A study of postural hypotension in a Chinese elderly outpatient population: are there really associated risk factors?

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Postural hypotension is reported to be a common finding in elderly patients with prevalence rates from 10% to 30% having been reported. Proposed risk factors for the development of postural hypotension in the elderly include a number of medical conditions and medications. However, little is known about Chinese populations. From July 1995 through November 1995, we conducted a cross-sectional study on a group of 400 elderly patients (>65 years) in a geriatric outpatient department. Nearly 23% experienced a drop of 20 mmHg or more in systolic blood pressure on going from a supine to standing position. The fall did not correlate well with known risk factors such as use of anti-hypertensive drugs, hypnotics, diabetes mellitus, parkinsonism, and history of a fall. No significant factors were found to be associated with postural hypotension. Our data suggest that the change is idiopathic and does not result in any significant clinical outcome such as falls, syncope, and dizziness.

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Introduction

Postural hypotension (PH) is reported to be a common finding in elderly patients[1] with prevalence rates from 10% to 33% having been reported in several large studies.[2-4]

Postural hypotension is most commonly defined as a decrease in systolic blood pressure from the lying position to the upright position of 20 mmHg or more after one to three minutes on standing.[5] It is thought to be a common correlate of ageing because of age-related physiological changes, medical conditions, and medications with known hypotensive effects.[6] Postural hypotension detracts from the quality of life of many elderly men and women and may result in lightheadedness on standing, falls and their consequences, syncope, cerebrovascular accident, and myocardial infarction.[7-9] These factors make this disorder an important clinical problem in geriatrics.

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Given the known changes in ageing physiology, PH is thought to be more common in the elderly than in the young. With ageing, there is a decline in baroreceptor sensitivity to hypotensive stress and a decrease in the compliance of arteries,[10] both of which make the elderly more susceptible to PH.

On the other hand, with advancing age, circulating noradrenaline levels are elevated, the vasodilator response to infused catecholamine is blunted, and the vasoconstrictor response is maintained—all of which are protective against PH.[11] So what is the end result of these two opposing effects? The aim of our study was to establish the prevalence of PH and its associated risk factors in elderly subjects.

Aim

Most studies in the literature have been performed on geriatric patients in Caucasian countries and in healthy populations. Little is known about the Chinese elderly or outpatients receiving medical treatment. The purpose of the present study was to determine the prevalence of PH in a Chinese elderly outpatient population and to study the impact of age and identify any associated risk factors.

Materials and methods

The data for this analysis were collected from a geriatric outpatient department (OPD) in a regional hospital in Hong Kong.

From July 1995 through November 1995, individuals with PH who were older than 65 years and on their first attendance at the geriatric OPD were recruited into the study. Exclusion criteria included: evidence of atrial fibrillation, second- or third-degree heart block, frequent ventricular ectopics, a heart rate less than 50 beats per minute, presence of a permanent pacemaker, or any arrhythmia that affects the Korotkoff sounds.[12] Patients who were bed- or chair-bound and unable to attain a standing position were also excluded.

Information collected in the interview included: age, sex, height, body weight, and the presence of medical conditions such as diabetes mellitus, hypertension, Parkinson's disease, and anaemia. The use of medications, alcohol intake, smoking habits, drinking habits (including coffee or tea intake), and the presence of various symptoms (falls, syncope, postural dizziness, history of fracture) were recorded (Table 1).

Blood pressure was measured by the investigators using a standard Accoson mercury sphygmomanometer (Accoson Co., UK) with an appropriate sized cuff applied to the patient's right arm while resting next to the chest wall. Each individual was supine for at least five minutes before their blood pressure was taken. Systolic blood pressure was recorded as Korotkoff sound I and diastolic pressure as Korotkoff sound V—the disappearance of sound. Each subject was then asked to stand upright without support with the assumption of this position representing time zero. The blood pressure was again measured in the same arm, relaxed at the side, at approximately the same level relative to the heart as was done with the supine measurement. The standing blood pressure reading was taken at one and three minutes after standing. The maximum fall in blood pressure from the lying to standing positions was calculated irrespective of the time, using either the one- or three-minute reading, whichever was lower. Postural hypotension was defined as a decrease in systolic blood pressure of 20 mmHg or more after standing from baseline. Subjects were also asked about any symptoms of postural dizziness during the blood pressure measurements.

