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REVIEW

# Hypertensive management in the elderly patient at risk for falls

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## Abstract

**Purpose:** Seventy percent of people over 65 years of age have hypertension, and one third of elders fall each year. These conditions frequently coexist, and each carries a risk for substantial functional decline or mortality. This article reviews the risks of and interventions to reduce falls in the elderly patient with hypertension.
**Data sources:** A systematic review of the published and unpublished literature and consensus panel recommendations through January 2008 are discussed.
**Conclusions:** Hypertension management in the frail elder at risk for fall must include a thoughtful assessment of the relative risks and benefits of treatments that are most likely to preserve function, independence, and quality of life. Stringent adherence to guidelines may not be appropriate for all patients. The periodic use of a standardized fall risk screening tool can assist the nurse practitioner (NP) to identify patients at risk for falls and adjust medication management accordingly.
**Implications for practice:** This article will assist the NP to weigh management options in the context of the complex elderly patient.

## Introduction

Hypertension is a known risk factor for cardiac, cerebrovascular, and renal diseases. Its high prevalence and impact on health drives nurse practitioners (NPs), researchers, industry, and other healthcare providers to pursue and implement evidence-based interventions that will mitigate the risk for target organ damage. One third of adults 65 and older fall each year in the United States, and among the elderly, falls are the leading cause of injury-related death (Centers for Disease Control [CDC], 2005). These conditions frequently overlap in the elderly, and each carries a risk for substantial functional decline or mortality.

According to National Health and Nutrition Examination Survey (NHANES) 1999–2004 data, more than 70% of people over age 65 are likely to have hypertension. Hypertension directly accounts for between 50 and 190 deaths per 100,000 elderly patients per year in the United States. Stroke and ischemic heart disease, which are associated with hypertension, account for an additional 1500 deaths per 100,000 elderly yearly (see Table 1). Known contributors to hypertension include age, genetic predisposition, obesity, diet, smoking, sedentary lifestyle, and vascular dysfunction (Chobanian et al., 2003).

The total direct cost of fall injuries in people over 65 in 2000 was $19 billion (Stevens, 2005). Indirect implications include reduced quality of life and productivity, increased need for functional support, and the associated economic impact incurred. Known contributors to falls are multi-factorial and include medical conditions, medication, nutrition, physical impairment, conditioning, sensory disturbances, and cognitive impairment. These are all factors that are often associated with aging (Healthcare Association of New Jersey [HCANJ], 2005).

There are clear and valuable guidelines for blood pressure regulation and good recommendations for



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**Table 1** Death rates in the United States for selected conditions (2004)

| | Rates per 100,000 deaths | | | | |
|---|---|---|---|---|---|
| Age | Ischemic heart | Hypertension | Stroke | Unintentional injury | Falls |
| 65–74 | 1097 | 51.5 | 382.3 | 95.6 | 38.8 |
| 75–84 | 1149 | 50.8 | 408 | 102 | 41.3 |
| 86+ | 559 | 189.8 | 1354.5 | 277.5 | 137.5 |

Source: http://www.cdc.gov/nchs/health_data_for_all_ages.htm.

identifying patients at risk for a fall. All of the established strategies, however, may not necessarily delineate the best treatment plan for a given patient. The NP must tailor each plan to determine the best way to reduce the risk of cardiovascular events without increasing the risk of falls.

Treatment guidelines are often developed from information obtained from clinical studies and meta-analyses. Although meta-analyses are helpful in that they review and analyze findings, the applicability of these findings to an individual may be limited and must be evaluated in the context of the patient. In both intent and design, studies aim to eliminate variables and generally select patients with as few comorbidities as possible. Patients with multiple comorbidities or existing treatment plans may fail to meet inclusion criteria in a study. For example, a cognitively impaired elder in the community requiring many medications may be at increased risk for both falls and cardiovascular disease. However, this type of complex patient is typically excluded from enrollment in a study.

Harm reduction remains paramount in elders with both fall and cardiovascular risks. This article explores hypertensive management in the elderly, and will assist the NP to weigh the risks and benefits of pharmacologic treatment options in the context of the complex and often frail patient who may also be at increased risk for a fall. We posit that treatment shown to be optimal for younger and/or healthier patients may not be ideal for this patient population.

