

STUDY TO DETERMINE RISK FACTORS ASSOCIATED WITH HYPERTENSION IN URBAN POPULATION OF BHOPAL (MP) INDIA

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Abstract:

Background: Hypertension is an acute public health problem both in developed and in developing countries, like India. It remains silent, being generally asymptomatic during its clinical course. As it is hidden beneath an outwardly asymptomatic appearance, the disease does immense harm to the body in the form of 'Target Organ' damage; hence, the WHO has named it the 'Silent Killer'¹. Job related psychosocial stress and sedentary life styles may directly and indirectly contribute to development of hypertension². With urbanization, the problem of hypertension is growing rapidly to epidemic levels in the developing countries. This invisible epidemic is an underappreciated cause of poverty and hinders the economic development of many countries³. Assessing the association of risk factors with Hypertension in the community is equivalent to assessing the submerged portion of the iceberg which is so much more obscure.

Objective: To carry out an Observational study amongst civil population of Bhopal to successfully determine the risk factors associated with Hypertension.

Materials and Methods: 375 randomly selected individuals were subjected to check of blood pressure with two readings being taken by two different examiners at an interval of 15 minutes. Subsequently 157 individuals found Hypertensive were further screened for risk factors for Hypertension by measuring height, weight, BMI, serum total cholesterol, serum triglycerides, serum HDL, random blood sugar levels, physical activity, smoking status & alcohol consumption.

Results: Out of 375 individuals screened, 157 individuals were found to be having high blood pressure. About 15.4% were found to be obese with BMI > 23Kg/m², 22% had hypercholesterolemia, 5.4% had IGT (Impaired Glucose Tolerance), 19.2% were current smokers and 3.4% were alcohol consumers. Higher age, BMI (Body Mass Index), high serum triglycerides, low serum HDL, IGT (Impaired Glucose Tolerance) and lack of exercising were found to be independently associated with Hypertension in multiple logistic regression analysis.

Conclusion: Our findings recommend the constant monitoring of risk factors for Hypertension and the formulation of effective preventive strategies for adequate control of its alarming incidence.

Keywords: Hypertension, Impaired Glucose Tolerance, Body Mass Index, High Density Lipoprotein, Coronary Heart Disease.

Introduction

Hypertension is an acute public health problem both in developed and in developing countries, like India. Hypertension remains silent, and generally asymptomatic during its clinical course. Due to its being hidden beneath an outwardly asymptomatic appearance, disease does immense harm to the body in the form of 'Target Organ' damage; hence, the WHO has named it the 'Silent Killer'. In our country, prevalence of hypertension has been estimated to be between 20% to 40% in urban adults which is likely to expand to 200 million by 2025, with equal numbers among men and women¹. As per background information, Undetected Hypertension is now on the increase in India, possibly due to the changing lifestyle, and is causing grave concern. Hypertension being the major risk factor for Coronary Heart Disease (CHD) and sooner it will become the most important cause of mortality in India as per futuristic predictions⁽²⁾. For about 80% of CHD and cerebrovascular disease, behavioural risk factors are mainly the culprit for causation⁽³⁾.

Hypertension is a huge public health problem because it is frequent and an important contributor to the epidemic of CHD, together with other risk factors including Cholesterol, Diabetes and Obesity, but it is modifiable⁽⁴⁾. Those individuals having a Systolic Blood Pressure above 140mm

Hg or a diastolic Blood Pressure above 90 mm Hg should be considered as Hypertensive, thus requiring proactive health-promoting lifestyle modifications to prevent CHD⁽⁵⁾. Individuals suffering from IGT (Impaired glucose tolerance) and / or IFG (Impaired fasting glucose) have a very high risk of developing Diabetes Mellitus and are also susceptible to experience an adverse cardiovascular event (Myocardial Infarction, Stroke, CHD death) later in life⁽⁶⁾.

The main objective of the present research study is to assess the prevalence of risk factors associated with Hypertension among Civil Population of Bhopal.

