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Association between Obesity and Hypertension in South Indian Patients

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Summary

Two hundred and forty four newly diagnosed hypertensives (cases) of age 40 years and above, attending the hypertensive clinic of the Government General Hospital during one year and three hundred and twelve normotensives (controls) belonging to the same age group and attending the outpatient department during the same period for other minor ailments formed the subjects for this case control study. There were 18 (7.4%) obese subjects among hypertensives and 6 (1.9%) among controls. Inspite of these low proportions, there was a strong association between obesity and hypertension with an overall odds ratio of 4 and there appeared to be a significant increasing trend in the proportion of cases of hypertension (37%, 63%, 75%) observed according to the different grades (underweight or normal. overweight, obese) of nutrition.

Introduction

Essential hypertension is a common condition and is a major risk factor for several potentially fatal diseases. notably ischemic heart disease and cerebra-vascular disease. Prevention of hypertension or even a reduction of blood pressure (BP) among hypertensives has been shown to reduce morbidity and mortality in populations.[1] Among the several risk factors for hypertension, the commonest is obesity. Higher relative body weights correlated with higher levels of blood pressure in cross sectional studies[2-3]. In prospective studies persons who gained weight also showed a greater rise in blood pressure, both systolic and diastolic compared to those who maintained their weights[4-6]. Tyroler et al. have shown that those who are obese from the beginning and gain further weight are at six times greater risk of getting hypertension that those who are thin and stay thin[7]. Reduction in weight has been reported to result in a reduction of blood pressure[8-10]. Contrary to results of above epidemiological studies Ballantyne[11] found no relation between adiposity and blood pressure except among male non-smokers[11]. among patients who attended a hypertension clinic for untreated hypertension.

The measures of association (odds ratio) obtained in different studies[1-11] showed a considerable variation ranging from one (negligible) to thirteen (very strong). These studies, have been undertaken in parts of the developed world where obesity is not so infrequent. In South Indian subjects. hypertension is fairly common. To the best of our knowledge we have not come a cross similar studies conducted in these subjects. Hence a case control study was undertaken to quantify, if any, the association between obesity and hypertension in South Indian subjects.

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Material and Methods

All newly diagnosed hypertensives of age above 40 years attending the Hypertension Clinic of the Government General Hospital formed the cases for this study. Normotensives among patients attending the out-patient department during the same period for minor ailments formed the controls for the study. Individuals with known organic diseases identified on questioning were excluded. This was less than 1% of the total interviewed. However no special investigations could be undertaken to identify individuals with organic diseases among those who were selected as controls. There were 244 cases and 312 controls.

Blood pressure was taken for each subject in the right arm in sitting posture using a mercury sphygmomanometer with a 15 cm cuff size. Phase V diastolic BP was recorded. A subject was considered to be hypertensive if the systolic BP was more than or equal to 160 mm of Hg and or diastolic BP of more than or equal to 91 mm of Hg or more[12].

Height was recorded for all subjects to the nearest half a centimeter. The subjects were barefooted when height was taken. All subjects were weighed and the measurement was taken to the nearest half a kilogram. Body mass index (BMI) was calculated using the formula BMI = Wt (kg) /Ht^2(mtr). The same weighing machine, height scale and

sphygmomanometer were used throughout the study for all subjects by the same investigator.

Subjects were. classified according to their Body Mass Index. Men and women with BMI less than 21 were considered under-weight, greater than or equal to 21 and less than 25 as normal, greater than or equal to 24 and less than 30 as over weight and greater than or equal to 30 as obese[12].

Since very few patients were classified as obese by this method, the nomogram of weight for height used by the Life Insurance Corporation of India (LIC) which is another method of classifying individuals as obese or non-obese was also used. This nomogram was developed by the LIC to assess obestity for insurance purposes[13]. Subjects whose body weight is 10% and above but below 20% of the ideal body weight (defined according to the age and height of the individual) are considered overweight and those weighing 20% and above the ideal body weight as obese by the LIC.

Odds ratio (and confidence limits) were calculated from a two-way-cross-classified table to assess the risk of hypertension.

Results

The age and sex distribution of 244 cases of hypertension and 312 controls is presented in Table 1. Of these, 38 % of cases and 43 % of controls were males. Among cases. there were 25%, 35% and 40% of subjects in the age groups 40-49, 50-55 and > 60 respectively. The corresponding proportions were 38% ,35% and 27% in the controls.

The mean weights (not tabulated) for males of different age groups ranged form 55-61 kgs for cases and 53-55 kgs for controls. The corresponding weight range for females were 51-57 kgs for cases and 40-49 kgs for controls. There appeared to be very little difference between cases and controls in the distribution of height (mean height for cases 152.3 cm: mean height for controls 153.9 cm). The number and proportion of subjects with overweight or obesity according to different age groups is shown for cases and controls in Table 2. It can be seen that among hypertensive cases, the proportion of subjects who were either overweight or obese was 2-3 times more than that of controls. There were 16 (11%) female hypertensives who were all obese as compared to 2 (2%) male hypertensives ($p < 0.05$) (Table 3). There was not much difference in the proportion of obese subjects (1/134 male vs 5/178 female ($p<0.05$) among normotensives. It is observed that there is a significant increasing trend ($p < 0.05$) in the proportion of cases (27 % , 43%, 63% and 75%) with varying grades (underweight, normal, overweight and obese) of BMI classification respectively. For LIC classification, underweight and normal were considered as one group and the corresponding proportion of cases for the 3 grades (43%, 38%, 71%) showed an increasing trend which was again significant. Compared with overweight and normal categories according to BMI classification the odds ratio were 1.8 and 5.2 respectively (Table 4). This association was also seen when LIC standards were used to classify individuals as obese, overweight and normal. The odds ratio was 2.2 and 4.7. Eventhough the number of obese individuals among cases and controls observed either according to BMI or LIC classification was not large (24 and 44 respectively), obese individuals appear to run a fourfold or fivefold risk of having hypertension as compared to non-obese individuals.

