunted response to the recruitment of the sympathetic system, older people tend to be more vulnerable to orthostatic stress than younger ones.[5] Some conditions, such as hypertension, diabetes mellitus, low blood volume, and use of medications, may even further impair the ability of the elderly to cope with this stress.[5,7,10,14-16]

Patients with OH have difficulties walking,[8,17] are more susceptible to falls, with their consequences[17-22]; experience more frequent dizziness and syncope[4,5,23-27]; tend to develop coronary events and transient ischemic attacks or strokes[6,8,28,29]; have poor prognosis if they are diabetic and hypertensive[6]; have decreased quality of life[30,31]; and might have a higher mortality rate.[11,32] Hence, the diagnosis of OH is important for the treatment of elderly patients and is based on blood pressure (BP) measurements in both the supine and the upright positions. Several studies evaluated the reproducibility of OH.[33,34] However, data from these studies yielded conflicting results. It remained unclear whether OH is affected by diurnal changes or is consistent throughout the day.

We, therefore, designed a study to determine the consistency of OH in elderly patients throughout the day.

METHODS

STUDY POPULATION

During a 2-year period (January 1, 1999, to December 31, 2000), 1852 patients were admitted to our acute 25-bed geriatric ward. Of these, 502 consecutive patients were enrolled in this study.

Patients were included in the study if they were at least 60 years old, able to get out of bed alone or with minor assistance, and able to stand up for at least 5 minutes. Patients were

Table 1. Patient Characteristics*

Age, mean ± SD (range), y	81.6 ± 7.0 (62-99)
Sex, M/F	241/261
Clinical data, mean ± SD (range)	
BMI, kg/m^2	25.2 ± 4.5 (14.0-42.6)
Supine morning SBP, mm Hg	146.6 ± 24.3 (90-213)
Supine morning DBP, mm Hg	72.0 ± 14.6 (41-140)
Supine morning HR, min	76.9 ± 13.5 (42-150)
Comorbid diseases, No. (%)	
Hypertension	313 (62.4)
Ischemic heart disease	282 (56.2)
Stroke	165 (32.9)
Congestive heart failure	160 (31.9)
Diabetes mellitus	151 (30.1)
Chronic lung disease	121 (24.1)
Parkinson disease	69 (13.7)
Medication use, No. (%)	
Diuretics	175 (34.9)
ACE inhibitors	161 (32.1)
Calcium antagonists	153 (30.5)
Nitrates	134 (26.7)
β-Blockers	86 (17.1)
Sleeping pills	146 (29.1)
Reasons for hospitalizations, No. (%)	
Stroke	119 (23.7)
Infectious disease	90 (17.9)
Weakness	55 (11.0)
Congestive heart failure	26 (5.2)
Syncope	18 (3.6)
Other causes	194 (38.6)

*BMI indicates body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; and ACE, angiotensin-converting enzyme.

excluded from the study if, for medical reasons, they could not stand up temporarily or were permanently bedridden. Patients were studied during their convalescence, 3 days before their planned discharge from the hospital. Since the study did not include any active intervention and included only repeated physical examinations, we obtained only an oral consent from the patients.

BLOOD PRESSURE MEASUREMENTS

Blood pressure and heart rate were measured with a device (Vital Signs Monitor 52 NTP model, Welch Allyn Protocol, Inc, Beaverton, Ore) that was checked every day for accuracy against a mercury sphygmomanometer.

Measurements were taken in the supine and the standing positions 3 times a day, 30 minutes after meals: between 8 and 9 AM after breakfast; between 1 and 2 PM after lunch; and between 5 and 6 PM after dinner. Because of technical problems, in 13 patients only 2 sets of measurements were obtained, and they were omitted from some of the calculations.

The BP was measured in the supine position after at least 5 minutes of complete bed rest, and then after 2 minutes of standing. The cuff was placed on the left arm, which was supported at heart level. To ensure accurate BP recording during standing, particular care was taken to keep the patient's hand extended with support at the heart level. The BP was measured twice, 1 minute apart, in each position and the average of the 2 measurements was recorded.

