Biology and Medicine

Shrivastava, et al., Biol Med (Aligarh) 2015, 7:3
http://dx.doi.org/10.4172/0974-8369.1000238

Research Article Open Access

Burden and Determinants of Hypertension in Rural Pondicherry, India

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Abstract

Background: Globally, hypertension has been acknowledged as a significant public health concern, and is also the most frequent potential risk factor of cardiovascular diseases. The present study has been undertaken to determine the burden of hypertension and its determinants in a rural area of Pondicherry.

Methods: The study was performed among the population of two villages in a rural area of Pondicherry in 2012-14. The sampling frame comprised individuals aged above 25 years and single stage cluster random sampling was carried out. Subjects satisfying the inclusion and exclusion criteria were interviewed after obtaining informed consent using a pre-tested semi-structured questionnaire. Data was analyzed using the SPSS statistical package version 16. The associations with risk factors were assessed using Chi-square test and Unpaired T test for the categorical (%) and continuous (mean ± SD) variables respectively. The adjusted risk of hypertension was assessed with a logistic regression model.

Results: The prevalence of hypertension was 24.7% (258/1043), with higher prevalence among male (28.7%) than females (21.0%). A statistically significant association was observed between hypertension and reduced physical activity/week, smoking, alcohol consumption, higher waist circumference, raised total cholesterol and triglyceride level, and excessive consumption of salt.

Conclusion: High prevalence of hypertension was observed in the study population. Interventions targeted for healthy diet, activity and de-addiction are the need of the time in rural Pondicherry.

Keywords: Hypertension; Abdominal obesity; Addiction; Diet; Rural India

Introduction

Globally, hypertension has been acknowledged as a significant public health concern to the population in socioeconomic and epidemiological transition, and is also the most prevalent risk factor of cardiovascular diseases [1]. In-fact, recent estimates show that hypertension affects more than a third of adults aged 25 and above, accounting for about a billion people worldwide and contributes to nearly 9.4 million deaths from cardiovascular diseases each year [2]. Furthermore, it has been estimated that by the year 2030, 23 million cardiovascular deaths are projected to be due to hypertension, of which about 85% cases will be from low-resource settings and developing nations [2]. A high and increasing prevalence of hypertension in both rural and urban areas of India has been reported in recent studies [3,4]. An analysis of nationally-representative survey data revealed that almost 22% of the men and 26% of women had hypertension [3]. In addition, findings of studies performed in different settings have revealed a conclusive evidence between high blood pressure and early onset/precipitation of other disorders (viz. coronary heart disease, stroke, heart failure and impaired renal function) [3,4].

Prevention of hypertension is possible. Early detection and appropriate/effective control of blood pressure is a critical element to reduce the risk of hypertension-induced-organ damage and other serious complications [3,5]. In addition, creating awareness among the members of the community regarding the potential risk factors that eventually determine the occurrence of hypertension is essential for combating the rising trends of hypertension in the community [5]. Thus implementation of effective primary and secondary prevention measures should be the most important goals in the planning of health policy measures [5]. There is a scarcity of literature on hypertension from rural India, which constitutes 70% of the total population. We followed a cohort of adults in rural Pondicherry, India over three years to study the incidence of T2DM. The research data were analyzed to explore the prevalence of hypertension and its risk factors [6].

Materials and Methods

Study setting

A population based study was undertaken in two of the villages (viz. Ramanathapuram and Pillaiyarkuppam), under the jurisdiction of Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry from 2012 to 2014.

Sample size

The sample size was estimated by employing a freely available open source software, Open Epi Version 2.3.10 [6]. The sampling frame comprised individuals aged above 25 years (n=2608). Single stage cluster random sampling was carried out. Using streets as the primary sampling unit, four streets in Ramanathapuram and six streets in Pillaiyarkuppam were chosen by lot method.

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Received April 16, 2015; **Accepted** May 30, 2015; **Published** June 06, 2015

Citation: Shrivastava SR, Ghorpade AG, Shrivastava PS (2015) Burden and Determinants of Hypertension in Rural Pondicherry, India. Biol Med (Aligarh) 7: 238. doi: 10.4172/0974-8369.1000238

Inclusion and exclusion criteria

From the houses of the selected streets, all participants aged more than 25 years were invited to take part in the study. Subjects not willing to participate (n=33) and those with missing forms [7] were excluded.

Study tool and variables

Subjects were interviewed with the help of a pre-tested structured questionnaire. Information pertaining to socio-demographic parameters (viz. age, sex, education, occupation, per capita income), family history, level of physical activity, tobacco and alcohol use were obtained using the questionnaire. In addition, each of the study subjects was subjected to anthropometric measurements (viz. height, weight and waist circumference).