Material and methods

A health awareness and screening camp was organized by Army Corps Headquarter of Bhopal for the civil population of Bhopal as observation of World Heart Day for two consecutive days on 28th 29th September 2015. In Army there is a welfare organization, called Army Wives Welfare Association (AWWA) which constantly monitors and supervises

optimal healthcare of all Army families and their husbands who are serving in the Army besides the civil population staying on the fringes of Bhopal Army Cantonment. Periodically, health promotion, specific protection and screening programs are conducted to ensure optimal healthy status of the civil population too. Uniform instructions for screening were given from the medical branch of Army Corps Headquarters after obtaining requisite go-ahead (Ethical Approval and concurrence) from the wife of Bhopal Army Corps Commander. 375 individuals from Civil population of Bhopal residing on the fringes of Bhopal Cantonment in the age group of 21 to 80 years and above were randomly included in the study. All eligible individuals were interviewed after obtaining informed consent to suffice the requirement of Ethical Approval.

375 randomly selected individuals were subjected to check of blood pressure with two readings being taken by two different examiners at an interval of 15 minutes. Subsequently 157 individuals found Hypertensive were further screened for risk factors for Hypertension by measuring height, weight, BMI, serum total cholesterol, serum triglycerides, serum HDL, random blood sugar levels, exercising status, smoking status & alcohol consumption.

Information about their age in completed years, marital status, occupation, tobacco use, pattern of alcohol consumption and daily exercising was recorded in a pre-tested Performa. 157 individuals having Hypertension were further studied and investigated in detail and simultaneously it was adequately ensured that all such ailing individuals found to be Hypertensive were forthwith put under required therapeutic management if they were not in receipt of any therapeutic management earlier, thus adequately complying with ethical criteria in the present observational study.

Assuming the prevalence of Hypertension to be 7%⁽⁷⁾, with 95% level of confidence and 5% absolute error and assuming the design effect of 1.5 for the systematic sampling with 10% non-response rate, the sample size was calculated to be 375. During the two day period 375 randomly selected participants were screened initially and later 157 found to be Hypertensive were subjected to screening for various risk factors of Hypertension.

The blood pressure of eligible participants was measured by taking of two readings, by two different examiners at an interval of 15 minutes. Hypertension

was labelled when the systolic blood pressure was found to be higher than or equal to 140 mmHg or the diastolic blood pressure was found to be higher than or equal to 90 mmHg, following the guidelines prescribed by “The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure”⁽⁵⁾.

Body weight of eligible participants was measured on a weighing scale (calibrated to measure accurately up to 100gms) with individual standing without footwear on the weighing scale with feet about 15 cm apart, thus equally distributing weight on both lower limbs. Anthropometric rod was used to measure the height of eligible participants, with their head positioned straight in standing position, so that the top of the external auditory meatus of both the ears were level with the inferior margin of both the bony orbits of eyes. The BMI (Body Mass Index) was calculated by dividing the weight of the individual in Kgs by the square of the height of the individual in metres. Individual was labelled overweight when BMI was $\geq 23 \text{ Kg/m}^2$ ⁽⁸⁾. Waist circumference was measured at the level of umbilicus up to the nearest 0.1 cm. Hip circumference was measured to the nearest 0.1 cm at bilateral greater trochanter level. As moderate-intensity aerobic activity of at least 150 minutes a week (2 hours and 30 minutes), lowers the risk for these diseases, details of exercising status of individual in his daily routine life was also enquired⁽⁹⁾.

When Total Cholesterol was more than 200 mg%, individual was labelled to be having Hypercholesterolaemia and when Triglycerides were more than 150 mg%, then individual was labeled to be having Hypertriglyceridaemia. Low HDL (High Density Lipoprotein) was labelled when HDL was less than 40mg % in Males and less than 45 mg% in females⁽¹⁰⁾.

RBS (Random Blood Sugar) level of 8 to less than 11mmol/L was classified as IGT, while RBS of more than or equal to 11 mmol/L was labelled as Diabetic⁽¹¹⁾. All eligible participants with an RBS of more than or equal to 8 mmol/L were labelled to be having an undesirable blood sugar level and were referred for further detailed investigations and required necessary treatment.