Table 1. Table showing patient information collected from study participants

Patient factors recorded	
Demographic data:	Age
	Sex
	Weight in kilograms
	Height in metres
	Body mass index
Lifestyle:	Smoking habits
	Alcohol intake
	Coffee/tea intake (caffeine)
Medical illness:	Diabetes mellitus
	Hypertension
	Parkinson's disease
	Cerebrovascular accident
	Anaemia
	Others
Drug intake:	Anti-hypertensive medication
	Hypnotic/anti-psychotic medication
	Oral hypoglycaemic agents
	Anti-convulsant medication
	Others
Fall-related factors:	History of fall (in the past year)
	Head injury
	Fractures
	Postural dizziness

Statistical analysis

Subjects with PH as defined above were termed the case group and those without PH were the control group. Characteristics and risk factors of the two groups were compared using the Chi-square test for the categorical variables and the unpaired two-tailed Student's *t* test for the continuous variables using the SPSS for Windows (version 6.0). Significant differences were defined at the $P<0.05$ level. Logistic regression was used to examine the multivariate effects of independent variables on PH. The variables were entered with stepwise entry. In the final analysis, all variables with a P value of 0.05 or less were entered after the predisposing variables. These analyses are designed to predict PH. A factor was considered a significant predictor if it was significant (at $P<0.05$) across the range of reliability estimates.

Results

The characteristics of the study population are sum-

marised in Table 2. Four hundred patients were recruited: 165 men (41.2%) and 235 women (58.8%), with ages ranging from 65 to 95 years. The mean age was 73.8 years. Changes in blood pressure varied from -30 to +60 mmHg with a mean blood pressure change of +4.3 mmHg. The distribution of changes in systolic blood pressure is shown in the Figure. Nearly 23% of subjects experienced a change of 20 mmHg or more in response to standing. Hence, the prevalence of PH is 228 in 1000 newly referred outpatients. The magnitude of the PH ranged from 20 mmHg to 60 mmHg, with a mean of 26.5 mmHg.

The group with PH and the control group were compared in terms of age, sex, history of symptoms, history of falls, smoking and drinking habits, the presence of risk factors (diabetes mellitus, hypothyroidism, Parkinson's disease, stroke, anaemia), regular medications (anti-hypertensives, anti-convulsants, hypnotics, anti-psychotics) [Table 3]. No significant relationship between these variables and PH were found.

A fall in the previous year was reported to have occurred in 13% of the entire group. Although the incidence was higher in the group with PH (16.5% vs 12.3%), this was not statistically significant.

Twenty-five per cent of patients reported a history of dizziness on standing. Those with PH reported this more often (33%) than did those without PH, however, this was not significantly different between the two groups. Furthermore, no subjects reported symptoms of postural dizziness when actively standing during the time of examination.

Anti-hypertensive drugs were used by 40% of the entire group but this was not found to be associated with PH. Eleven per cent of the PH group had had a cerebrovascular accident (CVA) while only 6% reported this in the non-PH group. Although CVA was more common in the PH group, the difference was not statistically significant.

Well known risk factors such as diabetes mellitus, hypertension, Parkinson's disease, and the use of certain drugs were not significantly related to PH. There were no significant differences in the history of smoking, drinking, or coffee or tea intake for the subgroups with and without PH.

There is a strong correlation (after adjustment for age) between body mass index (BMI) and diabetes, BMI and use of anti-hypertensives, stroke and use of anti-hypertensives, anaemia and fall, age and BMI, fall and fracture and also smoking with drinking ($P<0.000$). However, none of these are independently predictive of PH. Multiple logistic regression analysis was used to see which of the risk factors such as age, sex, BMI, diabetes, hypertension, Parkinson's disease, stroke, anaemia, smoking and drinking habits, use of medications including oral hypoglycaemic agents, anti-hypertensives, anti-convulsants, hypnotics, and sedatives are predictive of PH. When tested as backward regression analysis, the P value for each of the factors is greater than 0.05. The P val-

Table 2. Demographic differences found between the study and control groups

	Patient demographic characteristics			
	Study group (with PH)*	**Control group (without PH)**	**Total**	**P value**
No. (%)	91 (22.8)	309 (77.3)	400	
Male	36 (39.6)	129 (41.7)	165	
Female	55 (60.4)	180 (58.3)	235	0.69
Mean age ± SD	74.0 ± 6.6	72.9 ± 5.8	73.1 ± 6.0	0.29
Mean BMI† ± SD	23.7 ± 4.2	23.3 ± 4.5	23.6 ± 4.2	0.85

