Original article

Hypertension and its associated risks among Singapore elderly residential population

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Lee Seng Esmond Seow, BA [*], Mythily Subramaniam, MBBS, MHSM,
Edimansyah Abdin, PhD, Janhavi Ajit Vaingankar, MSc,
Siow Ann Chong, MBBS, MMed, MD

Research Division, Institute of Mental Health, Singapore

ABSTRACT

Background: Studies have shown hypertension to be a common health problem among the elderly. The prevalence, awareness, treatment, and control of hypertension, along with their sociodemographic and health-related correlates were established in a national cross-sectional epidemiological study of the elderly in Singapore. The associations between hypertension and select medical risks were also investigated.
Methods: Data was collected from 2488 randomly selected elderly ($\geq$ 60 years) as part of the Well-being of the Singapore Elderly (WiSE) study that involved face-to-face surveys and physical examination. Sitting blood pressure (BP) was measured twice with a 1 minute interval and averaged. Hypertension was defined by a systolic blood pressure (SBP) $\geq$ 140 mmHg, and/or a diastolic blood pressure (DBP) $\geq$ 90 mmHg, and/or current treatment with anti-hypertensive medication.
Results: The prevalence of hypertension in this population was 74.1%. The rate of hypertension was associated with older age, lower education, and higher body mass index (BMI). Those who were Malay, retired and very physically active were more likely to be unaware of being hypertensive. An age of $\geq$85 years, being unemployed, widowed or divorced/separated, and being a non-smoker were associated with uncontrolled hypertension. Those with hypertension were also more likely to report a diagnosis of diabetes.
Conclusion: The proportion of elderly with hypertension is high in this Asian population. What is of concern is the substantial proportion of undetected cases. This highlights the need for effective health screening among the elderly. Optimal control of BP in those diagnosed with hypertension is also a cause for concern, as identified in our study.

1. Introduction

Hypertension is a chronic health problem that involves the primary elevation of systemic blood pressure (BP), otherwise known as high BP. It is a global public health issue that affects approximately 1 billion people worldwide in both developed and developing countries.[1] Prevalence of hypertension increases with age and hence the elderly tend to have the highest prevalence within a particular population,[2,3] reaching as high as 60–80% in developed nations.[2,4]

The Framingham Heart Study found that the residual lifetime risks of developing hypertension through to the age of 80 years for men and women who were normotensive at age 55 years are 93% and 91% respectively. This means that more than 90% of individuals who are free from hypertension at 55 years of age will eventually develop it during their remaining life span.[5] As the world population ages progressively along with a concomitant increase in life expectancy, the issue of hypertension among the elderly has become a further cause for concern. Hypertension is a widely recognised major risk factor for cardiovascular disease such as stroke and myocardial infarction, as well as for chronic kidney diseases and congestive heart failure among men and women,[6,7] making it the leading cause of morbidity and mortality among the elderly. In addition, it has been suggested that hypertension increases the risk of dementia

* Corresponding author. Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747, Singapore.
 E-mail address: esmond_LS_SEOW@imh.com.sg (L.S.E. Seow).

and cognitive decline among the elderly.[8,9] The evidence supporting the relationship between hypertension and depression, however, remains controversial.[10,11] Generally, it was reported that the elderly have higher expenditures per capita for hypertension and related diseases.[12] The annual cardiovascular costs (including health care services, medication, and missed days of work) associated with hypertension in the United States for people aged 65–79 years are projected to increase by 238%, from $135 billion to $457 billion per year, from 2010 to 2030.[13]

Better control of hypertension among the elderly requires an increase in awareness among the population and improved effectiveness of pharmacological and non-pharmacological interventions.[14] Early detection and treatment aids in minimizing the medical care costs associated with hypertension and the other diseases for which people with hypertension are at increased risk. Randomized, controlled clinical trials have demonstrated significant clinical benefits in treating hypertension among the elderly.[15–17] In a meta-analysis involving 15,693 elderly participants with isolated systolic hypertension in eight clinical trials against placebo, the risk of stroke was reduced by 30%, coronary heart disease events by 23%, all cardiovascular complications by 26%, and cardiovascular mortality by 18% upon active drug therapy.[18] Singapore has an aging population with those aged ≥ 65 years making up 11% of the residential population in 2014.[19] Many studies have identified the effects of demographic and lifestyle factors such as gender, age, socioeconomic status,[20,21] smoking,[21,22] body mass index (BMI),[23] exercise[22,24] and alcohol consumption[25] on BP among the elderly. However, such characteristics are not uniform across countries due to key differences in demographics indicators (e.g., ethnicity) and level of socioeconomic deprivation. Hence, epidemiological analysis needs to be conducted in the local context for better planning and management of hypertension in any population. In this study, our aims were to: (1) investigate the prevalence, awareness, treatment, and adequacy of control of hypertension; (2) examine their respective sociodemographic and health-related correlates; and (3) investigate the association between hypertension and select lifetime medical conditions (self-reported) among the elderly population in Singapore.

