Original Article

Characteristics, and Disease Control and Complications of Hypertensive Patients in Primary-care – A Community-based Study in Singapore

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Abstract

Introduction: Hypertension is a common chronic condition usually managed by primary-care practitioners in Singapore. This study assessed the characteristics, control and complications of non-diabetic hypertensive patients managed at government primary healthcare clinics. Materials and Methods: A cross-sectional study involving 9 clinics was conducted over 1-week in 2006. Five hundred and six non-diabetic hypertensive patients were systematically sampled from all clinic attendees. Data relating to socio-demographic, lifestyle factors, treatment and complications were collected by interviewer-administered questionnaires and review of clinic medical records. Blood pressure (BP) measurements were taken with validated automated sets following a standard protocol. Results: The prevalence of good BP control (<140/90 mmHg) was 37.7% (95% CI: 33.6% to 41.8%). Ninety seven percent were on medication with about half on monotherapy. Seventy percent of patients had a body mass index (BMI) of 23.0 kg/m^2 or higher, 64% did not exercise regularly and 8% were current smokers. After adjusting for age and lifestyle factors, male hypertensive patients had poorer BP control compared to females. Nineteen percent of patients reported at least 1 complication of hypertension, especially cardiac disease. After multivariate analysis and duration of disease, age and the male gender were associated with the presence of hypertensive complications. Conclusions: More than half of the patients were not controlled to target levels. Male patients were more likely to have poorer control of hypertension and significantly higher risks of complications. Control of BP could be further improved by lifestyle modifications – weight reduction, promotion of physical activity, healthier eating habits and smoking cessation.

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Key words: Blood pressure, Cross-sectional, Prevalence

Introduction

Essential hypertension is a chronic disease involving the primary elevation of systemic blood pressure (BP). While the main causes of essential hypertension has not been identified, this disease is currently attributed to a host of genetic and environmental factors.[1] Worldwide, hypertension is increasingly prevalent in both developed and developing countries. In the United States (US), the prevalence of hypertension in the community aged 20 years and above is estimated to be 28.7%.[2] In Singapore's National Health Survey 2004 (NHS 2004), the prevalence of hypertension among Singapore residents aged 30 to 69 years old was found to be as high as 24.9%.[3]

The primary objective for the treatment of hypertension is to reduce the systolic BP level to below 140 mmHg and diastolic BP level to below 90 mmHg.[4] Uncontrolled high BP is known to lead to severe debilitating complications such as stroke and coronary artery disease.[5,6] Hypertension has been estimated to contribute 4.5% of current global disease burden[4] and this is expected to increase if the current trend continues. In the US, it was found that only 53.1% of treated hypertensive patients have good control.[7] In Singapore, based on a national cross-sectional population-based health survey, the prevalence of good BP control among known hypertensive patients was 49.5%.[3] Low prevalence of adequate BP control has also been documented in the US,

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Spain, Canada, France and the United Kingdom (UK), with the proportion of patients with a BP less than or equal to 140/90 mmHg ranging from 13% in France to about 22% in the UK.[8-13]

Many studies have demonstrated the effects of demographic and lifestyle factors on control such as gender, age, socioeconomic status,[14] body mass index,[15] exercise,[16] dietary salt intake,[17] alcohol intake,[18] smoking[19] as well as good knowledge and self-monitoring of BP.[20] Hence, it is important to understand the characteristics of hypertensive patients to institute plans for adequate treatment in the community to improve BP control and prevent the complications of hypertension.

In Singapore, almost half of the hypertensive patients seeking treatment aged 65 years and above are managed at government-funded primary-care clinics. This accounts for two-thirds of all hypertensive patients managed in the community with the other one-third being managed by specialists in the hospitals.[21] In this study, we seek to describe the characteristics of non-diabetic hypertensive patients attending 9 National Healthcare Group Polyclinics to assess the socio-demographic distribution, lifestyle and cardiovascular risk factors and their association with BP control.

Materials and Methods

Study Population

The subjects in our study were existing patients at the polyclinics over 1 working week (5½ days) seeking consultation for hypertension. These patients were identified by direct questioning by the interviewers at the point of clinic registration using the question: "Are you here to see a doctor for high BP?" A second question on whether the respondents had diabetes was asked if they answered 'yes' to the 1st question. Those who answered 'yes' to the first and 'no' to the second question were included in our study. Patients excluded were those who had hypertension but who were consulting the doctor for another condition for that day, those who had unconfirmed or newly-diagnosed (on the survey day itself) hypertension, pregnant patients, those with renal failure and diabetes mellitus. We excluded patients with diabetes, renal failure as well as pregnant patients as these patients had differing BP targets compared to those without these conditions.

