ORIGINAL RESEARCH

PREVALENCE AND PREDICTORS OF ESSENTIAL HYPERTENSION IN THE RURAL POPULATION OF HARYANA, INDIA: AN HOSPITAL BASED STUDY

SUMEET GUPTA[1], BIMAL K. AGRAWAL[2], PRABODH K. SEHAJPAL[3], and RAJESH K. GOEL[4]

[1]Department of Pharmacology, M. M. College of Pharmacy, M. M. University, Mullana (Ambala), Haryana; [2]Department of Medicine, M. M. Institute of Medical Sciences, M. M. University, Mullana (Ambala), Haryana; [3]Department of Molecular Biology and Biochemistry, Guru Nanak Dev University, Amritsar Punjab; and [4]Department of Pharmaceutical Sciences and Drug Research, Punjabi University, Patiala, Punjab, India.

Corresponding author: Professor Rajesh K Goel (goelrkpup@gmail.com)

ABSTRACT
Background: Pooling of epidemiological studies shows that hypertension is present in at least 25% of urban and 10% of rural adults in India. Prevalence of essential hypertension in the rural region Mullana block in the state of Haryana, India, has never been carried out. The objective of this study is to determine the prevalence of essential hypertension amongst this population, as well as investigating diseases and risk factors involved it its aetiology. Methods: An hospital based retrospective study was carried out investigating the demographic details of disease history of patients during the period June 2003 to September 2006 at M. M. Institute of Medical Sciences and Research. From a total of 2295 patients, 876 were identified as having essential hypertension. Age and sex matched essential hypertensive and normotensives patients were involved in a prospective study between December 2006 and June 2007. Results: Amongst the hospital based patients the overall prevalence of essential hypertension was 38.2%. The prevalence was 59.2% and 40.8% among males and females, respectively. Multivariate logistic regression analyses revealed that the risk of essential hypertension was significantly associated with body mass index, smoking status and a family history of essential hypertension. Conclusion: The prevalence of essential hypertension in the rural region Mullana block, Haryana, was higher than previously reported. Implementation of an effective awareness programme including lifestyle modification is necessary to control the cardiovascular disease burden in this population.

KEY WORDS: Hypertension; Hospital; Body mass index; Weight to hip ratio, Haryana, India.

INTRODUCTION

In most developing countries, there is a double burden of communicable and chronic non-communicable diseases due to epidemiological transition (Nawi et al., 2006). Among the non-communicable diseases, cardiovascular disease is the leading cause of mortality for both men and women worldwide and is estimated to have accounted for about 14.3 million deaths in 1990 (Lopez, 1993; Murray et al., 1997) and 16.7 million in 2000 (Yadav et al, 2008). These deaths are about 30.3 % of all deaths worldwide and more than half of these deaths occurred in developing countries of South Asia; Pakistan, India, Bangladesh, Nepal, and Sri Lanka. In India deaths from coronary heart disease rose from 1.17 million in 1990 to 1.59 million in 2000 and were expected to rise to 2.03 million in 2010 [WHO, 2001; Nishtar, 2002; Ghaffar et al., 2004). Pooling of epidemiological data showed that hypertension was present in at least 25% of the urban and 10% of the rural adult population in India (Gupta, 2007). Hypertension was positively associated with higher socio-economic status in both urban and rural areas. Hypertension amongst the urban population increased from 1.2% in 1949 to 36.4% in 2003 and for rural people from 2.0% in 1958 to 21.2% in 1994 (Nissien et al., 1988).

Various hypotheses have been put forward to explain the rising prevalence of hypertension in India. The demographic shift in the age profile of the population combined with new lifestyle related risk factors seem to accelerate the hypertension "epidemic" (Reddy 1993; Gupta et al., 1997; Reddy et al., 1998). The consequences of urbanization such as changes in lifestyle, diet and stress have been implicated (Dass et al., 2005). Urbanization and technological advances have led to dramatic changes in the lifestyle of many Indians who are embracing a modern and often more sedentary daily life. Technological advances have shrunken employment opportunities particularly among young Indians adding stress caused by strong competition for secure employment. Furthermore, detection and awareness of hypertension in urban areas are higher compared to rural populations.