Orthostatic hypotension was defined as a fall of at least 20 mm Hg in systolic BP (SBP) and/or 10 mm Hg in diastolic BP (DBP) on assuming an upright posture, as suggested by the Consensus Committee of the American Autonomic Society and the American Academy of Neurology.[35] We defined OH according to BP changes and not according to symptoms.

DATA COLLECTION

For each of the patients, the following variables were recorded: age, height, weight, body mass index, ethnicity or origin, reason for admission, diagnoses, and list of the main drugs used.

In addition, laboratory results of complete blood cell count and serum levels of glucose, urea, creatinine, sodium, potassium, thyrotropin, vitamin B_{12}, and folic acid were recorded.

STATISTICAL ANALYSIS

Results are reported as mean ± SD. Patients were divided into 3 groups: *persistent OH* for those who exhibited OH at least twice during the day, *variable OH* for those who exhibited OH only once during the day, and *no OH* for those without OH.

The difference in OH rate between morning, afternoon, and evening was tested by McNemar test. The difference between frequency of systolic and diastolic OH was tested by McNemar test for morning, afternoon, and evening. Test-retest consistency of OH was determined by means of the κ coefficient. To estimate the consistency, we also analyzed whether the orthostatic BP response in the morning could predict the additional responses during the day. We therefore used the χ^2 test to estimate the risk for at least 1 finding of OH in the afternoon or evening among 3 subgroups: those who experienced OH, those who had BP fall in the nonorthostatic range, and those who experienced no orthostatic BP fall in the morning.

The effect of sex on OH was tested in 2 ways. To assess if there was a difference at least 1 time during the day, we used the Mantel-Haenszel test for all 3 times. To find the time of day with the largest difference, we used the χ^2 test for morning, afternoon, and evening separately. Values of $P<.05$ were considered significant.

RESULTS

PATIENTS' CHARACTERISTICS

The study population included 502 patients (241 men and 261 women) with a mean age of 81.6 years. Women had a higher baseline supine SBP than men (150 ± 25/72 ± 15 mm Hg vs 143 ± 23/72 ± 14 mm Hg; $P=.002$) and were less likely than men to be smokers (4.6% vs 32%; $P<.001$). Other baseline characteristics were similar between men and women. Hypertension and ischemic heart disease were the most common underlying diseases, and most patients used diuretics, angiotensin-converting enzyme inhibitors, and calcium antagonists. The main clinical characteristics, drugs used, and reasons for hospitalizations are given in **Table 1**.

PREVALENCE OF OH

Three hundred thirty-two (67.9%) of 489 patients experienced OH at least once per day. Of these, 170 patients (34.8%) had OH at least twice (persistent OH) and 162 patients (33.1%) experienced OH only once (variable OH). Diastolic OH was more prevalent than systolic OH ($P<.05$). Two hundred eighty-eight (57.4%) of 502 patients experienced diastolic OH (DBP decline ≥10 mm Hg) at least

once per day. Among them, 109 patients (21.7%) had persistent diastolic OH and 179 patients (35.7%) had variable diastolic OH. Two hundred eighteen patients (43.4% of 502) experienced systolic OH (SBP decline ≥20 mm Hg) at least once during the day. Among them, 91 patients (18.1% of the total) had persistent systolic OH and 127 patients (25.3%) had variable systolic OH (**Table 2**). The prevalence of persistent OH was unrelated to age and to the reason for admission, whereas it was related to smoking ($P=.02$) and use of antiarrhythmic agents ($P=.01$), α-blockers ($P=.02$), and anticholinergic agents ($P<.001$).

Table 2. Prevalence of Orthostatic Hypotension (OH)

No. of Observations	No. (%) of Patients		
	OH	Systolic OH*	Diastolic OH*
1	162 (33.1)	127 (25.3)	179 (35.7)
2	108 (22.1)	65 (12.9)	77 (15.3)
3	62 (12.7)	26 (5.2)	32 (6.4)

*Systolic OH defined as systolic blood pressure decline ≥20 mm Hg; diastolic OH, diastolic blood pressure decline ≥10 mm Hg.

THE EFFECT OF SEX ON ORTHOSTATIC BP RESPONSE

Supine BP levels were higher in women than in men (**Table 3**; $P<.05$). Orthostatic BP fall was significantly greater in men than in women (Table 3; $P<.05$). During the afternoon, the prevalence of OH was higher in men than in women (**Table 4**; $P<.05$). Adjustment for smoking and use of α-blockers that affect orthostatic BP response eliminated the differences between sexes.