Systematic sampling of 1 in 10 eligible patients was performed as this was calculated to give sufficient power for the study. Our final sample population was 580 patients, of which 506 subjects agreed to participate in our study, giving a response rate of 87.2%. This formed the total study population. This study was approved by the Institutional Review Board of the National University of Singapore.

Questionnaire

A questionnaire administered by trained interviewers was used. It was translated into Chinese, Malay and Tamil. Information collected included demographic data, hypertension history, lifestyle factors and medication history. Smokers were defined as subjects who had smoked at least 100 cigarettes previously.[22] Information regarding passive smoking was only relevant if the subject was never a smoker or had quit smoking. Exposure to passive smoking was defined as considerable if the patient was near smoke on a daily basis at the workplace or if any individual(s) in the household smoked daily for 6 months or more. An alcohol drinker was defined as someone who consumed alcoholic beverages once a month or more, regardless of the type of beverage consumed.[23] Physical activity was classified into light, moderate or vigorous activity according to the guidelines provided by the American College of Cardiology and American Heart Association.[24] 'Significant physical activity' was defined as regular activity of moderate intensity performed at least 5 times a week for the past 3 months, with each session lasting at least 30 minutes.[16,25] A 21-item, 3-day food frequency questionnaire containing foods with high sodium content which are commonly consumed in Singapore was used to assess salt intake.

Measurements of BP, Height and Weight

The resting BP of the left upper limb was measured using a validated automatic BP set (model: OMRON HEM-705CP).[26] A standardised BP measurement protocol was implemented to minimise measurement errors.[27] Three readings were taken: 1 at the start of the survey and the subsequent 2 at intervals of 5 minutes or more. The average of the second and third readings was calculated and used as the BP reading. The height and weight of each patient were measured using standardised measuring tapes and weighing scales and training was conducted to ensure standardisation of measurement protocols, reducing possible measurement errors. All measurements were taken by third-year medical undergraduates of the National University of Singapore.

We defined BP control and categorised BMI by cardiovascular risk according to the Singapore Ministry of Health Clinical Practice Guidelines.[5,28] Ideal BP control was defined as a systolic BP of less than 140 mmHg and a diastolic BP of less than 90 mmHg.[5]

Statistical Analysis

All statistical analyses were carried out on SPSS version 14.0 (SPSS Institute, Chicago, IL, USA). Continuous variables between groups were compared using 2-tailed t-tests. For variables with skewed distribution, the Mann-Whitney-U test was used. For categorical variables, the χ^2-test was used, with additional linear-by-linear association

test if the variables were also ordinal. The multivariable analysis was done using the Cox Proportional Hazards Model. Since this was a cross-sectional study, unit follow-up time was assigned to all the study subjects for the analysis. All *P* values reported were 2-sided and *P* values less than 0.05 were considered statistically significant.

Results

Table 1 describes the demographic characteristics of the population in our study. The mean age was 61.4 years [standard deviation (SD): 12.1]. There were more females (57.5%) than males in our study population but the ethnic distribution was similar to that of the hypertensive patients among community-dwelling elderly found in a previous study.[21] The mean age for the diagnosis of hypertension was 51.3 years (SD: 12.3). The median duration of hypertension was 8 years (inter-quartile range: 12 years).

The mean systolic BP was 143.9 mmHg (SD: 19.0) and diastolic BP was 84.3 mmHg (SD: 11.0). By definition, 37.7% [95% confidence interval (CI), 33.6 to 41.8] of the patients was categorised as having good BP control.

Table 2 shows the distribution of associations of factors associated with non-ideal control of hypertension in our sampled population. After multivariate analysis, male gender was an independent risk factor significantly associated with poor BP control [prevalence rate ratio (PRR), 1.30; 95% CI, 1.00 to 1.69] after adjusting for age, duration of disease, ethnicity, BMI, smoking status, exercise status, salt intake and sleep duration. Compared to the Chinese, Malays were more likely to have poor BP control but this association was not seen after multivariate analysis. The associations with alcohol intake, salt intake, BMI, physical activity and self-measurement of BP on the control of BP were not found to be statistically significant.

