



Review

Hypertension and aging

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ABSTRACT

Hypertension is a highly prevalent condition with numerous health risks, and the incidence of hypertension is greatest among older adults. Traditional discussions of hypertension have largely focused on the risks for cardiovascular disease and associated events. However, there are a number of collateral effects, including risks for dementia, physical disability, and falls/fractures which are increasingly garnering attention in the hypertension literature. Several key mechanisms – including inflammation, oxidative stress, and endothelial dysfunction – are common to biologic aging and hypertension development and appear to have key mechanistic roles in the development of the cardiovascular and collateral risks of late-life hypertension. The objective of the present review is to highlight the multi-dimensional risks of hypertension among older adults and discuss potential strategies for treatment and future areas of research for improving overall care for older adults with hypertension.

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1. Introduction

“Our great struggle in medicine these days is not just with ignorance and uncertainty. It’s also with complexity: how much you have to make sure you have in your head and think about. There are a thousand ways things can go wrong.”

Atul Gawande (Gawande, 2009).

Life expectancy continues to increase in developed countries worldwide (Roberts, 2011), leading to ever-increasing representation of older adults (i.e., persons over 65 years of age) within the population. In fact, life expectancy worldwide has increased by 20 years since 1950. In the United States, the number of older adults is expected to double to approximately 80 million in the next three

decades (Federal Interagency Forum on Aging-Related Statistics, 2009). Given the dramatically disproportionate utilization of health care resources by older adults – e.g., nearly three quarters of cardiovascular disease (CVD)-related expenditures (Hodgson and Cohen, 1999) – the maintenance of health and well-being among older adults is a critical scientific and public health priority (Institute of Medicine et al., 2008; National Institute on Aging, 2007).

Among the potential targets for improving health among older adults, hypertension represents one of the most prevalent and potentially modifiable. Hypertension causes over 7 million premature deaths per year and contributes to 4.5% of the total disease burden worldwide (Bramlage and Hasford, 2009). Notably, older adults account for the bulk of hypertension-related morbidity and mortality—due largely to dramatically greater prevalence among the elderly (Mozaffarian et al., 2015). In fact, recent data from the National Health and Nutrition Examination Survey indicate

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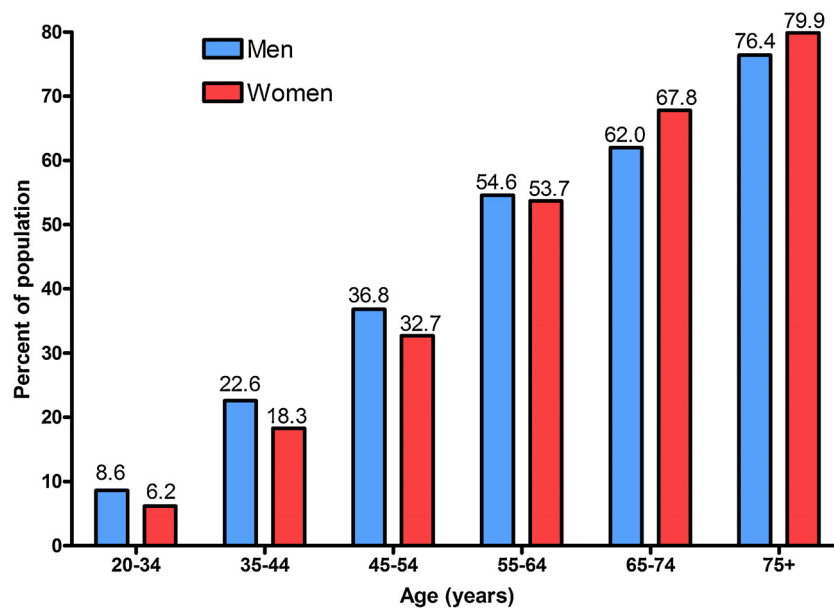


Fig. 1. Prevalence of hypertension among adults by age and sex according to the National Health and Nutrition Examination Survey: 2007–2012. Re-created from Chart 9.1 in Mozaffarian et al. (2015).

