Review Article

Baroreceptor dysfunction in congestive heart failure: Do the drugs need to be manipulated?

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Abstract:
Orthostatic hypotension is a condition in which there is fall in blood pressure on standing up from sitting or lying position. (Hypotension is low blood pressure.) Feeling dizzy or lightheaded on standing up is a common symptom. Sometimes, people with orthostatic hypotension may even faint. There are numerous causes of orthostatic hypotension like aging (more common in elderly), hypovolemia (low volume of blood), dehydration (low body fluid volume), immobility (staying in bed for a long time in hospital/home), pregnancy, heart conditions like heart attack, irregular heart rhythm, heart failure and valvular diseases, anemia (low red blood cell count), Parkinson's disease, Transient ischemic attacks, stroke and other nervous disorders. This review study is done to get the required insight and understanding of the various aggravating and associated factors of orthostatic hypotension in coronary and cerebrovascular patients.

Keywords: Postural hypotension, Medications, Coronary complications, Blood pressure

Introduction
Orthostatic hypotension (OH) was present in one quarter of outpatients with stroke, and coronary artery disease appeared to be a risk factor, suggesting stroke patients need to be screened for OH given that the presence of positional BP changes may alter clinical management (1). In severe heart failure, midodrine was helpful to optimize drug treatment in patients suffering from hypotension (2). Orthostatic hypotension is otherwise called as postural hypotension.

Postural hypotension in women:
Postpartum young woman developed postural hypotension as the first manifestation of fulminant myocarditis with an acute "cold and dry" right-sided heart failure and cardiogenic shock. Causes of postural hypotension included volume depletion, medications, diabetes, alcohol, infection, and varicose veins as well as dysautonomicsyndromes (3). In a study done on 374 elderly women, registered in primary care practice and without major cardiovascular events or other comorbidities at baseline, orthostatic hypotension contributed to the phenomenon of reverse dipping, and is a more robust predictor of cardiovascular events than reverse dipping (4).

Postural hypotension in elderly with coronary complications:
In elderly patients with paroxysmal atrial
Fibrillation (PAF), a significant number of false positive results during passive Head Up Tilt were found, suggesting increased vasovagal reactions despite aging. This suggests that Autonomic Nervous System imbalances may be observed in elderly population (5). In a study done on elderly patients with arterial hypertension, those with lowering of arterial pulse pressure (APP) more than 10 mm Hg significantly more often had cerebrovascular disease appearing as history of cerebral strokes and/or transitory ischemic attacks. The conclusion was made about possible significance of orthostatic increment of APP as supplementary marker of cardiovascular risk in elderly patients with arterial hypertension (6).

Postural hypotension occurred in 49.1% of patients with decompensated heart failure. Dizziness and/or palpitations manifested in 25%. Diastolic (36.1%) versus systolic (23.1%) postural hypotension prevailed. Seating-induced postural hypotension was common among older inpatients with decompensated heart failure, especially with longer bedrest, higher supine diastolic blood pressure and non-ischemic etiology. Leg compression bandaging was useful for the prevention of postural hypotension (7).

In patients with diabetes, the reduced cardiovascular autonomic function as measured by heart rate variability was strongly associated with an increased risk of silent myocardial ischemia and mortality (8).

**Side effect of tricyclic antidepressants:**
Tricyclic antidepressants are effective against depression but are associated with cardiovascular side effects including orthostatic hypotension, slowed cardiac conduction, antiarrhythmic activity, and increased heart rate. Selective serotonin reuptake inhibitors, by contrast, have benign cardiovascular profiles and are well tolerated in patients with cardiac disease (9). Cardiovascular autonomic neuropathy (CAN) was a common form of diabetic autonomic neuropathy and causes abnormalities in heart rate control as well as central and peripheral vascular dynamics. The clinical manifestations of CAN included exercise intolerance, intraoperative cardiovascular lability, orthostatic hypotension, painless myocardial ischemia, and increased risk of mortality. CAN contributed to morbidity, mortality, and reduced quality of life for persons with diabetes (10).