CONSISTENCY OF OH

The intraindividual consistency of OH was low (κ coefficient=0.2). The consistency was poor also for systolic and diastolic OH (κ coefficient=0.29 and 0.16, respectively). However, orthostatic BP response during the morning predicted OH during the day. Among 192 patients who experienced OH in the morning, 135 (70.3%) had persistent OH, whereas among 133 patients with no orthostatic BP fall, only 53 (39.8%) had persistent OH (**Table 5**; $P<.001$).

THE EFFECT OF TIME OF DAY AND LUNCH ON ORTHOSTATIC BP RESPONSE

Supine BP was the lowest during the afternoon (**Table 6**; $P<.001$). Orthostatic BP fall was significantly greater during the afternoon, after lunch (the main, heavy meal of the day), than during the morning and the evening (Table 6; $P<.001$), but the rate of OH in the afternoon was only slightly and not significantly higher than the rate during the morning. Orthostatic hypotension was observed less frequently during the evening than during the morning and afternoon (Table 6; $P<.05$ vs morning and $P=.003$ vs afternoon). Among those who experienced OH in the afternoon, 22.3% had no OH in the evening, whereas among those who experienced OH in the evening, only 14.1% had no OH in the afternoon ($P<.05$).

COMMENT

Orthostatic hypotension is a common disorder in the elderly. In the present study, 34.8% of the patients had persistent OH and 33.1% had variable OH. We studied sick hospitalized patients, and our results may not be applicable to outpatients. However, our patients were studied before their discharge, and the reason for admission had no effect on the prevalence of OH. Therefore, we believe that our findings may represent the prevalence of OH in elderly outpatients as well. The typical elderly outpatient uses multiple drugs that may cause OH. In our study the main drugs that affected the prevalence of OH were antiarrhythmic agents, α-blockers, and anticholinergic agents. The prevalence of OH varies in different studies and has been reported to range from 5% to 50%.[3,5,7-12,24,28,33,34] Ooi et al[33] studied 911 elderly patients in nursing homes. They observed at least 1 episode of OH in 51.5% of the patients and at least 2 episodes of OH in 33.2% of the patients. Puisieux et al[34] observed OH in 48% of 126 elderly inpatients. They obtained 2 sets of BP measurements for each subject, and only 13% had persistent OH. However, they defined OH only according to SBP response, while we defined OH according to either systolic or diastolic fall in BP. We prefer to use either, since a better association between DBP fall and cardiovascular morbidity and mortality has been shown.[11] Moreover, the consensus statement on the definition of OH recommended the use of either a decrease of at least 20 mm Hg in SBP or 10 mm Hg in DBP.[35] When we evaluated the prevalence of systolic OH, we also found a prevalence of OH of 43.1%, and only 18.1% had persistent OH. Several previous studies showed that the prevalence of OH increases with advancing age.[7,8,28] In the Cardiovascular Health Study,[8] the authors found that the prevalence of OH was 14.8% in those aged 65 to 69 years, but increased to 26% in those aged 85 years or older. We did not find a correlation between age and the prevalence of OH. However, our patients were all geriatric patients, with a mean age of 81.6 years (range, 62-99 years); had multiple comorbid conditions; and took multiple medications that may increase the risk of OH.[36,37]

Several studies found a similar prevalence of OH in men and women.[7,11,28] In the present study, men tended to exhibit a higher prevalence of OH than women throughout the day. However, adjustment for smoking and use of α-blockers eliminated the differences between men and women. Therefore, it seems that the prevalence of OH is similar in elderly men and women. Diastolic OH was more prevalent than systolic OH, which is the first time, to our knowledge, such an observation has been made. Luukinen et al[32] observed, in a sample of 792 home-dwelling elderly persons, a lower prevalence of diastolic OH than systolic OH (6% vs 22%). However, they studied home-dwelling persons, while our group consisted of elderly hospitalized patients. Jacob et al[38] found that blood volume is an im-

