

Research Article

Elevated systolic blood pressure is associated with increased incidence of chronic kidney disease but not mortality in elderly veterans



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Abstract

The optimal blood pressure to prevent development of chronic kidney disease (CKD) and mortality in the elderly is unclear. Our objective was to determine the effect of differing levels of blood pressure on incidence of CKD and mortality in elderly veterans. This retrospective cohort study included 15,221 individuals ≥ 70 years of age without CKD (outpatient estimated glomerular filtration rate >60 mL/min/1.73 m²) seen in the primary care clinic in the Veterans Affairs Health Care Upstate New York with Veterans Integrated Service Network 2 between 2001 and 2008. To examine the association of explanatory variables on hazard ratios for outcomes of interest, incident CKD, and death, competing risk analysis (with death as competing risk) was used for the analysis of incident CKD outcome, and time-dependent Cox model with CKD as the time-dependent covariate was used for the analysis of death outcome. The incidence of CKD was 16% over a median follow-up of 19 quarters. Compared with reference of systolic blood pressure of 130–139 mm Hg, there was an increased hazard of development of CKD with systolic blood pressure of 140–149 mm Hg or higher. As compared with a reference range of 130–139 mm Hg systolic blood pressure, the relative risk of mortality was higher in the range of 120–129 mm Hg systolic or less. The optimal achieved systolic blood pressure in elderly patients to prevent the development of CKD was <140 mm Hg. However, lowering the systolic blood pressure below 130 mm Hg was associated with increased mortality. *J Am Soc Hypertens* 2015;9(1):29–37. Published by Elsevier Inc. on behalf of American Society of Hypertension.

Keywords: Hypertension; outcomes; renal.

Introduction

The prevalence of chronic kidney disease (CKD) continues to increase especially in the elderly and is associated with a lesser quality of life, increased healthcare expenditures, and a decrease in life expectancy.¹ Hypertension is the second leading cause of CKD and end-stage renal disease (ESRD) in the United States.² Development of CKD has also been shown to be a risk factor for cardiovascular disease.^{3–6} There is continued debate as to the optimal

blood pressure (BP) target in the elderly. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) recommended that elderly patients be treated to the same BP goals as younger patients, that is, in patients without CKD or diabetes, a BP of $<140/90$ mm Hg.⁷ The recent 2014 Evidence-Based Guidelines for the Management of High Blood Pressure in Adults recommends that hypertensive patients age 60 or older should be treated to a BP goal of $<150/90$ mm Hg.⁸ There is not much data from randomized controlled trials to support these recommendations. However, elderly patients are often not treated to lower BP goals because of a higher incidence of side effects of medications.⁹

The available data shows that control of hypertension to a systolic blood pressure (SBP) of 140–150 mm Hg reduces

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stroke and mortality in elderly patients with normal renal function.^{10–15} It is unclear what the optimal SBP is to prevent the development of CKD in this population. We performed a retrospective cohort analysis on a large population of veterans in upstate New York to examine the association of SBP, diastolic blood pressure (DBP), and the development of CKD (estimated glomerular filtration rate [eGFR] <60 mL/min/1.73 m²) and mortality.

Methods

Study Population

The data were obtained from the Veterans Affairs Health Care Upstate New York Veterans Integrated Service Network 2 (VISN2), which contains longitudinal records of 180,553 Veterans Affairs patients. All patients who were seen in primary care clinic in VISN2 from April 1, 2001 until April 30, 2008 were screened for at least one observed eGFR estimated by Chronic Kidney Disease Epidemiology Collaboration (CKD–EPI) equation.

The study population included 15,221 elderly patients (age at baseline ≥ 70 years) with baseline eGFR >60 mL/min/1.73 m² (CKD–EPI equation) with at least one observation of each outpatient lab test of interest from April 2002 through April 2008. The study flow diagram is given in Figure 1.

Baseline Measurements and Definitions

Demographic data obtained included age, gender, race, and body mass index (BMI). The following comorbid conditions were obtained from the clinical problem list by International Classification of Disease (ICD) codes: vascular disease (including coronary artery disease, peripheral vascular disease [PVD], and cerebrovascular disease), congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), malignancy, and hypertension. Outpatient clinical measurements included are SBP and DBP as measured by a nurse using an automated device, serum creatinine (Scr), hemoglobin (Hgb), and serum lipid profile (high-density lipoprotein cholesterol [HDL], low-density lipoprotein cholesterol [LDL], triglycerides [TRIG], and urine protein by dipstick). Patients with negative or trace proteinuria were considered to be negative for proteinuria, those with 1+ or greater were considered to have proteinuria. These were also retrieved on every encounter in which they were performed. Medication use was defined as use of any antihypertensive medication.

CKD was defined as an outpatient eGFR <60 mL/min/1.73 m². The first recorded SCr value was used as the index SCr. Comorbidities were defined using the ICD codes. Death was documented by review of all charts.

Quarterly time periods were defined. The BP measurements associated with each quarter were the averaged values obtained within that quarter. The clinical

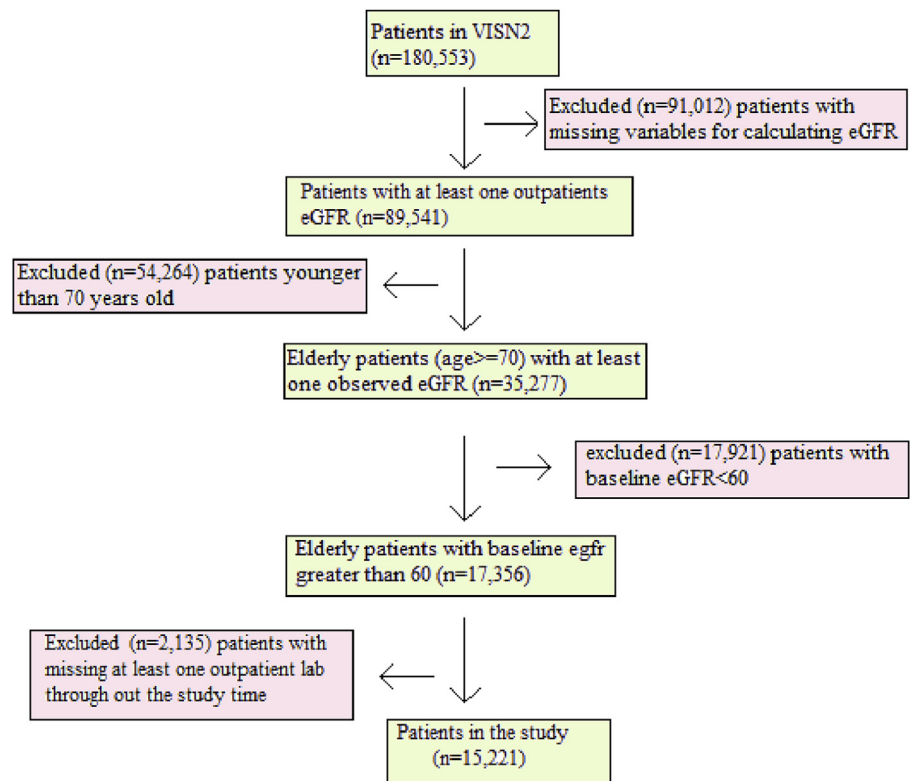


Figure 1. Population study flow diagram. eGFR, estimated glomerular filtration rate; VISN2, Veterans Integrated Service Network 2.

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