## An overview of medication and falls in the elderly

Forty-eight medications or classes of medication are listed on the Beers list, a standardized tool for appraising medication safety in the elderly. It alerts healthcare providers to medications that require cautious prescribing as their use is associated with adverse events, and identifies 20 different categories of medications that may initiate drug–disease interactions or that should be used cautiously in patients with specific coexisting conditions (Fick et al., 2003).

The elderly are more likely to take multiple medications that place them at increased risk of adverse reactions, including falls (Zermansky et al., 2006). Fall risk is known to increase as the total number of medications increases (Neutel, Perry, & Maxwell, 2002; Ziere et al., 2006). Patients taking more than 3 to 4 medications seem to be at an especially high risk (Leipzig, Cumming, & Tinetti, 1999). Additionally, there may be an increased likelihood of a fall within 2 weeks of the time a new drug is added to an elderly patient's regimen (Wells, Middleton, Lawrence, & Safarik, 1985). This supports the need for regular medication review, coordination of care providers, discontinuance of less essential medications, and heightened monitoring when changes in the medication regimen are instituted.

Psychotropic agents, antidepressants, hypnotics, anticholinergics, and anxiolytics are most consistently associated with a risk for falls, likely because of their neurological and autonomic effects (Chutka, Takahashi, & Hoet, 2004; Cumming, 1998; Egger, Bachman, Hubman, Schlienger, & Krahenbuhl, 2006; Neutel, Perry, & Maxwell, 2002). Specifically, antihypertensives, antipsychotics, levodopa, tricyclic antidepressants, and diuretics appear on the Beers list for cautious use in the elderly as they may potentiate dizziness and syncope, both contributors to falls (Fick et al., 2003).

Attributing a fall directly to medications that do not provide direct neurological or gait effects is more difficult, as there are many confounders and an individual assessment must be undertaken to estimate these risks in the specific patient. The presence of varying degrees of cognitive impairment and fluctuating mental status, for example, complicates assessment and fall prevention management. One study demonstrated no increased risk for fall if the patient was prescribed medications in the antianxiety or antipsychotic medication classes and these researchers concluded the increased risk for falling was more directly related to the medical condition of the patient rather than the medication itself (Katz, Rupnow, Kozma, & Schneider, 2004). Other studies support the finding that the underlying condition and/or neuromuscular impairment may play a greater role in falls than the medications themselves (Lee, Kwok, Leung, & Woo, 2006). In a consensus-based clinical practice algorithm that aims to reduce fall risk in the elderly through optimal medication management, Bulat, Castle, Rutledge, and Quigley (2008a) recommend a thorough medication assessment that includes optimizing doses or reducing the use of medications that are known to increase the risk of falls or injury. These include cardiovascular agents, benzodiazepines, antidepressants, antipsychotics, anticholinergics, bladder relaxants, anticonvulsants, and anticoagulants.

## Hypertension: Guidelines and epidemiology

The International Society of Hypertension (ISH) (2006) defines ''pre-hypertension'' as a blood pressure (BP) between 120 and 139 mmHg systolic or 80–90 mmHg diastolic, which is best addressed with non-pharmacologic interventions. A BP of under 140/90 is optimal for primary prevention, and a target BP of 130/80 is recommended in those with diabetes, coronary artery disease (CAD), chronic kidney disease (CKD), and acute coronary syndromes (ACS), or anyone at high risk for CAD. Recommendations for heart failure patients are lower (Rosendorff et al., 2007; WHO–ISH, 2003). Achieving these goals often requires the use of one or more medications for optimal risk reduction, and the Joint National Committee (JNC 7) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommends initiating combination therapy for stage 2 hypertension (Chobanian et al., 2003). The African American Study of Kidney Disease and Hypertension (AASK) data demonstrate that black people with mild to moderate kidney dysfunction require, on average, two to three agents to reach their BP goal (Douglas et al., 2003).

According to NHANES data collected from 1999 to 2002, African American men and women have a 40% and 43.5% prevalence of hypertension, respectively, as compared with non-Hispanic white people who have a 27% and 28.5% prevalence (CDC, 2006). The prevalence and severity of hypertension increases with age, and is an important contributing risk factor for cardiovascular disease. Fatal coronary events or stroke risk doubles for each 20 mmHg systolic or 10 mmHg diastolic above 115/75 mmHg (Chobanian et al., 2003; Lloyd-Jones, Evans, & Levy, 2005). The emergence of new-onset cardiovascular disease persists as patients age (Arnold et al., 2005). Clearly the aging population warrants treatment to address cardiovascular disease.