TABLE 1
Age & Sex Distribution of Cases and Controls

	CASES			CONTROLS		
AGE (yrs.)	M	F	T	M	F	T
40-49	15	47	62	51	67	118
50-59	27	58	85	38	72	110
>60	50	47	91	45	39	84
TOTAL	92	152	244	134	178	312

TABLE 2
Proportion of Subjects Classified as Overweight or Obese (Body mass Index) According to Age Group

	CASES			CONTROLS		
	N	OVERWEIGHT OR OBESE		N	OVERWEIGHT OR OBESE	
		N	%		N	%
40-49	62	26	42	118	18	15
50-59	85	37	44	110	19	17
>60	97	30	31	84	13	15

TABLE 3
Distribution According to Body Mass Index

	MALES		FEMALES	
	CASES	CONTROLS	CASES	CONTROLS
BMI CLASSIFICATION:				
Under weight	22	56	24	67
Normal	50	64	55	75
Over weight	18	13	57	31
Obese	2	1	16	5
TOTAL	92	134	152	178
LIC CLASSIFICATION:				
Normal	81	126	147	176
Over weight	7	7	4	1
Obese	4	1	1	1
TOTAL	92	134	152	178

* $p<0.05$; difference in proportion of obese between male and female among cases. ** $p <0.2$; difference in proportion of obese between male and female among controls is not significant.

TABLE 4
Association Between BMI (LIC Classification) and Hypertension

Classification	BMI		Odds Ratio	LIC		Odds Ratio*
	Cases	Controls	(95% CI)	Cases	Controls	(95% CI)
Underweight or Normal	151	262	5.2 (2.2-13.6)	175	275	4.7 (2.5-9.3)
Overweight	75	44	1.8 (0.7-4.8)	36	26	2.2 (1.2-4.9)
Obese	18	6	-	33	11	- -
TOTAL	244	312			244	312

* Odds ratio for each category of BMI was calculated along with 95 % confidence interval in relation to obese category

The risk was examined separately in each group for males and females using both methods of classification (Table 5). It was found that obese males of age less than 50 years and females 50-60 years were at a greater risk of hypertension. This was more marked when BMI classification was used. The effect of age was not so clear among obese females above 60 years.

TABLE 5
Risk of Hypertension (Odds Ratio) According to Age and Sex

AGE	BMI		LIC	
	MALE	FEMALE	MALE	FEMALE
40-49	5.8 (0.9-39.8)*	3.1 (1.3-7.5)	2.9 (0.4-18.9)	3.5 (1.2-10.0)
50-59	1.6 (0.5-5.9)	5.4 (2.2-18.1)	1.5 (0.4-6.3)	5.3 (2.1-13.5)
>60	2.3 (0.6-9.5)	4.1 (1.5-11.9)	2.9 (0.5-22.4)	1.6 (0.6-5.0)

* Figures in parentheses are the 95 % confidence interval for the odds ratio

Discussion

Hypertension is increasingly recognized as a common condition in South India. Obesity is generally believed to be not that common in this part of our country. If obesity is considered as one of the risk factors for hypertension, the prevalence of hypertension among obese persons and obesity among hypertensives could be high. In our present study only 7.4% of hypertensives and 1.9% of controls were obese. Inspite of these low proportions, there was a strong association between obesity and hypertension with an overall odds ratio of 4 and a definite dose response ranging from odds ratios of 2 to 5 when the effect of varying grades. classified according to BMI, were considered in relation to obesity.

Obesity is an excess of body mass. 'The cut-off point' for defining obesity found in the literature may be more relevant for developed countries. This may not be applicable especially to South Indian subjects who are by nature small statured. This may be me reason why very few of our subjects are classified as obese.

For this reason a nomogram developed locally (the LIC standards) has been used as an alternative measure. This has resulted is nearly twice the subjects being classified as obese as compared to BMI. However, the risk for hypertension remains similar, whichever classification is used.

Females tend to put on weight towards menopause. However, this does not seem an adequate explanation for the higher risk of hypertension that females over 50 years face as the proportion of obesity is uniform in all age groups (unpublished findings). Probably other factors associated with aging or menopause are responsible.

These findings are similar to those of Dustan[2] where a close association was seen between obesity and hypertension particularly in the industrialised population. Further they showed that weight gain in young adults was associated with increasing BP which was reversed by weight reduction. Weight reduction by itself was found to control BP[3, 7-10], where a significant drop in BP was seen, even in those individuals not on an&hypertensive therapy. Association of weight gain with increase in BP, has also been documented by other workers in different parts of the developed world[4-6].

To the best of our knowledge this is the first study scientifically documenting this association in South Indians using the case-control method. Eventhough preliminary results appear to be convincing a word of caution is indicated.

Obesity is a physiological change and usually is associated with hypertension, ischeamic heart disease. diabetes mellitus, hyperlipidemia etc. and very rarely occurs in isolation. It is quite often associated with other diseases that may contribute their share in the development of hypertension both individually and in combination. The extent to which obesity contributes to hypertension in the presence of me other risk factors needs to be investigated in depth.

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