Data were entered and coded in MS excel 2007 and presented in percentage. Descriptive statistics like mean, SD etc were used to check the nature of data. Student’s t test and chi square test were applied to check the statistical significance. P value < 0.05 was taken as significance level. Further multiple logistic regression analysis was employed to determine the relationship between Hypertension and various risk factors. SPSS ver. 18 was used to conduct the required Statistical analysis.

Results

Table 1: Distribution of study subjects according to marital status

Marital Status	Male		Female		Total Population	
	(n)	(%)	(n)	(%)	(n)	(%)
Married	167	77.0	106	67.1	273	72.8
Un-Married	28	12.9	22	13.9	50	13.3
Divorced	4	1.8	4	2.5	8	2.1
Widow/ Widower	18	8.3	26	16.5	44	11.8
Total	217	100.0	158	100.0	375	100.0

Table 1 pertaining to the study of urban area, shows that according to marital status; majority of (72.8%) study subjects were married followed un-married (13.3%), widow/ widower (11.7%) and divorced (2.1%) respectively.

Table 2: Distribution of study subjects according to their occupation status

Occupation Status	Male		Female		Total Population	
	(n)	(%)	(n)	(%)	(n)	(%)
Profession	115	53.0	68	43.0	183	48.8
Semi Profession	52	24.0	49	31.0	101	26.9
Clerical/ Shop Owner	39	18.0	23	14.6	62	16.5
Skilled Worker	8	3.6	17	10.8	25	6.7
Semi Skilled Worker	3	1.4	1	0.6	4	1.1
Total	217	100.0	158	100.0	375	100.0

Table 2 shows that according to occupational status, 48.8% subjects were professionals followed by (26.9%) semi-professionals and (16.5%) were shop owner / clerical jobs holders. Whereas, skilled workers were 6.7% and semi-skilled worker were 1.1% in the study respectively.

1. Age

Table 3: Distribution of study subjects according to HTN and Age

Age Group (years)	HTN		Non-HTN		Total		Chi Sq	p- Value
	(n)	(%)	(n)	(%)	(n)	(%)		
21 - 30	7	4.5	63	28.9	70	18.7		
31- 40	11	7.0	50	22.9	61	16.3		
41- 50	24	15.3	35	16.1	59	15.7		
51- 60	43	27.4	39	17.9	82	21.9	82.8	<0.001**
61- 70	30	19.1	14	6.4	44	11.7		
71- 80	20	12.7	12	5.5	32	8.53		
> 80	22	14.0	5	2.3	27	1.6		
Total	157	100.0	218	100.0	375	100.0		

** : Extremely significant at p- value (< 0.001)

Table 3 shows that the age as complete in number of years; out of 157 Hypertensive subjects, 43 (27.4%) in age group (51 - 60) years were found to be more than other age groups. According to the prevalence of Hypertension; age showed a steadily increasing trend in the study i.e. in age group 21 - 30 years has prevalence of Hypertension as 10.0% followed by age group 31 - 40 years has 18.0%, in age group 41 - 50 years 40.7%, in age group 51 - 60 years has 52.4%, in age group 61 - 70 years has 68.2%, 71 - 80 years has 62.5% and in > 80 years has prevalence of Hypertension as 81.5%. However after applying test of significance; age specific prevalence of Hypertension shows extremely significant trend with [Chi Sq; 82.8] with p-value (p < 0.001) i.e. as the age increases, prevalence of Hypertension also increases significantly in the study respectively.