that 70% of older adults have hypertension, compared to only 32% for adults aged 40–59 years (Fig. 1) (Mozaffarian et al., 2015). Despite the well-documented pervasiveness of late-life hypertension among older adults, many challenges remain. A 2010 report from the Institute of Medicine (IOM) called hypertension a neglected disease that is often ignored by the general public and underappreciated by the medical community (Institute of Medicine et al., 2010). “Although hypertension is relatively easy to prevent, simple to diagnose, and relatively inexpensive to treat, it remains the second leading cause of death among Americans, and as such should rightly be called a neglected disease”, said David W. Fleming, MD, chair of the committee that prepared the report (Mitka, 2010). Proper screening and adherence to treatment guidelines was particularly emphasized for elderly patients.

Since the release of the IOM report, a number of large clinical trials, systematic reviews, and meta-analyses have been published focusing on proper treatment for patients with hypertension. However, relatively few of these have focused on the treatment of hypertension among older adults (Goeres et al., 2014). This relative paucity of data in this area may be related to the common practice of excluding older adults from randomized controlled trials (RCTs) due to concerns about safety and/or confounding effects of co-morbid conditions (Pahor and Cesari, 2012; Van Spall et al., 2007). Indeed, numerous challenges exist in the treatment of hypertension among older adults – including and altered drug metabolism (Belmin et al., 2000), multiple concomitant medications and co-morbidities (Benetos et al., 2015), as well as increased blood pressure variability and orthostatic hypotension (Sera and McPherson, 2012) – that make it difficult to obtain definitive evidence of proper treatment guidelines. Still, it is these challenges which make it critical to conduct studies which will improve medical decision making related to the treatment of hypertension among older adults.

Furthermore, RCTs have primarily focused on cardiovascular effects of hypertension treatment despite well-documented links between late-life hypertension and other health outcomes relevant to older adults including physical function, bone health, and cognition. It is critical that we improve our understanding of how hypertension treatment influences such geriatric outcomes as they, like cardiovascular disease, dramatically influence risks for hospi-

talization, morbidity, and mortality (Ray et al., 1997; Sachs et al., 2011; Studenski et al., 2011). Decision making in treating hypertensive older adults is further convoluted by the fact that these varied health outcomes are not independent but often have similar etiologies and may interact to exacerbate the progression of one another. It is this complexity that makes it necessary to view geriatric hypertension decision making not from the perspective of a single outcome (e.g., CVD, dementia) but rather using a holistic approach that incorporates the individual characteristics of each patient and uses a broad lens to assess health. The objective of this review is to therefore synthesize hypertension literature from several fields into a framework which integrates these distinct but overlapping fields.

2. Common mechanisms of aging and hypertension—the vascular health triad

In humans, aging is a continual and progressive process that results in decreased physiologic function across all organ systems (Franceschi et al., 2008). These physiologic decrements result in an increased vulnerability to infection and disease which dramatically elevate mortality risk (Candore et al., 2006; Troen, 2003). In fact, compared to persons 25–44 years of age, mortality risk among older adults is elevated by 100-fold for stroke and chronic lung disease, roughly 90-fold for heart disease, pneumonia and influenza, and over 40-fold for cancer (Troen, 2003). As diverse as the etiologies of age-related diseases are, significant evidence implicates two interconnected mechanisms among the most common biologic contributors to age-related disease: (1) chronic, low-grade inflammation (Cevenini et al., 2010; Chung et al., 2009; Singh and Newman, 2011; Vasto et al., 2007) and (2) increased cellular oxidative stress (Chen et al., 2007; Harman, 1956; Valko et al., 2007; Yu and Yang, 1996).

Inflammation is a localized response to tissue injury or infection which aids in the repair of damaged tissue and/or destruction of the harmful agent. Classically characterized by pain, heat, redness, swelling, and loss of function—acute inflammation is typically resolved in relatively short order to promote the restoration of tissue function. However, during advanced age, the ability to resolve inflammation becomes impaired leading to sustained

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