Table 3. Blood Pressure (BP) and Heart Rate (HR) During the Day by Sex

Time of Day	Mean ± SD Supine BP, mm Hg		Postural BP Changes		Mean ± SD Supine HR, /min		Postural HR Changes	
	Men	Women	Men	Women	Men	Women	Men	Women
Morning	143 ± 23/72 ± 14	150 ± 25/72 ± 15*	–9.7/–2.8	–3.7/–0.6*	75 ± 14	78 ± 13	+10.3	+9.5
Afternoon	139 ± 24/72 ± 14	142 ± 25/69 ± 15	–10.2/–4.9	–5.4/–2.3*	74 ± 13	77 ± 12	+8.8	+9.7
Evening	144 ± 25/72 ± 16	150 ± 26/74 ± 16*	–4.9/–0.4	+0.5/+1.9*	74 ± 12	77 ± 13	+7.3	+8.5

*$P<.05$ vs men.

Table 4. Rates of Orthostatic Hypotension (OH) by Sex

Time of Day	No. (%) of Patients					
	OH		Systolic OH		Diastolic OH	
	Men	Women	Men	Women	Men	Women
Morning	102 (42.3)	95 (36.4)	67 (27.9)	53 (20.3)	76 (31.5)	69 (26.4)
Afternoon	111 (46.4)	97 (37.7)*	70 (29.3)	57 (22.2)	86 (36.0)	71 (27.6)
Evening	88 (36.8)	78 (30.9)	50 (20.9)	38 (15.1)	64 (26.8)	58 (23.0)

*$P<.05$ vs men.

Table 5. Morning Blood Pressure (BP) Response as a Predictor of Orthostatic Hypotension (OH) During the Day

BP Response During the Morning	No. (%) of Patients	
	OH on 1 Additional Measurement	OH on All Measurements
OH (n = 192)	73 (38.0)	62 (32.3)
BP fall in the nonorthostatic range (n = 164)	63 (38.4)	24 (14.6)
No orthostatic BP fall (n = 133)	42 (31.6)	11 (8.3)

Table 6. Postural Response and Rate of Orthostatic Hypotension (OH) During the Day

Time of Day	Mean ± SD Supine BP, mm Hg	Postural BP Change	No. (%) of Patients		
			OH	Systolic OH	Diastolic OH
Morning	147 ± 24/72 ± 14	–6.6/–1.7	197 (39.2)	120 (23.9)	145 (28.9)
Afternoon	141 ± 24/70 ± 14*	–7.7/–3.6*	208 (41.9)	127 (25.2)	157 (31.3)
Evening	147 ± 25/73 ± 16	–2.1/+0.8	166 (33.8)†	88 (17.6)†	122 (24.4)†

*$P<.05$ vs morning and evening.
†$P = .003$ vs afternoon, $P<.05$ vs morning.

portant component in the regulation of postural changes in DBP. Patients with contracted blood volumes and hyperadrenergic states tended to have an increase in DBP while standing. It is possible that our patients had well-balanced blood volume and had low adrenergic tone and therefore exhibited a high prevalence of diastolic OH. Alternatively, it is possible that elderly sick patients have reduced arterial sensitivity to the compensatory effect of the sympathetic nervous system. Indeed, diastolic OH was not associated with symptoms, but since diastolic OH may better predict vascular death than systolic OH,[32] and since this phenomenon is common in the elderly, we suggest that there should be greater focus on postural diastolic BP changes.

Since OH is common and may explain symptoms of dizziness and recurrent falls, it is important to assess the consistency of this finding. Several studies found poor day-to-day reproducibility of the diagnosis of OH.[14,39-42] In the present study, we found that the intraindividual consistency during the day is relatively poor, as the κ values were quite low. This poor consistency may be due to the multiple medications used by the studied population. Recently, Puisieux et al[34] also found, in a small group of patients, remarkable within-day variability in postural BP change. Unlike our findings, Youde et al[43]

found consistency in postural changes in BP within days and across days. However, they studied only a small group of 22 relatively healthy and not very old patients. Despite the relatively poor consistency, our results showed that the postural BP changes in the morning could predict, to some extent, the response during the rest of the day. Among those with OH in the morning, 70% had persistent OH (at least 1 additional OH during the day), whereas among those with no BP fall in the morning, only 39.8% had persistent OH.