1. Exercise

Table 4: Distribution of study subjects according to hypertension and exercising with univariate risk analysis

Exercising	HTN		Non-HTN		Total		Univariate OR (95 % CI)	Chi Sq	p- Value
	(n)	(%)	(n)	(%)	(n)	(%)			
Present	83	52.9	86	39.4	169	45.1	1		
Absent	74	47.1	132	60.6	206	54.9	0.58	6.64	0.010*
Total	157	100.0	218	100.0	375	100.0	[CI; 0.38-0.88]		

*: Significant at p-value (<0.05)

Table 4 shows the status of physical activity; hypertensive subjects found to be having no physical activity were 74 (47.1%) as compared to physically active subjects i.e. 83 (52.9%). It is because hypertensive subjects were physically active compared to non-hypertensive subjects. Therefore, according to univariate OR; lower risk of association seen among physical inactivity and hypertension [OR 0.58 (CI; 0.38 – 0.88)]. However applied test was found to be statistically significant [Chi Sq; 6.636] with p-value (p = 0.010) in the study respectively.

Table 5: Age, clinical and laboratory test findings of the study population

Background (N=157)	Characteristics	Mean	SD	95% C.I.
	Age (in years)	34.6	7.8	33.5-35.7
	BMI (kg/m ²)	22.7	2.8	22.3-23.1
	Waist hip ratio	0.85	0.05	0.84-0.86
	Systolic BP (mm Hg)	142.0	9.0	140.8-144.3
	Diastolic BP (mm Hg)	90.0	8.0	89.2-92.1
	Total cholesterol (mg/dl)	193.7	14.8	191.6-195.7
	Serum HDL (mg/dl)	38.8	3.7	38.3-39.3
	Serum triglycerides (mg/dl)	145.1	7.8	144.0-146.2
	Random Blood sugar (mg/dl)	119.3	9.8	117.9-120.6

Table 5 depicts Mean and Standard Deviation (SD) of understudy risk factors. The average Systolic Blood Pressure of the study population was 142.0 ± 9.0 mm Hg and Diastolic Blood Pressure of the study population was 90.0 ± 8.0 mm Hg, average values of BMI (kg/m²) (22.7 ± 2.8), Total cholesterol (mg/dl) (193.7 ± 14.8), Serum triglycerides (mg/dl) (145.1 ± 7.8) and Random Blood sugar (mg/dl) (119.3 ± 9.8).

Table 6: Distribution of behavioural and clinical parameters as a risk factor

Risk Factors (N=157)	n	%	95% C. I.	
			Lower Limit	Upper Limit
Serum cholesterol >200 mg/dl	44	22.0	16.3	27.8
HDL < 40 mg/dl	136	67.8	61.3	74.3
Serum triglycerides > 150 mg/dl	31	15.3	10.3	20.3
Random blood sugar 126-200 mg/dl	11	5.4	2.3	8.5
BMI > 23Kg/m ²	31	15.4	10.4	20.3
Current smoking	38	19.2	13.8	24.7
Alcohol (> 3 pegs/week)	7	3.4	0.9	6.0
No/ moderate/heavy exercise	14	7.0	3.5	10.5

Table 6 depicts the prevalence of various risk factors of Hypertension among urban population of Bhopal. Prevalence of Hypertension was about 41.87 per cent (95% CI: 56.3 – 43.7). Among 157 individuals found to be having Hypertension, when further subjected to screening of various other risk factors for Hypertension, then HDL levels of less than 40 mg/dl was found in 68 per cent of the total of 157 individuals having Hypertension, but prevalence of raised Total Cholesterol and Triglycerides was found to be 22 percent and 15.3 percent respectively. The prevalence of IGT was seen in 5.4 percent of individuals. 15.4% were found to be obese with BMI > 23Kg/m², 19.2% of 157 individuals having Hypertension were smoking concurrently and 3.4% were consuming alcohol to the extent of 3 pegs per week. 52.9% of the 157 individuals having Hypertension indulged into light or moderate exercise, whereas 47.1% did not indulge in exercising.

