



Prognostic significance of blood pressure in frail older adults

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Hypertension is a well-established risk factor for cardiovascular diseases and mortality. However, the clinical significance of hypertension may not be common to all individuals; high blood pressure (BP) in older persons did not always show a significant association with worse outcomes. For example, in a longitudinal study based on $\geq 12,000$ community-dwelling older adults, men aged 65–84 years with systolic BP < 130 mmHg have significantly lower mortality, while in the older subpopulation (≥ 85 years), the lowest mortality was observed in a subgroup with systolic BP ≥ 180 mmHg [1]. Similar results were observed in another longitudinal study of 85-year-old adults [2] and older nursing home residents (mean age: 85 years) [3].

A higher mortality rate in the normal BP range was also noted in observational studies of older patients with treated hypertension. The Berlin Initiative Study that included ≥ 70 -year-old patients taking antihypertensive drugs found that, compared with non-normalized BP, normalized BP was associated with an increased risk of all-cause mortality in patients ≥ 80 years old, but not in aged 70–79 years old patients [4]. Studies on nursing home residents older than 80 years old reported that individuals with low systolic blood pressure (< 130 mmHg) with multiple BP medications had the highest mortality rate [5]. Although a database analysis study using the English National Health Service observed a U-shaped association between treated BP levels and all-cause mortality in older (≥ 80 years old) patients with hypertension, the higher mortality in the high systolic BP range might be due to the high incidence rate of cardiovascular events [6]. A population-based longitudinal study

of older adults (mean age 92.1 years old) [7] clearly showed that the different associations between BP and cardiovascular and non-cardiovascular outcomes, i.e., higher systolic BP predicted death from cardiovascular disease, while lower systolic BP predicted death from non-cardiovascular causes, as the reason for the U-shaped association between BP and all-cause mortality.

These observational studies had one thing in common—in the oldest-old cohort ($\sim > 80$ years) BP in the normal range was associated with a less favorable prognosis and outcome. In nature, BP increases with age; however, it was reported to decrease for more than a decade before death in individuals dying at 60 years and older [8]. This unexpected fall in BP may partly be explained by potential comorbidities or poor functional status [9]. Therefore, the nonrandomized epidemiological associations of low BP with higher mortality in older individuals may partly be accounted for by reverse causation [10]. Because frailty, a clinical syndrome characterized by multiple features in older adults [11], but not the accumulation of potential comorbidities increases the BP drop before death [8], frailty may be a modifiable factor for the relationship between unexpected BP fall and mortality. Odden et al. [12] reported findings supporting this from the analysis using the National Health and Nutrition Examination Survey data set, a nationally representative survey of a noninstitutionalized US population. They reported that faster-walking (0.8 m/s or faster) older participants with elevated systolic BP (≥ 140 mmHg) had a higher mortality rate. However, among the participants who did not complete the walk test, participants with elevated systolic BP had a lower mortality rate irrespective of anti-hypertensive medication status. We should consider frail status in the interpretation of BP values in oldest-old adults.

In this issue of *Hypertension Research*, Inoue et al. [13] reported that mortality rate in frail older patients with hypertension (mean age: 78 [71–84] years) did not differ between systolic BP < 140 mmHg [HR = 4.72, 95% CI: 1.67–16.90] and BP ≥ 140 mmHg [HR = 3.56, 95% CI: 1.16–13.40] groups even in a sub-analysis of an older (≥ 75 years) population, though the mortality rates of both groups

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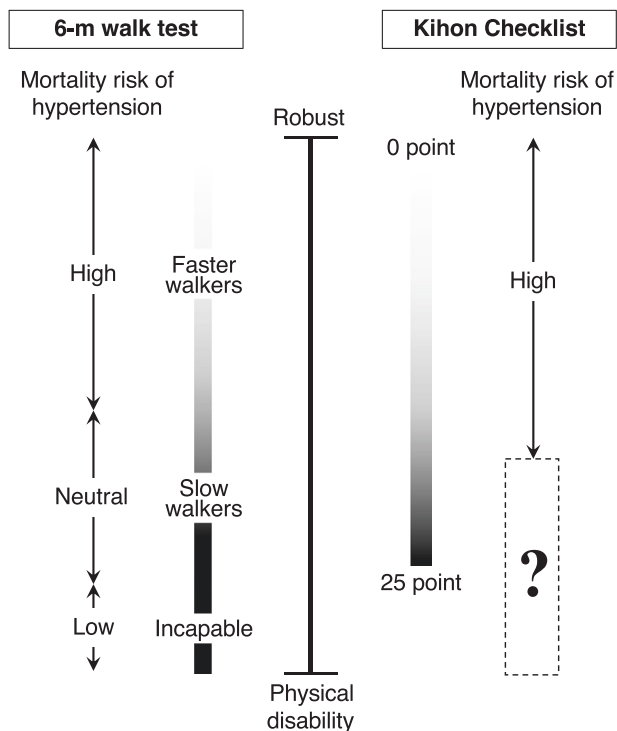


Fig. 1 Frailty status and its impact on mortality risk of hypertension.

were significantly higher when it was compared with that of non-frail patients with systolic BP < 140 mmHg. An important dissimilarity between this study and Odden's study [12] was the definition of frailty; this study used the Kihon Checklist score, a comprehensive questionnaire for the physical, psychological, functional, and social statuses of nondisabled older adults, while Odden et al. used 6-m walk speed. Although the Kihon Checklist score closely correlates with the Cardiovascular Health Study frailty index [14], Odden's criteria might have identified more severe physical frailty cases (Fig. 1). Given the methodological differences, the results of these studies could not be simply compared; however, when we considered frail individuals in Inoue's study as mild cases, the modestly high hazard ratio in the systolic BP < 140 mmHg group might be of importance. Because the confidence interval of the hazard ratio was very wide, owing to the limited number of the study population, I hope that this study will have more participants and provide results of the extended analysis for us. Home BP measurement would also be variable in clarifying the clinical and epidemiological significance of low to normal BP in frail older adults [15]. The priority given to aggressive BP reduction in frail older adults requires further evaluation by randomized clinical trial settings.

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Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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