ORIGINAL RESEARCH PAPER

General Medicine

RELATION OF HYPERTENSION WITH BODY MASS INDEX, BLOOD GLUCOSE LEVEL IN SOUTH INDIAN POPULATION

KEY WORDS:

Varun Roheet

Nitin Sathish

ABSTRACT

High blood pressure is a major determinant of risk for Coronary Heart Disease (CHD) and stroke, leading causes of death in the industrialized world. Similarly, the high blood glucose levels have been found to be major contributor for higher blood pressure [1]. So a tool to identify and categorize the at risk patients who are prone to develop high blood pressure is necessary for surveillance of a population. The main aim of this study was to arrive at factors which have significant influence on blood pressure in hypertensive individuals of the South Indian population. This is a prospective cross sectional study carried out in India.

Introduction –

Globally, high blood pressure is estimated to cause 7.1 million deaths, about 13% of the total. About 62% of cerebrovascular disease and 49% of ischemic heart disease are attributable to suboptimal blood pressure (systolic > 115 mm Hg). Overweight and obesity increase the risks of high blood pressure, coronary heart disease, ischemic stroke, type II diabetes mellitus, and certain cancers. Worldwide, about 58% of diabetes mellitus and 21% of ischemic heart disease are attributable to BMI above 21 kg/m2 [1].

The relationship between BMI and blood pressure has long been the subject of epidemiological research. Positive association BMI and blood pressure have also been reported among Asian populations [2–4]. Several studies indicate that high blood pressure is associated with age and is also because of the process of modernization [5, 6]. India in a process of rapid economic development and modernization with changing lifestyle factors has an increasing trend of hypertension, especially among the urban population [7].

Obesity as measured by Body Mass Index is positively and independently associated with morbidity and mortality from hypertension [8]. In Asian populations, a strong association has been depicted between BMI and mortality [9, 10].

Though there are several studies which relate blood pressure, BMI in normal population, this study is meant to explore the relationship between blood pressure and BMI, age and blood glucose levels in hypertensive individuals.

The study was aimed at identifying the key associated factors which impact the hypertension patients. By classifying the Obesity and Hypertension based on the WHO and JNC 7[11] standards, the study has zeroed in on potential "high risk" group.

Aims and Objectives

The main aim of the study was to arrive at factors which have significant influence on blood pressure in hypertensive individuals in the South Indian population.

The main issues examined are

1. Is there a significant correlation between high blood pressure and BMI? And, if so, what is the strength of the correlation?

2. Is there a significant correlation between high blood pressure and blood glucose Levels? And if so, what is the strength of the correlation?

3. At what age group the prevalence of hypertension is more?

Material and Methods

Study Design – Prospective cross sectional study

Study Area – Apollo Hospital, India

Inclusion Criteria – All patients newly diagnosed with hypertension as per JNC 7 criteria between the ages 20 to 65.

Exclusion Criteria - Patients with fever, patients undergoing dialysis, weight loss associated with cancer, subjects with hepatitis B or C infection, tuberculosis, hemophilia and other severe coagulation disorders, subjects using drugs (like diuretics) and pregnant women.

Study Population – 377 patients

Definitions - Individual with systolic BP (SBP) ≥140 mmHg, and/or diastolic BP (DBP) ≥90 mm, were categorized as hypertensive as per Joint National Committee (JNC 7[11]) criteria Body mass index (BMI) was calculated as weight (kg)/ht.(mt)2. Individuals with BMI of <18.5 was classified as "underweight", BMI between 18.5-22.99 as 'normal' and 23-27.49 as 'overweight', 27.5- 29.99 as 'obese-I' and BMI ≥30 as 'obese-II' [12].

Methodology –

Step-1: Record Details

The details of the subjects were recorded in a standard template available. The details that were collected were Name, Age, Sex, Family Details, Occupation.

Step-2: BMI

The Body Mass Index(BMI) was calculated by measuring the height and weight of the patient.

Step-3: Blood Pressure.

Blood pressure of the subjects was measured using electronic blood pressure monitor which works on "Oscillometric Method".

Product Description	Automatic Blood Pressure Monitor
Model	HEM-7132
Display	LCD Digital Display
Measurement Method	Oscillometric Method
Measurement Range	Pressure: 0 to 299 mm of Hg
Pulse : 40 to 180 beats/min	
Accuracy	Pressure: +-3 mm of Hg
Pulse: +- 5% of display reading	
Inflation	Fuzzy logic controlled inflation pump
Deflation	Automatic Pressure release valve
Rating	DC 6V 4W
Protection against Electric Shock	Internally powered ME equipment; Class II ME Equipment
Operating Temperature	+10 to + 40 deg C / 30 to 85% RH

Figure 1 - The technical details of the electronic blood pressure monitor

Step-4: Random Blood Sugar

Venous blood sample of was collected to measure the random blood sugar of the participants

Step-5: Statistical Analysis

The collected data was recorded in Microsoft Excel Spreadsheet and analysed with SPSS 22.0 version. To describe about the data descriptive statistics, the mean and S.D were used. To find the significance difference between the bivariate samples in Independent groups the Independent sample t-test was used. For the multivariate analysis the one-way ANOVA with Tukey's Post-Hoc test was used. To assess the relationship between the variables Pearson's Correlation was used. In all the above statistical tools the probability value .05 is considered as significant level.