Methodology

All the study participants were interviewed face-to-face using the pre-tested structured questionnaire after obtaining their informed consent. Blood pressure was checked with digital blood pressure monitor (OMRON SEM-1, Japan) in the right upper limb with subjects in sitting posture. Two readings were taken, the mean of two was considered as an individual's blood pressure measurement. As per JNC-8 classification, hypertension was defined as SBP of ≥ 140 mm of Hg or/and DBP of ≥ 90 mm of Hg or those taking antihypertensive medication.

Ethical consideration

Ethical clearance was obtained from the Institutional Ethics Committee prior to the start of the study. Written informed consent was obtained from the study participants before obtaining any information from them. Utmost care was taken to maintain privacy and confidentiality.

Statistical analysis

Data were analyzed using the SPSS statistical package version 16.0. The associations were assessed using Chi-square test and Unpaired T test for the categorical (%) and continuous (mean ± SD) variables respectively. Variables with $p<0.05$ in univariate analysis were included in the multivariate logistic regression using Backward method.

Results

Table 1 reflects the socio-demographic profile of study subjects in accordance with their blood pressure status. The age distribution of the study participants varied from 25 years to 98 years with a mean of 45.6 (± 13.7). The overall prevalence of hypertension was 24.7% (258/1043), with higher prevalence among male (28.7%) than among females (21.0%). The prevalence of diabetes in the community was 12.2%. Also, it was seen that 27.5% of hypertensive subjects were diabetic and 55.9% of the diabetics were hypertensive. Univariate analysis of the risk factors for hypertension revealed a statistically significant association was observed between hypertension and reduced physical activity/week, higher pack year of smoking, more consumption of alcohol, obesity, higher waist circumference, raised total cholesterol and triglycerides level, low HDL and excessive consumption of oil/salt. In addition, a positive family history of hypertension and co-existence of diabetes also accounted for the higher prevalence of hypertension among the study subjects. Normotensive and hypertensive individuals did not differ significantly with regard to the educational status, occupation status, per capita income and calorie intake per day.

Multivariate analysis showed that with each year increase in age, the risk of hypertension rose by 2.9% (Table 2). Also, those with a family history of hypertension and coexisting diabetes had 1.8 and 2.0 times higher chances of having hypertension. Of the modifiable risk factors, addiction in any form predisposed to high blood pressure i.e. a unit increase in pack year of smoking and gm/day of alcohol poses an additional risk of 11.9% and 1.1% respectively. Besides higher amount of body fat as measured by BMI and abdominal obesity independently predicted risk of hypertension. Among the dietary factors, salt intake was significantly linked to hypertension with consumption of each additional gram of salt per day mounted 4.7% extra risk of hypertension. Dyslipidemia in the form of elevated triglyceride determined higher chance of raised blood pressure.

Discussion

The prevalence of obesity among the study participants was 24.7% (258/1043), which was much similar to a community-based cross-sectional study performed in the South India (21.1%) [7]. However, the findings of a baseline epidemiological study done among South Asian adults revealed that the prevalence of hypertension ranged from 30.7% (India), 33.5% (Pakistan) and 39.3% (Bangladesh) [8]. The present study revealed higher prevalence among men (28.7%) than among women (21.0%). In contrast, reverse trend was observed in a study conducted by the World Health Organization in India [3]. The reasons for such variability may be the high prevalence of smoking (25.3%) and alcohol use (50.3%) amongst the men while none of the females used these substances in the study area. Also, more men were diabetic than females (14.5% Vs. 9.9%, $p<0.05$).

In the present study, a directly proportional relationship between increase in age and prevalence of hypertension was observed. Similar results were reported in a cross-sectional study [4]. This is probably because of the independent factor of age and adoption of range of harmful lifestyle habits - physical inactivity, smoking/alcohol addiction, faulty dietary practices, and full-blown appearance of other co-morbidities, as the age progresses.

Furthermore, a statistically significant relationship was seen between hypertension and lack of physical activity, addiction to smoking/alcohol, higher body mass index, raised serum cholesterol and higher caloric intake. Studies from different settings have revealed similar results [4,8,9]. This reflects the constellation of multiple lifestyle habits in the causation of the hypertension. In addition, a definite risk of hypertension was observed if the subjects had a positive family history of hypertension in our study. Family history of hypertension has been shown to be a strong predictor of development of hypertension [9,10]. Besides, simultaneous presence of diabetes augmented the chances of having hypertension by 1.8 times. Similar findings were revealed in a systematic review assessing the epidemiology of hypertension in India [11,12]. These finding reiterates the importance of common risk factors and highlights the need for comprehensive screening for other cardio-metabolic risk factors among the individuals presenting with any single risk factor [13].