For BMI status, the majority (69.8%) of our patients were at an increased risk of heart disease (42.0% with BMI 23 to 27.49 and 27.8% with BMI ≥27.5). Only 26.4% were in the low risk category (BMI 18.5 to 22.99) and 3.8% in the category indicating risk of nutritional deficiency (BMI <18.5). For physical activity, only 36.3% met the ACC/AHA criteria for adequate exercise.[24] More than half (53.2%) did not have sufficient exercise and 10.5% reported no exercise at all. Less than 1 in 10 (8.4%) reported that they were currently smoking cigarettes.

Almost 1 in 5 (19.1%) respondents had a past history of 1 or more hypertensive complications – heart disease, stroke, kidney disease or eye disease. Of these, 9 patients (1.8%) had more than 1 complication. Amongst those with 1 or more complications, heart disease (55.7%) and stroke (37.1%) were most common. Renal impairment and eye disease were less common complications (8.2% and 9.3%, respectively).

Table 1. Characteristics of Hypertensive Patients with Good and Poor Blood Pressure Control

	Good control n = 191 (%)	**Poor control n = 315 (%)**	***P***
Mean age ± SD (y)	60.5 ± 11.7	61.7 ± 12.0	0.25
Gender			
Female	129 (67.5)	62 (32.5)	
Male	162 (51.4)	153 (48.6)	<0.001
Ethnicity			
Chinese	170 (89.0)	267 (84.8)	-
Malay	6 (3.1)	27 (8.6)	0.02
Indian	15 (7.9)	18 (5.7)	0.47
Others	0 (0)	3 (1.0)	0.29
Marital status			
Single/Divorced/ Separated/Widowed	45 (23.6)	54 (17.1)	0.08
Married	146 (76.4)	261 (82.9)	
Housing			
1-3 Room HDB	45 (23.6)	81 (25.7)	0.61
4- room HDB and above	145 (75.9)	234 (74.3)	
Education level			
No formal education	74 (38.7)	126 (40.0)	0.74
Primary	52 (27.2)	93 (29.5)	
Post-Secondary	64 (33.5)	96 (30.5)	
Working status			
Working	73 (38.2)	117 (37.1)	0.77
Unemployed/Retired	70 (36.6)	126 40.0)	
Homemaker/Housewife	47 (24.6)	72 (22.9)	

Numbers do not add up to total numbers due to missing values

Table 3 shows the factors associated with hypertensive patients with complications. After multivariate analysis, we found that each increasing year (in patient's age) conferred a PRR of 1.03 (95% CI, 1.01 to 1.06). Stratifying by gender, men with hypertensive complications were 4.6 years older than those without (64.3 years vs. 59.7 years; 95% CI, 1.1 to 8.2), while women with complications were 10.9 years older than those without (71.3 years vs 60.4 years; 95% CI, 6.9 to 14.9). Compared to women, men were more likely to develop complications (PRR, 2.11; 95% CI, 1.29 to 3.44). Duration of hypertension was also associated with the development of complications – with each increment year conferring a PRR of 1.02 (95% CI, 1.00 to 1.05). There also appeared to be a linear-by-linear relationship ($P = 0.038$) between poorly controlled BP and the number of anti-hypertensive medications used.

Table 2. Factors Associated with Poor Blood Pressure (BP) Control*

	Poor control n (%)	Good control n (%)	PRR (95% CI)
Mean age ± SD (y)	61.7 ± 12.0	60.5 ± 11.7	
Gender			
Female	162 (51.4)	129 (67.5)	1.00
Male	153 (48.6)	62 (32.5)	1.30 (1.00-1.69)
Ethnicity			
Chinese	267 (85.5)	170 (89.0)	1.00
Malay	27 (8.7)	6 (3.1)	1.34 (0.88-2.03)
Indian	18 (5.8)	15 (7.9)	0.88 (0.54-1.45)
BMI status			
18.5 – 22.9	80 (25.6)	52 (28.0)	1.00
<18.5	13 (4.2)	7 (3.8)	1.08 (0.58- 2.00)
23.0 – 27.5	135 (43.1)	77 (41.4)	1.08 (0.81-1.43)
>27.5	85 (27.2)	50 (26.9)	1.06 (0.76-1.22)
Smoking status			
Never smoker	234 (74.5)	153 (80.1)	1.00
Ever smoker	51 (16.2)	24 (12.6)	1.00 (0.71-1.41)
Current Smoker	29 (9.2)	14 (7.3)	0.98 (0.64-0.50)
Exercise status			
Adequate	111 (35.4)	71 (37.2)	1.00
Inadequate	169 (53.8)	101 (52.9)	1.00 (0.78-1.27)
No exercise	34 (10.8)	19 (9.9)	1.12 (0.74-1.69
Salt Intake			
Normal	158 (50.8)	97 (52.2)	1.00
High	153 (49.2)	89 (47.8)	0.96 (0.77-1.22)
Sleep			
= < 6.5 hrs	151 (47.9)	101 (52.9)	1.00
> 6.5 hrs	164 (52.1)	90 (47.1)	0.97 (0.77-1.21)
Mean duration of disease ± SD (y)	9.9 ± 8.3	10.5 ± 9.3	0.99 (0.98-1.01)