In the Japanese Trial to Assess Optimal Systolic Blood Pressure (JATOS) in Elderly Hypertensive Patients, researchers suggest that BP should be reduced slowly and carefully in the elderly as aggressive antihypertensive treatment may hasten target organ damage. Although it appears that BP lowering under 140 systolic in ages 65–74 years is safe, less aggressive treatment in the older individual may be advisable (JATOS Study Group, 2006).

National and international guidelines for achieving optimal BP control abound, and all conclude that dietary and lifestyle changes are indicated for initial management. Although the absolute numerical reduction of systolic and diastolic measurements, type, timing, and pace of BP interventions remain under discussion and testing, there is clear consensus that reducing hypertension to within goal ranges directly correlates with reductions in cardiac and vascular morbidity and mortality.

Despite extensive outcome trials demonstrating the benefits of blood pressure control and widely distributed guidelines for management, BP control in the elderly remains poor. Oparil (2006) discusses likely contributing factors, which include inadequate treatment intensity, suboptimal drug regimens, and the failure of healthcare providers to consistently incorporate guidelines into practice.

## Antihypertensive agents and falls

It is unclear to what degree antihypertensive medications directly contribute to falls in the elderly. In a 1999 systematic meta-analysis of 29 studies of the association of cardiac medications, a weak association with falls was found only with diuretics, digoxin, and type 1A antiarrhythmics, but not with beta blockers, angiotensin converting enzyme (ACE) inhibitors, calcium channel blockers, or centrally acting antihypertensives (Leipzig et al., 1999). Hypertension is routinely treated with any of several classes of drugs or combination of agents. These may include diuretics, ACE inhibitors, angiotensin receptor blockers (ARB), beta blockers, calcium channel blockers, nitrates, alpha-blocking agents, or renin inhibitors.

Diuretics account for 16% of preventable drug-related admissions to hospital, which includes falls (Howard et al., 2007). Although the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) demonstrated an increased risk for developing new-onset diabetes in patients taking chlorthalidone, the efficacy, tolerability, cost-effectiveness, and safety of diuretics as first-line therapy for hypertension is generally well supported (ALLHAT, 2002; Chobanian et al., 2003). In cases where orthostatic hypotension is present, it may be prudent to stop or reduce the dose of the diuretic or decrease the salt restriction (Bulat, Castle, Rutledge, & Quigley, 2008b).

Compelling indications for beta blocker use include angina, heart failure, certain arrhythmias, or a history of myocardial infarction (Chobanian et al., 2003). Cautious use of these agents is warranted; however, as recent studies indicate that the use of beta blockers may actually increase cerebrovascular morbidity. A meta-analysis by Lindholm, Carlberg, and Samuelson (2005) demonstrates an overall increase in the relative risk of stroke of 16% among patients on beta blockers. The American Heart Association no longer supports the use of beta blockers for uncomplicated hypertension. Attenuation of compensatory response in the elderly at risk for falls is also of potential concern with these agents.

Calcium channel blockers are effective at reducing hypertension, have a low side effect profile in patients without heart failure, and do not appear to reduce cerebral perfusion in the elderly. ACE inhibitors and ARBs have similar effects on blood pressure, are preferred agents in patients with diabetes or chronic kidney disease, and there is little evidence at this time to support an association with fall risk when used at appropriate dosages.

Centrally acting agents, such as clonidine and non-selective alpha-blocking agents may increase sedation or contribute to orthostasis. Bulat et al. (2008b) recommend avoiding these agents in individuals who are at a higher risk for a fall.

## Orthostasis, vascular reserve, and hypotension in the elderly

The elderly are known to have a smaller physiological reserve and reduced baroreceptor response upon arising. Orthostatic hypotension is estimated to be present in 5%–30% of the elderly. Study results are mixed, however, as to whether or not antihypertensive medication-induced orthostatic hypotension contributes to falls (Cumming, 1998; Fisher, McLean, Davis, & Le Couteur, 2003; Ooi, Hossain, & Lipsitz, 2000). Estimates of the contribution of orthostatic hypotension to falls range from 5% to 32% (Van der Velde, Stricker, Pols, & van der Cammen, 2007a).

The association between orthostatic hypotension and falls is most evident in the frail elderly and in nursing home facilities, where patients are likely to have a combination of comorbidities, delayed reflexes, and/or disabilities (Rubenstein & Josephson, 2002). In one study of institutionalized elders, orthostatic hypotension remained an independent predictor of future falls after adjustment for medication use, but only in the subgroup that had experienced a prior fall (Ooi et al., 2000). Van der Velde, van den Meiracker, Pols, Stricker, and van der Cammen (2007b) assessed cardiovascular homeostasis with tilt table testing in older outpatients who had previously fallen. When potentially ''fall risk inducing drugs,'' which they identified as antihypertensives, vasodilators, antidepressants, neuroleptics, sedatives, and anti-Parkinson's medication, were withdrawn, they noted not only a reversibility of orthostatic hypotension in all groups, but also a significant reduction in the subsequent incidence of falls in the subgroup of patients on cardiovascular drugs (Van der Velde et al., 2007b). These findings are consistent with the knowledge that a prior fall is the strongest predictor of future falls, and recognizes the role of multiple factors and synergistic effects that may contribute to fall risk.

Reduction of systolic hypertension in the elderly is consistently supported (Stassen et al., 1997; Chobanian et al., 2003). Several studies demonstrate that there is likely a low point in the blood pressure curve (J-curve) at which further decreases in blood pressure may compromise coronary artery blood flow. Although data demonstrate that the reduction of blood pressure to the established goal reduces the risk for cerebrovascular events, there is also good evidence to suggest caution in lowering diastolic blood pressure below 60 mmHg in patients with known coronary artery disease who are at high risk for a coronary event (Messerli, Williams, & Ritz, 2007).

In healthy individuals, nighttime blood pressure drops 10%, and ''dippers'' have reduced cardiovascular morbidity and mortality as compared to ''non-dippers.'' In a pilot study, researchers found that in 32 ''non-dippers'' with CKD, moving one antihypertensive agent to nighttime dosing reduced nighttime blood pressures without impacting daytime pressures (Minutolo et al., 2007). This reduced the incidence of proteinuria and restored circadian BP rhythm. Both of these early endpoints are known to be associated with improved cardiovascular and renal outcomes in other studies, but this work is preliminary and the ultimate effect of this intervention on cardiovascular morbidity and mortality has yet to be established.

Aortic (central) systolic pressure may be lower than brachial pressures because of amplification effects at the brachial artery. Aortic pressure serves as a measurement of aortic and vascular stiffness and may be clinically important in determining treatment response to antihypertensive medications (Messerli et al., 2007). Short-term studies demonstrate that different classes of drugs exert unique effects on central aortic pressures. Calcium channel blockers and diuretics exert the greatest reduction in central blood pressure. Beta blockers affect the peripheral measurements but exert little effect on the central pressure (Psaty et al., 2003). The Conduit Artery Functional Endpoint study (CAFÉ) found greater reductions in aortic pressures with the administration of calcium channel blockers and ACE inhibitors as compared with beta blockers and diuretics (Oparil 2006). There may be a ''pseudo antihypertensive effect'' when reading only peripheral blood pressures (Messerli et al.). Studies are needed to determine if there is a clinical advantage to monitoring both brachial and central aortic pressures (Safar, Blacher, Protogerou, & Achimastos, 2008).

## Reducing falls: Identifying and evaluating the many factors that may contribute to fall risk

According to the American Geriatrics Society (AGS), British Geriatrics Society (BGS), and American Academy of Orthopaedic (AAO) Surgeons Panel on Falls Prevention

**Table 2** Intrinsic and extrinsic contributors to falls

| Patient (intrinsic) characteristics that contribute to falls | Environmental and personnel (extrinsic) characteristics that contribute to falls |
|---|---|
| History of a fall | Knowledge of risk factors by patients and providers |
| Perceptual impairments | Anticipation of needs and responsiveness by caregivers |
| Gait, balance impairment | Communication processes among caregivers and patients |
| Cognitive status and ability to communicate needs | Setting |
| Medication effects | Environmental and equipment safety |
| Illness, acute and chronic | Polypharmacy |
| Elimination status | |
| Comorbid additive or synergistic effects | |

Data from Fulmer et al., 2002; Lee et al., 2006; Oliver, Daly, Martin, & McMurdo, 2004; Yauk et al., 2005; Poe, Cvach, Gartrelu, Radzik, & Joy, 2005; Tinetti, Doucette, & Clous, 1995; Van den Berg, Landeweer, Tummers, & van Merod, 2006; Vassallo, Vignaraja, Sharma, Briggs, & Allen, 2004.