The current study depicted that with every unit increase in pack year of smoking and gm/day of alcohol, an additional risk of 11.9% and 1.1% respectively was posed on the development of hypertension. Addiction of tobacco was found to be a significant parameter in augmenting the risk of hypertension in the community [14]. These findings provide enough evidence to enhance the efforts of health sector in creating awareness about the consequences of smoking/alcohol consumption, and enforce legal provisions in a stringent manner.

Variables*	Normal n (%)	Hypertension n (%)	p value#
Total	785	258	-
Age in years	44.4 (± 13.3)	49.5 (± 14.2)	<0.001
Gender			0.004
Women	422 (79.0)	112 (21.0)	
Men	363 (71.3)	146 (28.7)	
Educational status			0.420
No schooling	243 (76.9)	73 (23.1)	
Attended school	542 (74.6)	185 (25.4)	
Occupational status			0.343
Non-workers	234 (73.4)	85 (26.6)	
Worker	551 (76.1)	133 (23.9)	
PCI in Rs/month	1363 (± 1122)	1523 (± 1296)	0.056
Physical activity (Mets/wk)	8383 (± 5454)	6649 (± 5294)	0.001
Smoking pack year	0.1 (± 0.9)	0.7 (± 3.9)	<0.001
Alcohol (gm/day)	5.6 (± 19.5)	10.7 (± 28.3)	0.001
Body mass index (kg/m^2)	22.2 (± 4.4)	23.9 (± 4.0)	<0.001
Waist circumference (cm)	79.8 (± 11.3)	85.9 (± 11.5)	<0.001
Total cholesterol	173.0 (± 33.5)	186.3 (± 42.0)	<0.001
Triglyceride	112.3 (± 62.9)	142.3 (± 87.4)	<0.001
LDL	107.7 (± 28.4)	112.0 (± 35.0)	0.062
HDL	42.5 (± 10.1)	46.0 (± 11.9)	<0.001
Calorie (kcal/day)	1986.6 (± 789.2)	2000.4 (± 773.6)	0.667
Protein (gm/day)	48.9 (± 20.9)	49.4 (± 20.4)	0.707
Oil consumption (L/month)	0.74 (± 0.33)	0.79 (± 0.35)	0.092
Salt intake (gm/day)	16.4 (± 5.9)	18.0 (± 6.6)	0.003
Family history of hypertension			<0.001
Absent	683 (77.3)	200 (22.7)	
Present	102 (63.8)	58 (36.3)	
Diabetes			<0.001
Absent	729 (79.6)	187 (20.4)	
Present	56 (44.1)	71 (55.9)	

#p value of Unpaired T test and Chi square test for continuous and categorical variables PCI: Per capita income, BMI: Body mass index

Table 1: Socio-demographic profile normotensive and hypertensive subjects.

Variables	AOR (95% CI)	p value
Age in years	1.029 (1.016-1.042)	<0.001
Smoking pack year	1.119 (1.006-1.245)	0.038
Alcohol (gm/day)	1.011 (1.004-1.018)	0.001
Body mass index	1.053 (1.000-1.109)	0.051
Waist circumference	1.020 (1.000-1.039)	0.050
Total cholesterol	1.004 (1.000-1.009)	0.072
Triglyceride	1.003 (1.000-1.005)	0.019
Salt intake (gm/day)	1.047 (1.019-1.075)	0.001
Family history of hypertension		
Absent	1	
Present	1.758 (1.150-2.689)	0.009
Diabetes		
Absent	1	
Present	2.047 (1.306-3.209)	0.001

Factors with p value <0.05 were included

Table 2: Backward logistic regression for the risk of hypertension.

Owing to the exploration of most of the socio-demographic and lifestyle attributes, the findings of the study can be definitely utilized by the policy makers to address the identified risk factors. Limitation of the study was single contact data of diet by recall method and family level aggregate information was obtained on vegetable, oil and salt intake. In addition, as the research was from a nonrandom sample of villages of southern India, the generalization of the findings needs caution.

Conclusion

The research revealed a high prevalence of hypertension in the rural adults of Pondicherry. The need of the hour is to develop comprehensive

and flexible measures to promote adoption of a healthy diet, physical activity and de-addiction in the general population.

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