Table 7: Relationship between Hypertension and various risk factors by multiple logistic regression analysis

Variables	Hypertension		
	Risk Ratio	95% C.I.	P value
Age group (in years)			
20-30	1 (Ref)		
30-40	2.67**	1.54-4.22	0.001
40-50	4.12**	2.89-5.43	0.001
BMI			
< 23 kg/m ²	1 (Ref)		
> 23 kg/m ²	1.76*	1.12-2.91	0.044
Serum triglycerides			
< 150 mg/dl	1 (Ref)		
> 150 mg/dl	2.83*	1.98-6.11	0.024
Total cholesterol			
< 200 mg/dl	1 (Ref)		
> 200 mg/dl	0.47	0.11-4.32	0.345
Serum HDL			
> 40 mg/dl	1 (Ref)		
< 40 mg/dl	1.58*	1.08-3.21	0.047
RBS			
< 126 mg/dl	1 (Ref)		
126 - 180 mg/dl	2.59*	1.87-6.32	0.03
*P<0.05; **P<0.01			

Table 7 Statistical Analysis with the help of Multiple logistic regression analysis showed the association of Hypertension with BMI >23 kg/m²(OR 1.76, 95% CI:1.12- 2.91, P=0.044), serum HDL cholesterol <40 mg/dl (OR1.58, 95% CI:1.08- 3.21, P=0.047), serum triglyceride >150 mg/dl (OR 2.83, 95% CI:1.98- 6.11, P=0.024), age (for age group 30-40; OR = 2.67, 95% CI: 1.54-4.22, P<0.001 and for age group 40-50; OR = 4.12, 95% CI:2.89-5.43, P<0.001) and RBS 126- 180 mg/dl (OR = 2.59; CI= 1.87 – 6.32, P = 0.03).

Discussion

The present research study found a high prevalence of Hypertension amongst urban population of Bhopal which is a serious cause for concern as these individuals stand a high risk of developing hypertension and CHD in later life. Statistical Analysis with the help of Multiple logistic regression analysis showed the association of Hypertension with increasing higher age, BMI >23 kg/m², serum HDL cholesterol <40 mg/dl, serum triglyceride >150 mg/dl and RBS 126- 180 mg/dl IGT (Impaired Glucose

Tolerance) and lack of exercising. Out of 375 individuals screened, 157 individuals were found to be having high blood pressure. About 15.4% were found to be obese with BMI > 23Kg/m², 22% had hypercholesterolemia, 5.4% had IGT (Impaired Glucose Tolerance), 19.2% were current smokers and 3.4% were alcohol consumers. Higher age, BMI (Body Mass Index), high serum triglycerides, low serum HDL, (Impaired Glucose Tolerance) and lack of exercising were found to be independently associated with Hypertension in multiple logistic regression analysis.

Similar, cross sectional study conducted Parveen Gani et al in Tamil Nadu showed prevalence of hypertension to be 30.56%. 35.9% patients were found to be overweight / obese. There was no significant difference between the blood pressures of males and females. Persons above 30 years of age had significantly higher systolic (p<0.001) and diastolic blood pressures (p=0.03) as compared to younger age groups¹².

Midha T et al in Lucknow found the prevalence of hypertension to be 32.8% in the urban population. The mean blood pressures were 128.4 +/- 18.8 mmHg systolic and 82.6 +/- 10.2 mmHg diastolic in urban area. A significant correlation of blood pressure with increasing age was noticed. In urban areas, hypertensives were less physically active and were found to be more likely to smoke and consume alcohol. Also, about 9.2% of the hypertensives had coexisting diabetes mellitus. Mean weight, BMI and waist circumference of hypertensives was significantly higher, whereas there was no significant difference between mean heights. Multivariate logistic regression showed that age and gender, were significant risk factors of hypertension. In the urban population, Diabetes (OR = 6.917) and BMI (OR = 1.195), physical activity (OR = 0.483) and waist circumference (OR = 1.094) were significantly associated¹³.

Shikha Singh et al found in Varanasi, prevalence of hypertension to be (32.96%). Age was found to be an important risk factor for hypertension. As the age was advancing so did the prevalence of hypertension among both the sexes. Marital status, education, occupation, socioeconomic status, BMI, obesity, tobacco use, alcohol use, and physical activity were found to be significantly associated with the Hypertension¹⁴. Madhu Priya et al also found out in Varanasi that out of 611 subjects, 314 (51.7%) were Hypertensive. As much as 19.6% and 8.7% subjects were in stage 1 and stage 2 Hypertension. Presence of Hypertension increased significantly ($p < 0.001$) with advancing age¹⁵.