95% CI: 95% confidence interval; PRR: prevalence rate ratio of poor vs good control

* Multivariate model using Cox-proportional Hazards, factors adjusted for age and each other. Numbers do not add up to total due to missing values.

† $P = 0.038$, Chi-square test linear by linear association.

Table 3. Factors Associated with Complications of Hypertension*

	One or more complications n (%)	No complications n (%)	PRR (95%CI)
Mean age ± SD (y)	67.1 ± 11.1	60.1 ± 12.0	
Gender			
Female	38 (39.2)	261 (62.4)	1.00
Male	59 (60.8)	157 (37.6)	2.11 (1.29-3.44)
Ethnicity			
Chinese	82 (85.4)	357 (86.0)	1.00
Malay	6 (6.3)	29 (7.0)	0.95 (0.37-2.41)
Indian	8 (8.3)	29 (7.0)	1.18 (0.53-2.59)
BMI status			
18.5-22.9	27 (29.7)	107 (25.8)	1.00
<18.5	3 (3.3)	17 (4.1)	0.82 (0.24-2.76)
23.0-27.5	38 (41.8)	173 (41.8)	0.96 (0.57-1.61)
>27.5	23 (25.3)	117 (28.3)	1.07 (0.59-1.94)
Smoking status			
Never smoker	64 (66.0)	330 (79.3)	1.00
Ever smoker	25 (25.8)	49 (11.8)	1.28 (0.56-2.93)
Current smoker	8 (8.2)	37 (8.9)	1.58 (0.66-3.77)
BP control			
Good	29 (31.2)	156 (39.8)	1.00
Poor	64 (68.8)	236 (60.2)	1.29 (0.80-2.08)
Duration of disease (y)	13.2 (10.0)	9.4 (8.3)	1.02 (1.00-1.05)

95% CI: 95% confidence interval; PRR: prevalence rate ratio of poor vs good control

* Multivariate model using Cox-proportional Hazards, factors adjusted for age, duration of disease, gender, ethnicity, BMI status, smoking status and BP control

Numbers do not add up to total due to missing values.

For types of medications, there were 4 patients whose medication lists were not available. The majority (96.8%) were on 1 or more anti-hypertensive drugs with the rest on dietary and lifestyle modifications. For those on medication, about half (50.8%) were on monotherapy, 37.5% were on 2 medications and 11.7% on 3 or more medications. The most common single drug used was beta-blockers (BB) (51.0%). Calcium-channel blockers (CCB) (21.1%), angiotensin converting enzyme-inhibitors (ACEI), angiotensin receptor blockers (ARB) (14.2%) and diuretics (13.4%) made up the rest. For those on 2 medications, the most commonly used combination was BB with diuretics (32.6%), followed by BB with CCB (21.8%). Patients aged 60 and above were more likely to be on combination therapy (PRR, 1.67; 95% CI, 1.18 to 2.37). Gender and ethnicity were not found to be associated with being on more than 1 anti-hypertensive drug.

Discussion

Our study found that only slightly more than one-third of our respondents had good BP control. Among those with

poor BP control, a majority (51.7%) had raised isolated systolic BP, 42.5% had both raised systolic and diastolic BP and 5.7% had raised diastolic BP. This is slightly lower than the profile of non-ideal control of hypertension in the US, where 77% of hypertensive patients with poor control have isolated systolic BP.[29]

Female respondents constituted almost 60.0% in our sample although hypertension was more predominant in males compared with females in the NHS 2005.[3] Several reasons may account for this. A larger proportion of hypertensive male patients may be working during the opening hours of the polyclinics. They could end up consulting their company doctors during office hours or private GPs after office hours for the treatment of their hypertension. Men also tend to have poorer health-seeking behaviour compared to women.[30]