*PH postural hypotension; †BMI body mass index

Table 3. Associations found between patient factors and postural hypotension

Factor	Total	With PH*	Without PH	P value
No. (%)	400	91 (22.8)	309 (77.3)	
Drugs:				
Anti-convulsant	4	0	4 (100.0)	0.27
Anti-hypertensive	160	43 (47.2)	117 (37.8)	0.10
Oral hypoglycaemic agent	68	17 (18.6)	51 (16.5)	0.62
Hypnotic	16	6 (6.5%)	10 (3.2%)	0.14
Lifestyle:				
Smoking	61	15 (4.5)	46 (14.9)	0.70
Alcohol intake	18	2 (2.2)	16 (5.2)	0.22
Coffee/tea intake	105	20 (22.0)	85 (27.5)	0.29
Medical illness:				
Diabetes mellitus	86	22 (24.0)	64 (25.7)	0.47
Hypertension	166	41 (45.1)	125 (40.5)	0.43
Parkinsonism	24	8 (8.8)	16 (5.2)	0.06
Cerebrovascular accident	29	10 (11.0)	19 (6.1)	0.11
Anaemia	15	4 (4.4)	11 (3.6)	0.45
Fall factors:				
Fall (past year)	53	15 (16.5)	38 (12.3)	0.3
Head injury	13	3 (3.3)	10 (3.2)	0.9
Fracture	14	4 (4.4)	10 (3.2)	0.59
Dizziness	101	30 (33.0)	71 (23.0)	0.05

*PH postural hypotension

ues ranged from 0.07 to 0.69. This indicates that none of these variables predicts significantly for the presence of PH.

Discussion

In this study, 21.8% of the men and 23.4% of the women had a fall in systolic blood pressure of at least 20 mmHg when changing from a supine to a standing position. This supports the contention that PH is quite a common finding in the elderly. The overall prevalence is 228 in 1000 newly-referred clinic patients with no sex difference in prevalence.

All blood pressure measurements were taken in the morning OPD session and were preprandial, thus eliminating the factor of blood pressure variation with the time of the day.

Postural hypotension was not found to be statistically related to increasing age after 65 years (Table 4). A comparison of the 'young-old' (65-75 years) and the 'old-old' age groups (>85 years), showed a P value of >0.05. Hence, the prevalence of PH is more or less static after age 65.

In contrast to many who believe that PH is associated with postural dizziness, we found no correlation between the two. This is in agreement with the findings of Mader et al.[13] The reason for this lack of correlation between a postural blood pressure decrease and presence of symptoms on standing is unknown, but there is some evidence to support the notion that symptoms may be due to impaired cerebral blood flow that can occur with or without a postural blood pressure change. In addition to PH and cerebral ischaemia, other mechanisms responsible for dizziness on standing in the elderly include vestibular dysfunction, visual impairment, and disturbances in proprioception.[14] Hence, a clinical symptom is an unreliable means for confirming or excluding PH.

Table 4. Age differences found between the study and control groups

Age (y)	Study group (with PH)*	Control group (without PH)	Total	P value
65-75	58	211	269	
76-85	28	90	118	
>86	5	8	13	
Total	91	309	400	0.25

*PH postural hypotension

Table 5. Regression analysis of the possible patient factors associated with postural hypotension

Factor	Regression coefficient	Standard error	P value
Medical illness:			
Diabetes mellitus	0.48	0.57	0.39
Hypertension	-0.28	0.48	0.55
Parkinsonism	0.91	0.50	0.07
Cerebrovascular accident	0.59	0.44	0.18
Anaemia	0.33	0.62	0.60
Drugs:			
Anti-convulsant	-4.69	11.11	0.67
Anti-hypertensive	0.49	0.47	0.29
Oral hypoglycaemic agent	-0.29	0.62	0.64
Hypnotic	0.51	0.59	0.39
Lifestyle:			
Smoking	0.32	0.36	0.68
Alcohol intake	-0.85	0.80	0.29
Coffee/tea intake	-0.26	0.30	0.39