Because older subjects tend to have lower BP after food intake,[44-47] we assumed that OH might be more prevalent after lunch. We therefore compared the postural BP response in the early afternoon shortly after lunch with the response in the morning and evening. Supine BP was lower and the postural BP fall was more remarkable after lunch, but the prevalence of OH was the same as in the morning. Thus, the main meal lowered BP and accentuated the postural drop in BP, but the magnitude of the BP drop was mild and did not increase the rate of OH. Other investigators also failed to show increased prevalence of OH after a meal.[13,34] Other possible causes, in addition to food intake, for the large within-day variability may be related to drug intake or diurnal hormonal changes.

Ooi et al[33] and Puisieux et al[34] found that OH was more prevalent in the morning before breakfast than during the rest of the day. We found that OH was less prevalent during the evening. During the evening, supine BP was similar to that of the morning, but the postural drop in BP and the prevalence of OH were significantly less in comparison with the findings during the morning and afternoon. This observation cannot be explained by diurnal hormonal variation, since the elevated morning levels of catecholamines and corticotropin should increase BP levels and prevent postural BP drop. Thus, some other factors should play a role in the diurnal variability of OH. Sodium reabsorption is important to maintain BP levels and prevent OH. Circadian variations in renal sodium handling may contribute to the variability of the orthostatic syndrome, as suggested by Pechere-Bertschi et al.[48] Alternatively, slow adaptive mechanisms such as increased muscle tone after activities throughout the day may increase the "pumping up" of venous blood toward the heart, thereby attenuating postural BP fall.[49,50]

In conclusion, we found that OH is very common in the elderly and that diastolic OH is more common than systolic OH. The intraindividual consistency of OH during the day is poor, even though morning OH can, to some extent, predict subsequent responses during the day. Lunch slightly accentuates the postural fall in BP, but not the prevalence of OH. The prevalence of OH is the lowest during evening. Thus, more attention should be paid to diastolic OH and the diagnosis should be based on repeated measurements during the day.

