The ethnic prevalence of hypertension in a diabetic clinic

P. J. PACY
M.B., M.R.C.P.

M. BEEVERS
S.R.N.

P. M. DODSON
M.B., M.R.C.P.

R. F. FLETCHER
M.D., Ph.D., F.R.C.P.

K. G. TAYLOR
M.D., M.R.C.P.

Department of Diabetes and Endocrinology, Dudley Road Hospital, Birmingham B18 7QH

Summary

Using the WHO criteria of hypertension, we have demonstrated that 40% of randomly selected diabetic clinic attenders under the age of 65 were hypertensive.

Black diabetics had a significantly greater prevalence ($P<0.001$) of hypertension than either white or Asian diabetics. Hypertension was commoner in black and white females compared with males ($P<0.001$); in Asians this difference was not statistically significant.

Systolic hypertension was the most common form in all ethnic groups. Only 38.7% of diabetics receiving antihypertensive therapy had normal blood pressure readings.

Blood pressure measurement should therefore be routinely performed in all diabetic patients under the age of 65, particularly in females of all ethnic groups and in black males.

KEY WORDS: hypertension, diabetes, blacks, whites, Asians.

Introduction

The possible association of hypertension with diabetes mellitus has been the subject of research since the early 1920s. Much of the early work on this subject was reviewed by John (1932). He concluded his paper by writing 'the consensus of opinion of various authors is that blood pressure is higher in diabetics than in non-diabetics of the same age'.

This association was challenged by Freedman, Moulton and Spencer (1958) who found that there was a significantly increased prevalence of hypertension only in diabetics over the age of 70 years.

Pell and D'Alonzo (1967) reported that in their

working population, hypertension was 54% more frequent in diabetics of both sexes than in age-sex matched controls and that this was independent of obesity. They were also able to show that this difference in prevalence could be observed in the pre-diabetic state. The Framingham study (Garcia *et al.*, 1974) has shown that mean systolic pressures are higher in diabetics than in age-sex matched controls with this being greater in females. Jarrett *et al.* (1978) in the large Bedford population study found that mean systolic blood pressures were significantly higher in men and women in borderline and established diabetics while in the male civil servants at Whitehall there was a significant positive correlation between both systolic and diastolic blood pressures and the blood glucose 2 hr after a 50 g glucose load. However, the blood pressure in established diabetics was no different from that of normoglycaemic controls.

Christlieb *et al.* (1981) from the Joslin Clinic, Boston, reported an increased prevalence of hypertension in insulin dependent diabetics at all ages over 24 years and Barrett-Connor *et al.* (1981) found a positive association in an elderly community (between 50-79 years). This association was strongest in those with the highest levels of fasting glucose and duration of diabetes. This relationship although diminished remained after correcting for obesity and age.

From large multivariate studies from Philadelphia (Dunn *et al.*, 1970), Israel (Sive *et al.*, 1971) and Chicago (Stamler *et al.*, 1975), an independent association between glucose intolerance and hypertension has also been observed among blacks but these findings tended to be less consistent than seen in the white population.

Despite over 60 years of research into the prevalence of hypertension in diabetes mellitus, there remains conflicting evidence which may have arisen due to a number of methodological differences which include the definition of hypertension, how the diastolic pressure is measured and the effect of obesity on blood pressure measurement.

We have therefore studied the prevalence of hypertension in patients attending a large diabetic clinic with emphasis on eliminating many of the problems that have arisen in some of the previous papers.

Methods

We have taken the current WHO criteria of hypertension (1979) which is that of a systolic pressure ≥ 160 mmHg and/or a diastolic pressure ≥ 95 mmHg using the 5th Korotkoff phase.

We have also included any patient currently receiving antihypertensive therapy regardless of their blood pressure reading.

Patients under 65 attending the Diabetic Clinic were chosen by a research nurse who recorded the blood pressure with the patient in the supine position after a 5 to 10 min rest using a random zero sphygmomanometer.

A standard width sphygmomanometer cuff (14 cm) was used if the mid-arm circumference was less than 33 cms. If this measurement was greater than this, a large (19 cm) width cuff was used to negate the false elevation of blood pressure produced by a standard cuff. All the patients met the criteria of the National Diabetes Data Group (1979) for the diagnosis of diabetes mellitus.

The chi-squared and unpaired Student's *t*-test were used to determine the degree of significance between the groups.

Results

Overall, 507 diabetic patients under the age of 65 were screened and of these 203 (40%) were hypertensive. The ethnic breakdown revealed that blacks at 48.9% had significantly greater prevalence ($P < 0.001$) than either whites at 37.5% or Asians at 35.4%.

The prevalence of hypertension according to sex is shown in Fig. 1. Females at 48.9% had a significantly greater prevalence ($P < 0.001$) of hypertension than males at 32.9%. This increased prevalence in females was observed in the whites (46.5% v. 30.1%; $P < 0.001$) and in blacks (58.6% v. 39.1%; $P < 0.001$). Asian females had a greater prevalence than their male counterparts (41.2% v. 32.3%) but this failed to reach statistical significance.