Diverse ethnic groups with distinct cultures live in Haryana, which is a northern state of India. In Haryana, treatment rates of hypertension are very low compared to other Indian states (Dass et al., 2005). To our knowledge there is only one previous epidemiological study (Malhotra et al., 1999) available which focussed on hypertension in the rural population of Haryana. The present study was undertaken to further investigate hypertension in Haryana. The study aimed (1) to assess the prevalence of essential hypertension amongst patients with different diseases and (2) to identify risk factor for essential hypertension.

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METHODS

Setting

The study was conducted in Mullana a small block of rural area (Figure 1) in the district of Ambala in the state of Haryana. Mullana has a tropical climate. The population (approximately 30,000) is stable and has a diet high in cholesterol, alcohol, salt and saturated fat (Deshmukh et al., 2005). This hospital based study was carried out by the M. M. Institute of Medical Sciences and Research, Mullana, which is the only established hospital in the rural region of Ambala to which patients come for treatment within a 30 km radius. Only patients with essential hypertension were considered; patients with any form of secondary hypertension were excluded from the analysis.

Figure 1: Map of India.

Design

To achieve our objectives, a hospital based retrospective and prospective study was conducted at the M. M. Institute of Medical Science and Research, Mullana, Haryana. The retrospective study was conducted during the period June 2003 to September 2006 during which data on all patients visiting the Outdoor Patient Department (OPD) of the hospital was collected. The patient population was divided into two major sub-groups on the basis of their underlying aetiology: 876 individuals with essential hypertension; 1419 patients with other acute and chronic diseases.

Our retrospective data suggested that a sufficient number of essential hypertensive patients were available to conduct a further study to identify risk factors for hypertension. For evaluation of different factors affecting the prevalence of hypertension in this population a case-control study was carried out from December 2006 to June 2007. Various anthropometric characteristics, socio-demographic profile, as well as smoking status and alcohol consumption were investigated. One hundred and twenty essential hypertensive patients were recruited into this part of the study based on some predetermined selection criteria as these patients were followed for response to antihypertensive therapy and pharmaco-genomics studies. The control subjects were recruited from employees of the M.M. Institute of Medical Science and Research, Mullana, Haryana.

Inclusion criteria for cases were: (1) Physicians diagnosed patient with essential hypertension (systolic blood pressure greater or equal 140 mmHg and diastolic blood pressure greater or equal to 90 mmHg); (2) patients between 18 and 80 years of age; (3) patients residing in the area for at least one year. Inclusion criteria for controls were: (1) Normotensive individual (systolic blood pressure less than 140 mmHg and diastolic blood pressure less than 90 mmHg); (2) individuals between 18 and 80 years of age; (3) individuals residing in the area for at least one year; (4) individuals who did not receive anti-hypertensive therapy.

Cases with essential hypertension were age and sex matched to normotensive controls (Table 1). The normotensive control population comprised of 70 (57.9%) males and 51(42.1%) females. The age of males ranged between 23 and 82 years with a mean age of 51.3 (SD 12.5) years. In females the age ranged from 40 to 85 years with a mean age of 53.7 (SD 10.0) years. The cases with essential hypertensive comprised of 71 (59.2%) males and 49 (40.8%) females. The age of males ranged from 21 to 82 with a mean age of 52.8 (SD 14.3) years and female age ranged between 40 and 75 with a mean age of 56.1 (SD 8.0) years.

Table: 1 Distribution of cases (essential hypertensive) and controls (normotensive) matched by age and gender.

	Essential hypertension (n=120)		Normotensives (n=121)	
Age groups	Male	Female	Male	Female
20-30	5	0	5	0
31-40	9	1	7	4
41-50	19	14	23	19
51-60	17	21	16	16
61-70	15	12	15	11
≥70	6	1	4	1
Total	71 (59.2%)	49 (40.8%)	70 (57.9%)	51 (42.1%)

The study was approved by Human Ethical Committee of the M.M. Institute of Medical Science and Research, Mullana (IEC/22).