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REFERENCES

1. Caird FI, Andrews GR, Kennedy RD. Effect of posture on blood pressure in the elderly. *Br Heart J*. 1973;35:527-530.
2. Mader SL, Josephson KR, Rubenstein LZ. Low prevalence of postural hypotension among community-dwelling elderly. *JAMA*. 1987;258:1511-1514.
3. Palmer KT. Studies into postural hypotension in elderly patients. *N Z Med J*. 1983; 96:43-45.
4. Mader SL, Palmer RM, Rubenstein LZ. Effect of timing and number of baseline blood pressure determinations on postural blood pressure response. *J Am Geriatr Soc*. 1989;37:444-446.
5. Lipsitz LA. Orthostatic hypotension in the elderly. *N Engl J Med*. 1989;321:952-957.
6. Davis BR, Langford HG, Blaufox MD, Curb JD, Polk BF, Shulman NB. The association of postural changes in systolic blood pressure and mortality in persons with hypertension: the Hypertension Detection and Follow-up Program experience. *Circulation*. 1987;75:340-346.
7. Harris T, Lipsitz LA, Kleinman JC, Cornoni-Huntley J. Postural change in blood pressure associated with age and systolic blood pressure: the National Health and Nutrition Examination Survey II. *J Gerontol*. 1991;46:M159-M163.
8. Rutan GH, Hermanson B, Bild DE, Kittner SJ, LaBaw F, Tell GS, for the CHS Collaborative Research Group. Orthostatic hypotension in older adults: the Cardiovascular Health Study. *Hypertension*. 1992;19:508-519.
9. Applegate WB, Davis BR, Black HR, Smith WM, Miller ST, Burlando AJ. Prevalence of postural hypotension at baseline in the Systolic Hypertension in the Elderly Program (SHEP) cohort. *J Am Geriatr Soc*. 1991;39:1057-1064.
10. Burke V, Beilin LJ, German R, et al. Postural fall in blood pressure in the elderly in relation to drug treatment and other lifestyle factors. *Q J Med*. 1992;84:583-591.
11. Raiha I, Luutonen S, Piha J, Seppanen A, Toikka T, Sourander L. Prevalence, predisposing factors, and prognostic importance of postural hypotension. *Arch Intern Med*. 1995;155:930-935.
12. Tilvis RS, Hakala SM, Valvanne J, Erkinjuntti T. Postural hypotension and dizziness in a general aged population: a four-year follow-up of the Helsinki Aging Study. *J Am Geriatr Soc*. 1996;44:809-814.
13. Ooi WL, Hossain M, Lipsitz LA. The association between orthostatic hypotension and recurrent falls in nursing home residents. *Am J Med*. 2000;108:106-111.
14. Lipsitz LA, Storch HA, Minaker KL, Rowe JW. Intra-individual variability in postural blood pressure in the elderly. *Clin Sci*. 1985;69:337-341.
15. Hosking DJ, Bennett T, Hampton JR. Diabetic autonomic neuropathy. *Diabetes*. 1978;27:1043-1055.
16. Clarke BF, Ewing DJ, Campbell IW. Diabetic autonomic neuropathy. *Diabetologia*. 1979;17:195-212.
17. Rubenstein LZ, Robbins AS. Falls in the elderly: a clinical perspective. *Geriatrics*. 1984;39:67-71, 75-76, 78.
18. Tinetti ME, Williams TF, Mayewski R. Fall risk index for elderly patients based on number of chronic disabilities. *Am J Med*. 1986;80:429-434.
19. Lipsitz LA, Pluchino FC, Wei JY, Rowe JW. Syncope in institutionalized elderly: the impact of multiple pathological conditions and situational stress. *J Chronic Dis*. 1986;39:619-630.
20. Jonsson PV, Lipsitz LA, Kelley M, Koestner J. Hypotensive responses to common daily activities in institutionalized elderly: a potential risk for recurrent falls. *Arch Intern Med*. 1990;150:1518-1524.
21. Schatz IJ. Orthostatic hypotension, I: functional and neurogenic causes. *Arch Intern Med*. 1984;144:773-777.
22. Hines S, Houston M, Robertson D. The clinical spectrum of autonomic dysfunction. *Am J Med*. 1981;70:1091-1096.
23. Mader SL. Orthostatic hypotension. *Med Clin North Am*. 1989;73:1337-1349.
24. Mader SL. Aging and postural hypotension: an update. *J Am Geriatr Soc*. 1989; 37:129-137.
25. Kapoor WN. Syncope in older persons. *J Am Geriatr Soc*. 1994;42:426-436.
26. King MB, Tinetti ME. Falls in community-dwelling older persons. *J Am Geriatr Soc*. 1995;43:1146-1154.
27. Mathias CJ. Orthostatic hypotension: causes, mechanisms, and influencing factors. *Neurology*. 1995;4(suppl):S6-S11.
28. Rose KM, Tyroler HA, Nardo CJ, et al. Orthostatic hypotension and the incidence of coronary heart disease: the Atherosclerosis Risk in Communities study. *Am J Hypertens*. 2000;13:571-578.
29. Eigenbrodt ML, Rose KM, Couper DJ, Arnett DK, Smith R, Jones D. Orthostatic hypotension as a risk factor for stroke: the Atherosclerosis Risk in Communities (ARIC) study, 1987-1996. *Stroke*. 2000;31:2307-2313.
30. Carlson JE. Assessment of orthostatic blood pressure: measurement technique and clinical applications. *South Med J*. 1999;92:167-173.