2. Methods

2.1. Study overview

Data was collected as part of the Well-Being of the Singapore Elderly (WiSE) study, a cross-sectional household survey involving face-to-face interview and physical examination conducted from October 2012 to December 2013. The door-to-door visits were preceded by an extensive training program for the field interviewers who were individually assessed for their proficiency and skill in performing the necessary procedures. Participants were given an inconvenience fee upon completion of the survey. The study was approved by the relevant ethics committees in Singapore i.e. the National Healthcare Group, Domain Specific Review Board, and the SingHealth Centralised Institutional Review Board. The study methodology has been described in detail in a prior article.[26]

2.2. Study participants

The respondents in the study were Singapore residents (including Singapore citizens and permanent residents) aged ≥ 60 years who were living in Singapore. They were randomly selected from a national database that maintains the names, sociodemographic information such as age, gender, ethnicities, and household addresses of all residents. Efforts were made to follow up on residents who were admitted to, or residing in a hospital or nursing home during the course of the study. Residents who were living outside the country and those not contactable due to incomplete or incorrect addresses were excluded from the study. Prior to participation, written informed consent was obtained from all respondents and in the case of participants who were unable to provide informed consent, a written informed consent was taken from their legally acceptable representative or next of kin. To increase the precision of subgroup estimation, a disproportionate stratified sampling (by age group and ethnicity) was planned, where the three main ethnic groups—Chinese, Malay, and Indian—were sampled in proportions of approximately 40%, 30%, and 30% respectively. Individuals aged ≥ 75 years were also over-sampled. Sociodemographic information including age, gender, ethnicity, marital status, education, employment status, as well as level of physical activity and smoking status were collected using a structured questionnaire. The interviewers also measured the height and weight of each respondent to obtain their BMI for risk assessment of cardiovascular disease. The suggested categories based on Asian populations[27] are as follows: (1) underweight (< 18.5 kg/m^3); (2) increasing, but acceptable risk of cardiovascular disease (18.5–23.0 kg/m^3); (3) increased risk (23.0–27.5 kg/m^3); and (4) high risk (> 27.5 kg/m^3).

2.3. Measurement of BP

During the course of the visit, resting BP was measured twice, with a 1 minute interval, by the trained interviewers using an electronic sphygmomanometer (Omron HEM-7211; Omron Healthcare). Participants were advised to relax in a sitting position, with their left elbow raised to the heart level and were asked to abstain from eating, drinking alcohol or caffeinated beverages, exercising or smoking for at least 30 minutes prior to their BP measurement. The mean of the two readings was used to define the systolic (SBP) and diastolic (DBP) blood pressure.

2.4. Definitions

Hypertension was defined as having a SBP ≥ 140 mmHg, a DBP ≥ 90 mmHg, and/or undergoing current treatment with antihypertensive medication. This definition excludes hypertensive individuals who have attained a BP level in the normotensive range by non-pharmacological means.[28] Awareness of hypertension was defined as a prior diagnosis by a doctor. Treatment of hypertension was defined as the current pharmacological treatment initiated by the doctors for lowering elevated BP. Control of hypertension was defined as having a current SBP < 140 mmHg and DBP < 90 mmHg associated with the pharmacological treatment.

2.5. Statistical analyses

All estimates were weighted to adjust for over-sampling and post-stratified for age and ethnicity distributions between the survey sample and the Singapore resident population in 2011. Mean and standard error were calculated for BP values, and frequencies and percentages for all other categorical variables. We also examined the mean and distribution of BP classes, as defined by the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7),[28] in the study sample across age, gender, and ethnicity.

For the purpose of the study, a series of multiple logistic regression analyses were performed to study the impact of select sociodemographic and health-related factors on the prevalence of hypertension. We used hypertension status as the main outcome variable, with age, gender, ethnicity, marital status, education, employment status, BMI, exercise, and smoking as predictor variables. Respondents' awareness, treatment and control of hypertension were also investigated. The association between