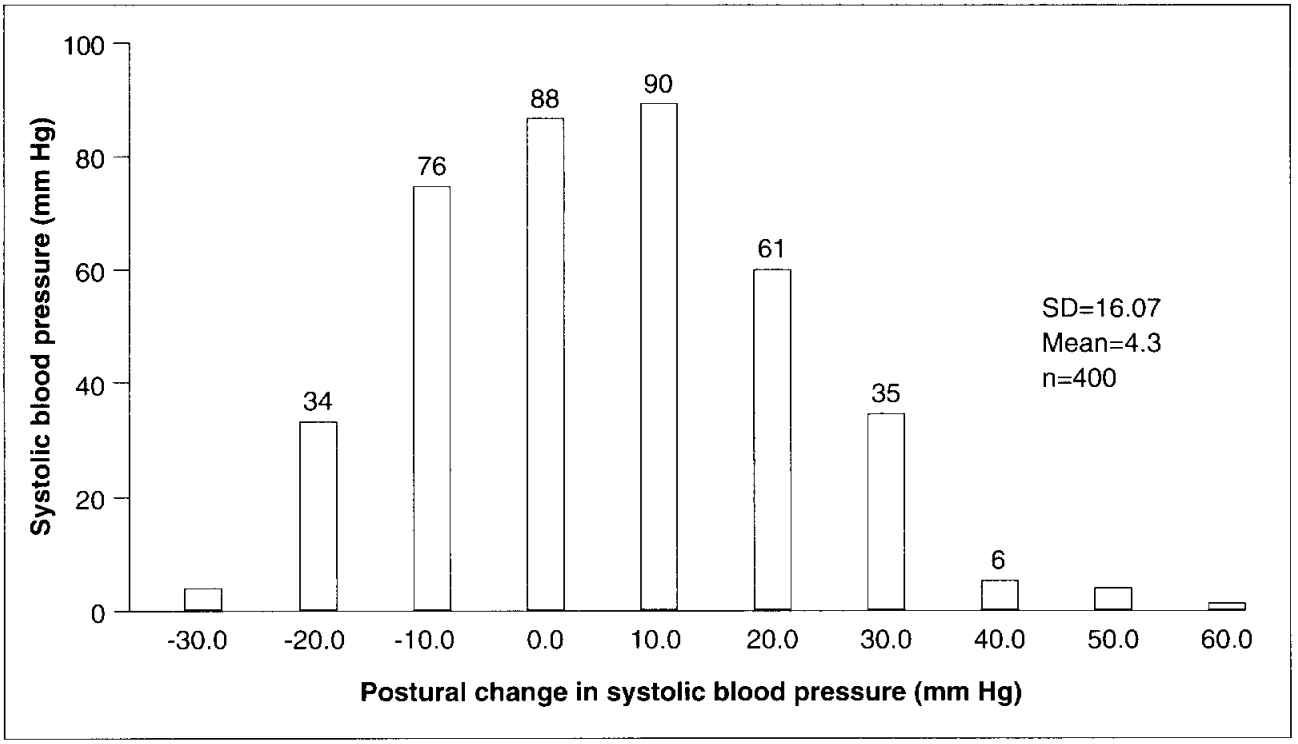
There was no association found between PH and a history of falls. This result, while confirming the findings of some,[15] contrasts with the popular notion that PH is a major contributor to falls in the elderly.[16] Actually, the majority of falls are not due to syncope episodes but are related primarily to neuromuscular, vision, and balance problems and environmental hazards.

Postural hypotension was not correlated with a history of diabetes mellitus, stroke, alcohol consumption, smoking, or Parkinson's disease. This is in contrast to many textbook opinions and may be due to the fact that most autonomic failure is relatively uncommon in elderly diabetics.[17]

Although the presence of PH is often assumed to reflect the use of certain drugs, it was not related to the use of anti-hypertensives, anti-convulsants, or hypnotics in our study. This association with medications, however, may be biased as with this type of cross-sectional data a side effect or a related symptom may have been monitored and lead to an adjustment of the regimen.[6]

Several limitations of this study should be acknowledged. A one-time measurement of standing blood pressure was taken, performed with a sphygmomanometer and stethoscope. Hence, the blood pressure measurements are subject to the terminal digit and the biases associated with manual blood pressure read-

Fig. Distribution of postural systolic blood pressure changes in the study group



ings. Blood pressure changes were assessed at only one point in time, so we do not know the reproducibility of our measurements. However, these data are representative of the type of blood pressure measurements that are generally obtained in most OPD settings.

The reliability of the information given by the study participants is unclear because we did not assess their level of cognitive function; this may affect the accuracy of the risk factors measured. Self-report of medical conditions, medications, falls, and syncope episodes relied on subject recall, which may not be accurate.

Another limitation of the study is the lack of measurement for autonomic dysfunction and evidence of peripheral neuropathy. Although autonomic failure is uncommon, we cannot be certain that the presence of PH is independent of autonomic dysfunction (this requires further research to confirm).

There may also have been bias in the selection of the study group members. Since the subjects were chosen from new patients at a geriatric OPD, most of the patients have some medical problems. Therefore, the results we obtained cannot be wholly applied to healthy community-dwelling elderly people. A large community-based study is needed to reflect the true prevalence of PH in the elderly.

Our results show that PH is not associated with any of the traditional risk factors despite it being common in clinic patients (238/1000). The conclusion of this study does not mean that an intensive investigation of the potential causes of PH in an elderly patient (causing symptoms or falls) should not be carried out. Statistical significance is dependent on the numerical power of a study. Hence, if we kept the same percentages but doubled the number of subjects in the study, the differences might be statistically significant. However, it is true that our sample size may not be large enough to detect individual conditions such as Parkinson's disease, stroke, and the use of certain drugs. The question remains: "Could PH be merely an idiopathic ageing consequence without any serious implications?". This question can only be answered by performing a long term prospective study that investigates the prognosis of those elderly individuals with PH.

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