Survey instrument

To improve the description of hypertensive patients, information was collected on the socio-demographic profile (age, sex, education, occupation, work status, family history of hypertension), anthropometry (BMI, waist-to-hip ratio, waist circumference), physical activity questionnaire (IPAQ)(WHO, 1995), smoking status, alcohol use and salt intake as well as details of prescribed medications (name, dosage form, frequency and duration of administration).

Definitions

Hypertension was defined as a systolic blood pressure greater than 140mmHg and diastolic blood pressure greater than 90mmHg (Sharma et al., 2006). Waist-to-hip ratios of greater than 1.0 and greater than 0.85 were taken as cut-off points defining obesity in men and women, respectively. Waist circumference of greater than 90cm and greater than 80cm were taken as cut-off points for obesity in men and women, respectively, using WHO definition (WHO 2002). Body mass index (BMI) was calculated using the formula: weight (kg)/height (m)(WHO, 1995).

Anyone smoking at least one cigarette per day for a minimum of the past six months was considered a smoker, and others were classified as non-smokers. For alcohol intake, subjects were categorized as abstainers if they never consumed alcohol, and participants who consumed more than 30 ml of ethanol per day, that is, 720 ml of beer per day or 300ml per day of wine were categorized as heavy drinkers (Stamler et al., 1997).

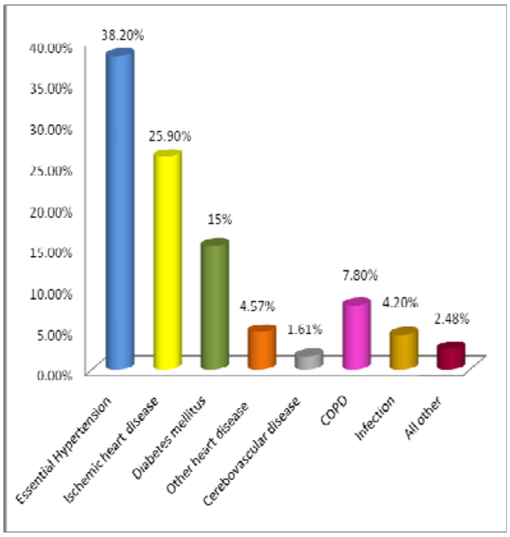
Statistical analysis

Data was entered and analysed using SPSS 16.0 (SPSS Inc., Chicago, Illinois). Prevalence of essential hypertension is presented as a percentage together with a 95% confidence interval. Between group comparisons were done using chi-square tests for categorical variables and student *t*-tests for numerical variables. Multivariate logistic regression models were used to examine the relationships of essential hypertension with body mass index, smoking, alcohol intake, age and family history. Odds-ratios were calculated for different risk factors. A p-value less than 0.05 was used as the definition of statistical significance.

RESULTS

A total of 2295 patients were examined, out of which 876 patients (38.2%; 95%-CI = 36.2, 40.2) were found to have essential hypertension (Figure 2). There were more males (59.2%) with essential hypertension than females (40.8%). The second most frequent disease diagnosed was ischemic heart disease (25.90%), followed by diabetes mellitus (15.0%). The number of essential hypertensive patients was increasing during the studied period: from 157 cases in 2003-2004, 316 cases in 2004-2005, to 403 cases in 2005-2006.

Figure 2: Prevalence of diseases of 2295 patients who visited the Outdoor Patient Department of Medicine in the rural region of Haryana at MMIMS, Mullana, India, between June 2003 and September 2006.



The comparison of the anthropometric and socioeconomic characteristics of cases and controls is shown in Table 2.The mean body mass index ($p<0.001$), body weight ($p=0.006$), waist circumference ($p=0.003$) and hip circumference ($p<0.001$) were significantly higher in essential hypertensive cases than normotensive controls. For men, body mass index was statistically significantly ($p=0.027$) higher in cases with essential hypertension compared to normotensive controls (Table 3). In females, mean waist circumference, hip circumference and body mass index were higher ($p<0.001$, respectively; Table 3).