Ravi R Marinayakanakoppalu et al in Mysore found the prevalence of hypertension to be 31.4% and 25.0% from urban and rural area respectively & was statistically significant ($p = 0.04$). Factors such as salt intake, tobacco consumption, alcohol consumption, stress had a significant association ($P < 0.05$)¹⁶. Chellama P Nair et al found in Kollam, Kerala that the prevalence of hypertension was found to be 40% in the study area; 27% were identified as pre-hypertensives. Higher age and better educational status have significant association with hypertension (p value 05). Also stress, comorbidities, increased BMI and waist: hip ratio, positive family history and alcohol intake were found to be significantly associated with high blood pressure ($p < 0.05$)¹⁷. Islam IM et al found in Sullia, Karnataka that the prevalence of hypertension was 21.0% (23.7% in the

urban population and 18.3% in the rural population). Increasing age, sedentary occupation, higher socioeconomic status, extra salt intake, family history of hypertension, reduced physical activity, tobacco smoking, smokeless tobacco consumption, alcohol consumption, body mass index (BMI) ≥ 25 kg/m², and high waist-hip ratio (WHR) were found to be significant risk factors of hypertension. Family history of hypertension, BMI ≥ 25 kg/m², and high WHR were found to be predominant risk factors of hypertension in the urban areas¹⁸.

The prevalence of pre-hypertension observed in this research study was much higher than the estimates reported by other studies. Yadav et al in their study conducted in an affluent north Indian population found prevalence of Hypertension to be 36% in males⁽¹⁹⁾. Singh et al found prevalence of Hypertension among males to be in range of 23.5% - 35.1% in their research study conducted concurrently in five different cities of India⁽²⁰⁾. Shanthirani *et al* reported a 47% prevalence of Hypertension among urban residents in Chennai who were >18 yr⁽²¹⁾, while in a survey in an industrial population, Prabhakaran *et al* reported pre-hypertension in 44%⁽²²⁾. Abeetha S et al found the prevalence of Hypertension highest (55.6%) among medical students out of a total of 323 students from various courses such as medicine, engineering, and arts from a deemed university in Chennai. The prevalence of Hypertension was 1.42 times more among people with high stress, 1.8 times more among people with anxiety and 1.5 times more among medical students which were found statistically significant⁽²³⁾.

Sedentary lifestyle and Obesity are important modifiable risk factors for hypertension⁽¹¹⁾. Among behavioural risk factors for CHD the prevalence of smoking, alcohol consumption and sedentary lifestyle was 19.2%, 3.4% and 7.0% respectively. In our research study independent association between higher age, BMI, high serum triglycerides, low HDL and IGT with increased prevalence of Hypertension was adequately revealed with the conduct of required statistical analysis using multiple logistic regression analysis.

Strength and Study Limitation

Strength of the study was that we could successfully show the significant frequency of the risk factors associated with Hypertension in limited number of individuals, comprising of healthy civil population of

Bhopal, who adequately represented the general population of Bhopal.

The elicited history for smoking and alcohol consumption by the eligible participants might have been less in our research study as there might have been hesitancy on the part of individuals, comprising of healthy civil population of Bhopal to divulge such behaviours to the Army personnel conducting the study. The eligible participants in our research study were civil population of Bhopal so, this may not limit the generalization of the results to other subgroups, and the present findings are consistent with findings from other studies involving different subgroup, of people. We strongly recommend conduct of future prospective multicentre investigations to have clear estimates for future interventions and implementation of preventive strategies.

Conclusion

Our research study adequately demonstrates that the prevalence of Hypertension and other CHD risk factors are high among the civil urban population of Bhopal, therefore very strongly recommended that further research studies should be encouraged to assess the effect of lifestyle modification on Hypertension morbidity and mortality

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