31. Abe H, Numata T, Hanada H, Kohshi K, Nakashima Y. Successful treatment of severe orthostatic hypotension with cardiac tachypacing in dual chamber pacemakers. *Pacing Clin Electrophysiol*. 2000;23:137-139.
32. Luukinen H, Koski K, Laippala P, Kivela SL. Prognosis of diastolic and systolic orthostatic hypotension in older persons. *Arch Intern Med*. 1999;159:273-280.
33. Ooi WL, Barrett S, Hossain M, Kelley-Gagnon M, Lipsitz LA. Patterns of orthostatic blood pressure change and their clinical correlates in a frail, elderly population. *JAMA*. 1997;277:1299-1304.
34. Puisieux F, Boumbar Y, Bulckaen H, Bonnin E, Houssin F, Dewailly P. Intraindividual variability in orthostatic blood pressure changes among older adults: the influence of meals. *J Am Geriatr Soc*. 1999;47:1332-1336.
35. Consensus Committee of the American Autonomic Society and the American Academy of Neurology. Consensus statement on the definition of orthostatic hypotension, pure autonomic failure, and multiple system atrophy. *Neurology*. 1996;46:1470.
36. Tonkin A, Wing L. Aging and susceptibility to drug-induced orthostatic hypotension. *Clin Pharmacol Ther*. 1992;52:277-285.
37. Fotherby MD, Iqbal P. Antihypertensive therapy and orthostatic responses in elderly hospital in-patients. *J Hum Hypertens*. 1997;11:291-294.
38. Jacob G, Biaggioni I, Mosqueda-Garcia R, Robertson RM, Robertson D. Relation of blood volume and blood pressure in orthostatic intolerance. *Am J Med Sci*. 1998;315:95-100.
39. Belmin J, Abderrhamane M, Medjahed S, et al. Variability of blood pressure response to orthostatism and reproducibility of the diagnosis of orthostatic hypotension in elderly subjects. *J Gerontol A Biol Sci Med Sci*. 2000;55:M667-M671.
40. Alli C, Avanzini F, Bettelli G, et al, for the Gruppo di Studio Sulla Pressione Arteriosa nell'Anziano. Prevalence and variability of orthostatic hypotension in the elderly: results of the "Italian Study on Blood Pressure in the Elderly (SPAA)." *Eur Heart J*. 1992;13:178-182.
41. Jansen RW, Kelly-Gagnon MM, Lipsitz LA. Intraindividual reproducibility of postprandial and orthostatic blood pressure changes in older nursing-home patients: relationship with chronic use of cardiovascular medications. *J Am Geriatr Soc*. 1996;44:383-389.
42. Ward C, Kenny RA. Reproducibility of orthostatic hypotension in symptomatic elderly. *Am J Med*. 1996;100:418-422.
43. Youde JH, Manktelow B, Ward-Close S, Potter JF. Measuring postural changes in blood pressure in the healthy elderly. *Blood Press Monit*. 1999;4:1-5.
44. Loew F, Gauthey L, Koerffy A, et al. Postprandial hypotension and orthostatic blood pressure responses in elderly Parkinson's disease patients. *J Hypertens*. 1995;13:1291-1297.
45. Lipsitz LA, Nyquist RP Jr, Wei JY, Rowe JW. Postprandial reduction in blood pressure in the elderly. *N Engl J Med*. 1983;309:81-83.
46. Jansen RW, Lipsitz LA. Postprandial hypotension: epidemiology, pathophysiology, and clinical management. *Ann Intern Med*. 1995;122:286-295.
47. Jansen RW, Connelly CM, Kelley-Gagnon MM, Parker JA, Lipsitz LA. Postprandial hypotension in elderly patients with unexplained syncope. *Arch Intern Med*. 1995;155:945-952.
48. Pechere-Bertschi A, Nussberger J, Biollaz J, et al. Circadian variations of renal sodium handling in patients with orthostatic hypotension. *Kidney Int*. 1998;54:1276-1282.
49. Zhang LF, Zheng J, Wang SY, Zhang ZY, Liu C. Effect of aerobic training on orthostatic tolerance, circulatory response, and heart rate dynamics. *Aviat Space Environ Med*. 1999;70:975-982.
50. Brilla LR, Stephens AB, Knutzen KM, Caine D. Effect of strength training on orthostatic hypotension in older adults. *J Cardiopulm Rehabil*. 1998;18:295-300.

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With the January 2003 issue, the *Archives of Internal Medicine* will introduce photographs as cover art for the journal. Do you have a scenic photograph you have taken that you think would make a great cover shot? Submissions should be from our readers, reviewers, and authors, and must be formatted horizontally. They should be in color and at least 3.5 × 5 in but no larger than 8 × 10 in. Due to legal concerns, no recognizable people should appear in the picture. Please include your name and address and where the picture was taken. Send submissions to *Archives of Internal Medicine*, 1840 E River Rd, Suite 207, Tucson, AZ 85718. Cover photos will be chosen at the discretion of the ARCHIVES editorial staff. We look forward to seeing your photo on the cover of a future issue of the ARCHIVES!

James E. Dalen, MD, MPH
Editor