Risk factors for essential hypertension

Risk factors for essential hypertension were analysed using multivariate logistic regression analysis (Table 4). The significant determinants of essential hypertension were body mass index (odd ratio: 2.82, $p<0.001$), smoking (odd ratio: 9.06, $p<0.001$) and family history of hypertension (odd ratio: 1.42, $p<0.001$).

Discussion

Developed countries with an ageing population are expected to have a higher prevalence of hypertension than a developing country with a younger population such as India. But there are several studies that have documented a high prevalence of hypertension in developing countries (Nissein et al., 1988; Reddy,1996). India is in a phase of transition in which infectious as well as lifestyle diseases are major causes of morbidity and mortality. One disease with major impact is hypertension (Singh et al., 2006) which is an important cause of morbidity and mortality in the elderly population and is a risk factor for many other diseases. The prevalence of hypertension has been increasing in India, both in rural and urban regions. The prevalence of hypertension in rural areas of north India was estimated ranging from about 2% in 1958 to 21.2% in 1994 (Mathur et al.,1963; Malhotra 1970; Gupta et al., 1997) and it has increased to between 20% and 33% during the last decade (Gupta et al., 1995; Anand, 2006; Shantirani et al., 2003;Yadav et al., 2008). Studies conducted among the rural population elsewhere in India showed a lower prevalence (14%) (Yajnik, 2002). We speculate that changes in traditional dietary habits and lifestyle patterns as well as smoking and a longer life expectancy made Indians living in urban areas more vulnerable to hypertension. The reasons for this rise in the incidence of hypertension among urban Indians are a subject of concern and require more research (Singh et al., 2006).

Due to poor medical facilities and little support, a true population-based survey is very difficult to carry out. Hence our study was conducted in an hospital setting which allowed us to gain reliable information and to follow up patients more easily. As a consequence, the resulting prevalence of hypertension is not a true population prevalence, but rather the prevalence in our outpatient population.

In the present study, the overall prevalence of essential hypertension was 38.2% assessed according to WHO-ISH/JNC-VIII guidelines which is higher compared than most of the other reported studies in India (north east 33.3%, 20.2% in north India and 12.5% in south India (Hazarika et al., 2004; Singh et al.,1997; Gilberts et al.,1994). Our data showed that the number of essential hypertensive patients presenting at our outdoor patient department increased during the study period.

Table 2: Comparison of demographic and clinical features between normotensive controls and cases with essential hypertension.

Parameters	Cases with essential hypertension (N = 120)	Normotensive controls (N=121)	P-value
Ratio of males to females	71/49	70/51	n.s.#
Mean age (SD) [years]	54.1 (±12.2)	52.3 (±11.5)	n.s.
Mean height (SD) [cm]	156.6 (±8.8)	159.5 (±9.8)	0.018
Mean weight (SD) [kg]	63.6 (±12.8)	59.0 (±12.4)	0.006
Mean body mass index (SD) [kg/m²]	26.0 (±5.8)	23.1 (±5.5)	< 0.001
Mean waist circumference (SD) [cm]	89.1 (±17.7)	82.9 (±14.0)	0.003
Mean hip circumference (SD) [cm]	98.1 (±18.6)	89.2 (±14.6)	< 0.001
Mean waste to hip ratio (SD)	0.903 (±0.079)	0.933 (±0.133)	0.035
Mean systolic blood pressure (SD) [mm Hg]	142.8 (±14.4)	115.8 (±5.3)	< 0.001
Mean diastolic blood pressure (SD) [mm Hg]	91.3 (±7.6)	75.5 (±5.7)	< 0.001
% Educated*	61 (50.8%)	73 (60.3%)	n.s.
% Sedentary**	43 (35.8%)	54 (44.6%)	n.s.
% Alcohol consumers	22 (18.3%)	16 (13.2%)	n.s.
% Current smokers	25(20.8%)	14 (11.5%)	n.s.
% With family history of hypertension	15(12.5%)	9 (7.4%)	n.s.