**Postural hypotension in hypertensive organ disease and stroke:**

In three patients with hypertensive organ disease, Fludrocortisone acetate was started, and short-acting vasopressor agents during the day and dihydropyridine-calcium antagonist during the night in the other two. During the follow-up a transient ischemic attack occurred in the patient treated with fludrocortisones. When fludrocortisone was titrated down and short-acting antihypertensive drugs were started, the patient did not complain of any symptoms (11). Orthostatic hypotension was present in a heterogeneous group of disease states, symptomatic, and associated with an abnormal blood pressure profile of reversal of circadian pattern, postprandial hypotension, and non-compensatory heart rate variability (12). In a study done by Abramkin DV, Iavelov IS, Gratsianskiĭ NA, in Russia, it was found that simple autonomic tests like active orthostatic test, tests with controlled breathing (6 and 15 breaths per min), and Valsalva maneuver can be safely carried out in most stable patients on days 4-11 of myocardial infarction (13). Intermittent exposure to orthostatic stress during the bed rest stage of hospital convalescence and recovery phase at home obviated much of the deterioration in cardiovascular performance following myocardial infarction (14). In a study done on patients during early period after stroke, it was concluded that use of antihypertensive drugs in the early period post stroke is not detrimental to postural BP regulation. Antihypertensive therapy may therefore be used when indicated in acute stroke, without having to restrict early mobilization; but the results cannot be extrapolated to the postacute phase (15).
Drug induced symptoms:
Standing but not sitting blood pressure was slightly lower shortly after a cardiac rehabilitation session, but the post exercise orthostatic hypotension was not sustained during normal activities of daily living(16). In an open randomized hospital study conducted in France, as an initial therapy for stabilized left ventricular systolic dysfunction, the first dose of perindopril PER (2 mg) induced a significantly smaller decrease in blood pressure than the first dose of captopril CAP (6.25 mg); with significantly fewer dropouts due to orthostatic hypotension with PER than with CAP(17). In a study done on untreated elderly hypertensives, in the supine position, plasma levels of norepinephrine, atrial natriuretic peptide and aldosterone were in the normal range, while the plasma renin activity was low. Immediately upon tilt the systolic blood pressure fell but it reverted to baseline values after 15 min of orthostasis. At that time the cardiac output decreased while the systemic vascular resistance and the plasma norepinephrine concentration rose. The atrial natriuretic peptide appeared to fall, and the renin-aldosterone level did not change. Elderly people with systolic hypertension having orthostatic symptoms don't require a different approach from that needed for others of the same age group (18). Early administration of enalapril had a potential proischemic effect in hypotension-prone patients mediated through exacerbation of the hemodynamic response, inasmuch as initial blood pressure fall after myocardial infarction is related to residual myocardial ischemia and recurrent acute ischemicsyndromes (19). Isosorbide treatment was associated with a higher prevalence of symptoms of cerebral hypoperfusion and a failure to increase systemic vascular resistance during tilt. Nicardipine decreased vascular responsiveness to sympathetic activation, the baroreflex-mediated vasoconstrictor response to upright tilt remained intact. In contrast, isosorbide impaired the systemic vascular response to orthostatic stress in elderly patients with stable coronary artery disease (20).

Drugs used for coronary artery disease:
With the aid of a protracted passive postural test, the rate of occurrence and the variants of orthostatic hypotensive reactions in hypertensive patients were studied. 89.4% of whom were taking antihypertensive medications, were reviewed. Orthostatic hypotensive reactions were recognized in 33.8% of examinations (21). Coronary artery bypass surgery (CABS) impaired cardiovascular reflexes used in the diagnosis of diabetic autonomic neuropathy. Retinal changes suggesting microembolisation of fundi occurred after CABS of diabetic subjects (22). Coronary heart disease had an increased prevalence in diabetic patients, not related with diabetes duration or the type of treatment. Early and late morbidity and mortality after acute myocardial infarction and/or revascularization surgery was twice as common in the diabetic patient (23). Several disorders cause symptomatic orthostatic hypotension including age-related changes in physiology, disorders of the autonomic nervous system, drugs, and a decrease in circulating blood volume. No single agent has been universally successful in relieving the symptoms of orthostatic hypotension in the elderly. Trials of single agents or combinations of agents are needed to identify the most appropriate therapy for individual patients (24). OH was caused by diabetes mellitus, aging, and treatments for ischemic heart disease and hypertension. Medical management of OH eliminated the need for stroke prevention measures like surgery or anticoagulation (25).

Coronary artery disease, aortic insufficiency, congestive heart failure, left ventricular hypertrophy, premature ventricular contractions, supraventricular arrhythmias, mitral valve prolapse, orthostatic hypotension, and aortic dissection are some of the conditions that influence the choice of treatment in hypertensive patient with concomitant heart disease. More than one drug choice is used (26). Baroreceptor abnormalities in the autoregulatory response to postural change are important determinants of the cardiovascular responses required during exercise and influence exercise performance. They influence the long-term efficacy of vasodilator therapy in chronic congestive heart failure (27). Combination of nitroglycerin and diltiazem had a greater effect on afterload than either drug alone, the combination did not provide greater improvement in cardiac performance. Patients who received nitroglycerin plus diltiazem experienced symptomatic hypotension, while patients who received placebo plus diltiazem experienced hypotension (28). The orthostatic HR increase was considerably augmented by nitroglycerin causing severe orthostatic symptoms.
Verapamil treatment did not influence this response, while metoprolol caused significant reductions (29). Orthostatic hypotension was present in 35% of aged and hypertensive subjects. Cardiovascular causes play a by no means unimportant part in its determination. 20% of the cases observed were attributed to drug treatment (30). In patients with chronic congestive heart failure, combination of vasodilator drugs hydralazine and isosorbidedinitrate produced improvement in supine hemodynamic measurements before and during vasodilator therapy (31).

Development of orthostatic hypotension was observed after the injection of morphine in patients with uncomplicated myocardial infarction after the i.v. injection of 0.75 cg morphine sulphate with no marked fall in cardiac output (32).
References:


