Falls Risk, Orthostatic Hypotension, and Optimum Blood Pressure Management: Is It All in Our Heads?

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The vast majority of people young and old experience some drops in blood pressure (BP) after standing. This is normal, with BP usually recovering quickly to baseline within 30 seconds of standing.¹² However, with ageing and disease this response progressively alters, due to hypovolemia, cardiovascular disease, autonomic impairment, dehydration, and medication effects leading in some to sustained BP drops on standing, i.e. orthostatic hypotension (OH).³⁴ OH is defined as a sustained reduction of systolic BP of at least 20 mm Hg and/or diastolic BP of 10 mm Hg within 3 minutes of standing or head-up tilt.⁵ OH may lead to cerebral hypoperfusion, presyncope, or syncope⁶ and may exacerbate the risk of falls in older adults.⁷

Falls are a leading cause of morbidity in older adults with one in three older adults falling annually.⁷ Identification and proper management of causative and treatable risk factors for falls is paramount in future strategies to support ageing.⁸

Jansen et al.⁹ in a recent systematic review, noted that while hypotension was associated with falls the evidence for an association between OH and falls was inconclusive. This was attributed to the varied quality of reviewed studies, which have employed different assessment methods to detect OH, a varied range of sample population sizes and study designs.

The study by Juraschek et al.⁹ addresses some of these shortcomings, by assessing prospectively the association between OH and falls risk in a large sample of 12,661 middle-aged participants (aged 54 (5.7) years) recruited as part of the ARIC study over a 23-year follow-up period. OH was assessed, alongside demographics and cardiovascular status at baseline (1987–1989), using an automated oscillometric BP measurement method during 2 minutes of standing. OH was defined by consensus criteria as the presence of a drop in SBP of 20 mm Hg or drop in DBP of 10 mm Hg within these 2 minutes.⁷ A fall was defined as the first occurrence of any fall-related hospitalization or claim for inpatient or outpatient services occurring over the period 1991–2012. This information was collected using active annual telephone surveillance of the ARIC participants combined with linkage to Centers for Medicare and Medicaid Services (CMS) claims data.

The investigators report a baseline prevalence of OH of 5% with 2,384 falls (19%) occurring over a median period of 23 years, the majority of which (59.3%) were identified using outpatient claims through the CMS Medicare data.⁴¹⁰ It was noteworthy that those with OH had a higher burden of cardiovascular morbidity, hypertension (58.8% vs. 32.9%), and diabetes (22.4% vs. 11.3%). The incidence rate of falls was 3.2 per 1,000 person-years in those with OH vs. 2.5 per 1,000 person-years among those without OH at baseline. After adjustment for a broad range of demographic and cardiovascular confounders at baseline, those with OH were at an increased risk of falls (hazard ratio: 1.30 95% confidence interval: 1.1–1.54) compared to those without OH. While both DBP and SBP drops were associated with falls, DBP drops (per 5 mm Hg) were associated with the highest risk (hazard ratio: 1.09 95% confidence interval: 1.05–1.13). Interestingly, the authors detected no interaction effects with age, gender, race, obesity, hypertension, and diabetes. Furthermore, no optimum diagnostic thresholds for OH were evident from the analysis examining hazard ratio vs. changes in BP after standing⁶.

Given the importance of falls and the high and increasing prevalence of sustained OH with age (up to 20% in over 80’s) the results reported here will inform current and future falls prevention strategies.¹¹ The study by Juraschek et al.⁹ identifies the key role of standing BP as a diagnostic and treatment target for reducing falls in older adults, establishing that those with mid-life OH are at increased risk of falls in later life. Since poorly controlled BP can often be treated by targeted and personalized interventions, this work offers avenues for reducing falls risk in older adults, thereby reducing hospital attendance and admission rates, with obvious downstream health and societal benefits. State of the art clinical guidance in this regard is given by recent AGS and BGS falls prevention guidelines¹¹ and ESC guidelines for syncope.

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doi:10.1093/ajh/hpw129

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Initially submitted September 19, 2016; date of first revision September 21, 2016; accepted for publication September 23, 2016; online publication November 9, 2016.

American Journal of Hypertension  30(2)  February 2017  115
management, although much work remains to be done in identifying suitable treatment regimens for OH in the context of falls prevention.

Although this paper considers a large, well-designed prospective study, the follow-up period (median time 23 years) is long. In addition data on time-varying prevalence of OH and other co-morbidities and risk factors were not available.

The gold standard in conducting prospective falls risk studies is the falls diary which at a population scale is logistically challenging. Here, these data were collected using a combination of self-reported hospitalization and medical claims data. This limits the scope of results to falls that require medical intervention only, i.e., predominantly injurious falls. Injurious falls are known to effect 10% of the population while over 19% of the over 50’s suffer a fall annually. A large group of fallers are thus unaccounted for in this study. In addition, given that OH may lead to localized or global cerebral hypoperfusion, it is likely that an important subgroup of fallers, i.e., those with unexplained falls and syncope are not captured here. Both groups of fallers are likely to play a pivotal role in understanding the relationship between OH and falls.

The simplicity of the traditional consensus definition of OH belies the complexity of making a diagnosis of OH. Misdiagnosis is a very real clinical possibility unless strict protocols and measurement methods are utilized. This study employed oscillometric BP measurement methods taken intermittently at 30-second intervals for 2 minutes following standing. It is well known that the initial BP response to active standing is a complex dynamic process that evolves over 3 minutes with a wide range of differing behaviors possible. For application of the consensus definition using traditional BP measurement approaches, it is important to eliminate early measurements (within 30 seconds of standing) to avoid confounding effects of movement and restabilization. Traditional oscillometric approaches cannot, however, capture fast transient hypotensive episodes such as initial OH, or increased standing BP variability. These rapid time-varying responses can only be captured accurately and differentiated from sustained OH using continuous beat-to-beat BP measurement methods.

So what of the future? Those with sustained OH obviously need careful evaluation when being prescribed medications known to affect BP, cognitive function, balance, or falls risk. With the trend in BP management guidelines towards aggressive lower BP targets and the recent results from randomized control trials such as the SPRINT and ACCORD studies suggesting that lowering BP does not increase injurious falls risk or OH incidence, it is imperative that a balance is struck between reducing cardiovascular, falls, and syncope risk. It remains, however, unclear what target resting BP optimally balances these risks in older patients. Given the data presented by Juraschek et al., it is possible that this is an individualized U-shaped relationship. It remains to be seen how variations in resting BP values effect this curve—is the risk of injurious falls altered in the face of coexisting hypertension and OH? The stratified data analysis presented in suggests that this is not the case.

This study raises further pertinent questions. What is the relative importance of SBP and DBP in OH, and what BP thresholds are optimal in defining OH? Is searching for a threshold appropriate given that falls risk lies on a continuum as demonstrated in by Juraschek et al.? Or should the field be more concerned with identifying BP patterns that lead to poor clinical outcomes and less concerned with identifying exact thresholds to define OH?

Cerebral perfusion should also not be ignored in this context. Lassen in 1959 first suggested that cerebral autoregulation maintains constant blood flow within a range of BP (60–150 mm Hg) with hypertension resetting and narrowing the range of cerebral autoregulation activity to higher BP values. Clinical management of fallers has been guided by this physiological model leading to the theory that reducing resting BP is likely to lead to cerebral hypoperfusion especially in those with a reset cerebral autoregulatory curve and subsequent falls. These classical models of autoregulation have been challenged recently by emerging data from Liu et al. and others. They note that the cerebral autoregulatory curve is highly individualized, deviating from this presumed behavior in over 50% of people, with age progressively reshaping the cerebral autoregulatory curve with often counter-intuitive mechanisms demonstrated. Identifying an optimum BP management strategy must therefore not only balance OH, falls, syncope, and cardiovascular risk but also consider personalized BP and cerebral perfusion status.

DISCLOSURES

The authors declared no conflict of interest.

REFERENCES