Table 1 shows the age and percentage ideal body weights of the patients screened. The hypertensives were significantly older than the normotensives but only in whites of both sexes and blacks overall were the hypertensives significantly more obese than the normotensive diabetic.

The analysis of the various forms of hypertension both overall and in each ethnic group, is shown in Table 2. Table 3 shows the response of those receiving antihypertensive therapy. Of importance is the finding that of all the diabetics on treatment only 38.7% had normal blood pressure levels with similar results in the three ethnic groups.

FIG. 1. Prevalence of hypertension in male and female diabetics (** $P < 0.001$, females v. males).

TABLE 1. Clinical details of patients studied with blood pressure status, sex and ethnic origin and percent ideal body weight (mean $\pm$ s.e.m.)

Ethnic group	Age			% ideal body weight		
	Normotensive	Hypertensive	P	Normotensive	Hypertensive	P
White						
Male	45.02 $\pm$ 1.25	43.39 $\pm$ 1.32	†	116.09 $\pm$ 1.92	130.21 $\pm$ 3.64	†
Female	42.02 $\pm$ 2.06	55.45 $\pm$ 1.02	†	125.00 $\pm$ 3.74	137.36 $\pm$ 3.87	*
Black						
Male	48.57 $\pm$ 1.64	55.28 $\pm$ 0.95	†	116.66 $\pm$ 2.26	122.88 $\pm$ 2.96	
Female	51.55 $\pm$ 1.46	54.10 $\pm$ 0.83	†	138.19 $\pm$ 3.62	138.00 $\pm$ 2.98	
Asian						
Male	46.38 $\pm$ 1.24	50.57 $\pm$ 1.58	*	116.26 $\pm$ 1.75	117.41 $\pm$ 2.37	
Female	44.70 $\pm$ 1.86	52.86 $\pm$ 1.41	†	130.64 $\pm$ 3.65	134.60 $\pm$ 4.02	

* $P < 0.05$; † $P < 0.001$ for comparison of hypertensives and normotensives.

TABLE 2. Analysis of the hypertension in both males and females in each ethnic group

Ethnic group	% isolated systolic hypertension	% isolated diastolic hypertension	% combined	% normotensive on treatment for hypertension
White				
Male	48.6	5.4	32.4	13.5
Female	59.6	2.1	19.1	19.2
Black				
Male	33.3	11.1	29.6	25.9
Female	48.8	2.4	34.1	14.6
Asian				
Male	37.9	10.4	30.0	20.7
Female	52.4	0	28.6	19.0

TABLE 3. Response to hypotensive treatment in the ethnic groups studied

Ethnic group	% of all cases receiving hypotensive drugs who were normotensive at time of survey
Whites	38.9
Blacks	32.4
Asians	50.0

Discussion

The most important finding of this study is that in a district general hospital diabetic clinic, 40% of the diabetics under the age of 65 were hypertensive. We have confirmed the findings of other authors in demonstrating that blacks had a significantly greater prevalence than whites or Asians as do females and that isolated systolic hypertension was the most common form (Epstein *et al.*, 1965; Garcia *et al.*, 1974).

The aetiology of hypertension in the majority of diabetics is not clear. A number of theories have been proposed among which are that the osmotic effect of

hyperglycaemia results in chronic expansion of the circulating blood volume (Christlieb *et al.*, 1975). De Châtel *et al.* (1977) have demonstrated that some patients have an increased total body sodium while Weidmann *et al.* (1979) showed that diuretics can restore body sodium and normalize the blood pressure. De Fronzo, Goldberg and Aguero (1975) have implicated insulin itself in the pathogenesis of hypertension as it probably acts on the proximal convoluted tubules to increase the reabsorption of sodium; only small increases in plasma insulin (30–40 μ /litre) are required for this effect.

Diabetics are more prone to atherosclerosis than non-diabetics which may result in a loss of elasticity and hence compliance in the major blood vessels and which may explain the increased prevalence of systolic hypertension. Nephropathy is also more prevalent in diabetics and may be a contributory factor.

Lastly, there is the effect of obesity on the prevalence of hypertension. This relationship has long been recognized (Fletcher, 1953; Kannel *et al.*, 1967) and may be the reason for the apparent increase in prevalence as many diabetics are obese.

Ragan and Bordley (1941) showed that if a normal width sphygmomanometer cuff was used to measure the blood pressure of patients with fat arms, there was a false elevation in the pressure recorded when compared to direct arterial pressure measurement. A correction factor was initially determined by Pickering, Roberts and Sowry (1954) and more recently by Maxwell *et al.* (1982) to minimize this effect. However, Chiang, Perlman and Epstein (1967) in a review on obesity and hypertension have concluded that 'correcting blood pressure by arm circumference will obscure the important influence of body weight on blood pressure in epidemiological studies'. Our study is in agreement with that of Demanet *et al.* (1976) who has shown that the association remains even after correcting for arm circumference.

We conclude that there is a high prevalence of hypertension in diabetic patients who may benefit from treatment and that this prevalence cannot be solely explained by an association with obesity. The highest prevalence was seen in black female diabetics.

Acknowledgments

P. Pacy is a Wellcome Research Fellow. We are grateful to Mrs B. Singh for typing this manuscript.

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