*Education differentiated between illiterate and educated; **Occupation differentiated between worker and sedentary; #n.s. = not significant.

Table 3: Comparison of clinical parameters between hypertensive and normotensive participants stratified by gender.

Parameters	Cases with essential hypertension	Normotensive controls	P-value
Males	N=71	N=70	
Mean height (SD) [cm]	159.6 (±8.8)	161.3 (±9.6)	0.282
Mean weight (SD) [kg]	62.4 (±12.6)	58.6 (±12.2)	0.076
Mean body mass index (SD) [kg/m²]	24.4 (±5.2)	22.6 (±4.6)	0.027
Mean waist circumference (SD) [cm]	82.8 (±15.3)	82.1 (±15.0)	0.781
Mean hip circumference (SD) [cm]	90.9 (±13.7)	88.2 (±15.2)	0.266
Mean waste to hip ratio (SD)	0.904 (±0.086)	0.934 (±0.146)	0.139
Females	N=49	N=51	
Mean height (SD) [cm]	152.3 (±6.8)	157.0 (±9.6)	0.006
Mean weight (SD) [kg]	65.3 (±13.0)	59.6 (±12.8)	0.030
Mean body mass index (SD) [kg/m²]	28.2 (±6.0)	23.9 (±6.5)	< 0.001
Mean waist circumference (SD) [cm]	98.3 (±17.2)	84.1 (±12.4)	< 0.001
Mean hip circumference (SD) [cm]	108.6 (±19.9)	90.6 (±13.8)	< 0.001
Mean waste to hip ratio (SD)	0.902 (±0.068)	0.930 (±0.115)	0.144

Table 4: Multivariable logistic regression models for determination of predictors of hypertension.

Variable	Essential Hypertensive N (%) (n=120)	Normotensives N (%) (n=121)	Odd ratio	95% CI*	P value
Body mass index					
<22.9 kg/m²	38(31.66%)	65(53.71%)		Reference	
>23.0 kg/m²	82(68.34%)	56(46.28%)	2.82	(1.60-4.97)	< 0.001
Smoking					
No	95 (79.17%)	107(88.42%)		Reference	
Yes	25(20.83%)	14 (11.58%)	9.06	(3.76-2.18)	< 0.001
Alcohol use					
No	98(81.67%)	105 (86.78%)		Reference	
Yes	22 (18.33%)	16 (13.22%)	1.05	(0.43-2.53)	0.921
Family history					
No	105(87.50%)	112 (92.56%)		Reference	
Yes	15(12.50%)	9 (7.44%)	1.42	(5.69-3.52)	< 0.001

*95% CI = 95% confidence interval; The model was adjusted for the matching variables age and gender.

Studies have shown that if the condition is detected and managed properly the mortality and morbidity associated with hypertension can be considerably reduced (Machmohan, 1990; WHO, 1978; Yamini et al., 1994; Petrovitch et al., 1995; Dennis 1997, Bhalla et al., 1993; Macmohan, 1993). The elevated systolic blood pressure in adults and the elderly is of public health concern as uncontrolled hypertension leads to organ damage and especially to stroke.

It has been previously shown that the mean systolic blood pressure increases with age in men and women (Aggarwal et al; 2005). Unfortunately many people with hypertension, even among health care workers, go undetected (Sidiqui, 2000). Multivariate logistic regression analysis found significant associations between hypertension and body mass index, smoking and family history of hypertension. A positive relationship between the use of smoking and blood pressure in men has been reported previously (Shey-Wiyosnge et al., 2004).

Our study concludes that hypertension is very prevalent in the rural population of Haryana, India. Hypertension is more common in males then females. Obesity is the risk factor for the hypertension in both sexes. Therefore, there is need to focus attention towards primary prevention of essential hypertension and more studies are required to assess the prevalence, determinants preventive interventions of essential hypertension in rural areas. There is a need for strengthening health education programs promoting hypertension awareness, and emphasizing preventive measures. We believe that this study will focus attention on this "silent killer" arousing awareness of health care services for surveillance and opportunistic intervention and will provide a baseline for future studies.

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