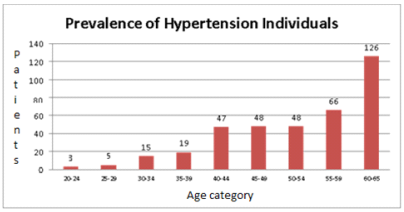
Observation and Results –

Basic data of the subjects in five different age groups is shown in table-1 given below.

Table 1 – Showing data in various age groups

Age Category		N	Minimum	Maximum	Mean	Std. Deviation
21-30	BMI	12	21.13	26.67	24.0333	2.09303
	DBP	12	80.00	110.00	93.3333	9.84732
	RBS	12	65	190	102.17	34.157
	SBP	12	140.00	190.00	149.1667	14.43376
	Valid N (listwise)	12				
31-40	BMI	58	14.17	35.61	24.5019	4.07208
	DBP	58	60.00	140.00	94.4828	13.53001
	RBS	58	64	164	105.45	21.931
	SBP	58	140.00	180.00	147.2414	9.51326
	Valid N (listwise)	58				
41-50	BMI	96	18.49	35.94	24.1079	3.69600
	DBP	96	60.00	140.00	89.5833	13.68185
	RBS	96	61	197	112.27	27.777
	SBP	96	140.00	180.00	146.4583	9.28827
	Valid N (listwise)	96				
51-60	BMI	158	15.24	45.92	24.0637	4.42595
	DBP	158	60.00	130.00	87.5949	13.32735
	RBS	158	66	199	113.49	26.541
	SBP	158	130.00	190.00	148.7658	11.53348
	Valid N (listwise)	158				
61-65	BMI	53	14.69	32.39	23.3249	3.81365
	DBP	53	70.00	140.00	91.5094	14.05979
	RBS	53	66	198	117.83	29.956
	SBP	53	140.00	190.00	151.6981	13.96918
	Valid N (listwise)	53				

The distribution of the subjects across various age categories is shown in the graph - 1 given below. As can be seen, the prevalence of hypertension individual increase with age with 33.4% of individuals in 60-65 age group.



Graph 1 – showing the prevalence of hypertension in various age groups

Table – 2 Correlation of the parameters across the age groups

		Age	SBP	DBP	BMI	RBS
Age	Pearson Correlation	1	.100	-.126*	-.076	..103*
	Sig. (2-tailed)		053	.015	.140	.045
	N	377	377	377	377	377
SBP	Pearson Correlation	.100	1	.334**	.104*	.024
	Sig. (2-tailed)	.053		.000	.044	.637
	N	377	377	377	377	377
DBP	Pearson Correlation	-.126*	.334**	1	.022	-.045
	Sig. (2-tailed)	.015	.000		.674	.387
	N	377	377	377	377	377
BMI	Pearson Correlation	-.076	.104*	.022	1	.031
	Sig. (2-tailed)	.140	.044	.674		.545
	N	377	377	377	377	377
RBS	Pearson Correlation	.103*	.024	-.045	.031	1
	Sig. (2-tailed)	.045	.637	.387	.545	
	N	377	377	377	377	377

Discussion –

Significant positive correlation was found between BMI and SBP (P=.104) at 0.05 level for the entire group. Significant positive correlation was found between Age and RBS (P=.103) at 0.05 level for the entire group (Table-2). The pathophysiology related to the observation may be due to the prevalence of glucose intolerance increasing with age [41]

Significant negative correlation was found between Age and DBP (P=-.126) at 0.05 level for the entire group (Table-2). The pathophysiology related to the observation may be due to arteriosclerosis (stiffening of arteries). There is a reduction of elasticity or compliance of the vessel wall which decreases the peripheral resistance. Thus the DBP tends to decrease with age.

The increase in BMI which indicates obesity where the excessive storage eventually leads to the release of excessive fatty acids from enhanced lipolysis which lead to atherosclerosis. This in turn increases the blood pressure.

Prevalence of hypertension is high in 60-65 age group and BMI category "Normal". The high prevalence rate at higher age can be attributed to pathophysiological reasons like arteriosclerosis. The high prevalence of hypertension in "Normal" BMI category can be attributed to demographical, socioeconomic and occupational. The high prevalence of hypertension in normal BMI category indicates that BMI alone cannot be considered as an indicator for hypertension.

There was no significant correlation observed between RBS and Blood pressure levels. Moreover, most of the subjects

included in the study had normal RBS levels. (<200 mg/dl). Though there is deteriorating glucose tolerance with increasing age, their nutritional intake is low due to lower socioeconomic background. Thus the RBS levels remained normal. This might be also supported by occupational reasons as they are primarily laborers and field workers (Demography of the population).

CONCLUSION

This study shows that

a) High risk group for hypertension falls in the age group of 60-65. Above 61 years, the impact of BMI on blood pressure level is also high.

b) Obesity (measured as BMI) has a positive impact on Hypertension

c) Stage-II hypertensive individuals are impacted more due to increase in BMI

d) Increase in BMI affects the blood pressure levels of Obese-I individuals more prominently

e) Age had a negative impact on DBP

There is no evidence seen on the impact of blood sugar levels on hypertension. However, RBS levels increase with age.

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