Guideline for the Prevention of Falls in Older Persons (2001), risk factor assessment is essential for treatment planning. This panel also advises varying the intensity of the risk assessment by target population, so that higher risk groups undergo more thorough assessment (AGS, BGS, AAO Panel, 2001). Tinetti, well known for her extensive work on falls, considers risk for a fall in the context of host factors, which include cognitive, medical, physical, behavioral, and performance factors in addition to environmental factors (Tinetti, 1986; Tinetti Doucette, & Claus, 1995).

The strongest predictor of a future fall is having fallen in the past, and risk for falls increases as the total number of risk factors increase (Agostini, Baker, & Bogardus, 2001). Evidence supports fall risk stratification based on the presence and degree of both intrinsic and extrinsic characteristics (see Table 2)

### Gait and balance disorders

Gait and balance disorders and impaired strength or range of motion in the extremities are of prime importance when considering the risk for a fall. Many conditions alter stride length, speed, posture, step symmetry, step continuity, sway, stance, or gait hesitancy. All of these factors are scored on the Tinetti Assessment Tool: Gait (Tinetti, 1986), a validated and widely used instrument for gait evaluation. Evidence-based guidelines consistently include assessment, treatment, and mitigation of risk, many of which are based on Tinetti's initial and subsequent work (Tinetti HCANJ, 2005; AHRQ, 2006). The Tinetti Assessment Tool: Balance assesses patients while sitting, attempting to rise, turning, nudged while standing, turning, and with the eyes closed. This scale also includes a rating of stability in the first 5 s upon arising from a chair (Tinetti). The NP should observe the elderly patient for the need to grasp the chair on arising and recognize this as a potential contributor to a future fall.

Balance may be affected by strokes, vertigo, dizziness, medication use, neurological impairment, cardiac disorders, or perceptual abnormalities. For example, patients with a right hemispheric stroke may have difficulty with spatial perception. A cerebellar infarct may result in reduced efficiency of the balance center and labyrinthitis may result in an altered positional sense. The Balance measure includes balance assessment while reaching and the ability to retrieve an object from the floor while seated (Berg, Wood-Dauphinee, & Williams 1995).

## Conclusion

An individualized treatment plan that addresses hypertension without increasing the risk for a fall is essential to improve outcomes. Reducing the total number of medications may conflict with guidelines for optimal disease management. Whereas multiple drugs may be required to bring BP to goal, adverse events can be directly related to inappropriate medication dosing, drug–drug or drug–condition interactions, or coadministration of medications that have additive effects. NPs may need to trade off specific treatment recommendations in favor of a plan that considers the individual's overall vulnerability to injury.

As baroreceptor changes may be amplified by antihypertensive agents and some of these may attenuate a sympathetic response, it would seem prudent to keep the patient's BP within the upper window of the recommended BP guidelines when the fall risk is high. In equivocal cases, continuous ambulatory BP or central aortic pressure monitoring may be helpful in establishing an optimal treatment regimen while avoiding organ hypoperfusion. Slow withdrawal of beta blockers should be considered in those patients who do not have a compelling indication for use, such as those with hypertension but no evidence of CAD. It also seems reasonable to move one of several antihypertensive medications to an evening dosing time, thereby avoiding multiple medications that peak in a narrow window. This may also restore a nighttime blood pressure dip, although data are still inconclusive as to the long-term benefit of this approach.

Prescribing considerations for the administration of antihypertensives must include caution and vigilance in patients with cognitive impairment, fluctuating mental status, or the presence of a gait or balance disorder. The presence of any of these factors increases the risk for falls,

and multiple risks confer additional risk. Screening for impairment in an office setting is easily done, and may suggest the need for additional testing, intervention, or modification of the treatment plan. Standardized tools, such as the Tinetti Gait and Balance Scales, should be administered periodically in the office setting, and measurements should be repeated when a medication adjustment is made, during and directly after an acute illness or hospitalization, or if there is a suspicion for functional decline.

Stringent adherence to all guidelines may not be appropriate for all patients. Thorough consideration of hypertension treatment in the frail elder at risk for a fall must include a thoughtful assessment of the relative risks and benefits of treatments and interventions that are most likely to preserve function, independence, and quality of life.

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