The prevalence of ideal control among hypertensive patients in our study was found to be 37.7%. This was lower than the last NHS 2004 (49.5%)[3] but higher than a developing country like China (28.8%).[31] Like other developed countries around the world – Canada (41%) and United States (53.1%) – the achievement of ideal control of hypertension poses a considerable public health challenge globally and better measures are required at the population level to tackle this problem.[7]

We found several factors affecting BP control. First, the prevalence of non-ideal control was higher in males than in females. This is consistent with data from studies in the US.[29] Poorer control among males may be attributed to a poorer health-seeking behaviour or it could be due to the fact that males were more likely to seek medical treatment for hypertension at a later stage or were less concerned about control of their disease.[30] There was also the possibility of confounders. Studies have shown that more males were smokers[32] and were more likely to be exposed to work-related stress as males are more active in the workforce.[33] These factors have been shown to affect the control of BP.[19,34] It is well-known that smoking increases arterial stiffening, has powerful sympathetic excitatory effect, as well as reduced arterial baro-reflex in individuals exposed to tobacco smoke.[35]

High BMI and hypertension are well-established independent risk factors of cardiovascular disease.[36,37] Stratifying by BMI, almost three-quarters of our subjects would have been classified as having moderate to high risk of cardiovascular disease.[38] Combined with hypertension, such patients would be at an even greater risk of cardiovascular disease. Although our study did not show any significant association between BMI and poor control of BP, there is a need to manage effectively obesity among hypertensive patients.

Almost half of our hypertensive patients did not exercise regularly, which is important in reducing BP.[16,39] There is also an association between a sedentary lifestyle and poor control of BP.[40] A relatively high proportion of sedentary subjects among our respondents was of concern. High dietary salt intake is also associated with non-ideal BP control in hypertensives[17] but our study did not find any association. This may be due to limitations of our questionnaire and the cross-sectional design of our study. A more comprehensive study including the analysis of the sodium content in 24-hour urine collection, detailing food portion and intake frequency, would better assess the dietary sodium intake among our respondents.

For hypertensive complications, we found that increasing age, male gender and a longer duration of disease were associated with the development of complications; the most common being heart disease and stroke. This follows the natural history of hypertension, where increasing vascular damage is accumulated over years resulting in complications.

We also found that men were more likely to develop complications earlier than women. While we cannot infer a temporal relationship between the patients with poor control and complications of hypertension, our results suggest that male hypertensive patients are a higher-risk group that we need to pay extra attention.

Our cross-sectional study had several strengths. We had a large sample size of 506 patients with a high response rate. Sampling was done over an entire work week, obtaining a fair representation of the population being studied. To reduce interviewer bias, our interviewers were trained to standardise questioning methods in administering the questionnaire. Standard protocols were instituted for the measurements of height, weight and BP, and instruments of measurement were also standardised across polyclinics, reducing measurement errors. The limitation of our study was that the study involved only National Healthcare Group polyclinics, with no representation of patients managed under the other polyclinic cluster and those by private GPs. Thus, we could not extrapolate the results of our study to all hypertensive patients attending primary healthcare in Singapore. Several aspects of our questionnaire, notably the diet and exercise components, depended on the memory of our participants and cannot be validated by objective measurements. The self-reporting of complications may have also led to an under-estimation of its true prevalence. The cross-sectional design of our study also limited our ability to draw conclusions about etiological factors of poor control or hypertensive complications and to follow-up our subjects.

In the management of hypertension, lifestyle modifications are central to improving health outcomes. The healthcare

team should emphasise smoking cessation, increased physical activity and weight reduction to decrease the prevalence of these risk factors. Studies have shown that cessation of smoking could reduce overall BP and cardiovascular risk.[41] Smoking cessation programmes should run concurrently with weight loss programmes as stopping smoking has been shown to cause weight gain.[42] Exercise programmes should be adopted and targeted to reduce BMI and increase levels of physical activity. These, however, need to be age-appropriate and we would like to advocate activities such as brisk walking, recreational swimming, tai-chi, yoga or qigong which patients in the older age group can perform.

Our study among hypertensive patients attending polyclinics showed that males were more likely to have poorer BP control and for developing complications of hypertension. Another group that might warrant more attention might be Malay hypertensive patients even though the association was not clearly demonstrated in our study. Targeted health promotion programmes can be designed to increase awareness of hypertension screening, provide education on management of the disease, promote better control of BP and prevent complications.

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