How useful is weight reduction in the management of hypertension?

P.R. CROFT, MB

D. BRIGG

S. SMITH

C.B. HARRISON

A. BRANTHWAITE, BSc, PhD

M.F. COLLINS, MSc, PhD

SUMMARY. A group of previously untreated obese hypertensive patients were started on a weight reduction programme supervised by two dietitians working in a general practice surgery. It was stressed from the beginning of the programme that reducing blood pressure was the purpose of the diet. The results of follow-up after six months are presented together with results for a control group of obese hypertensive patients not receiving dietary advice or drug therapy, but being followed by the general practitioner. The weight, systolic blood pressure and diastolic blood pressure of the dieting hypertensive group were significantly lower than those of the non-dieting group after six months. However, the drop-out rate was significantly higher for the dieting group than for the non-dieting group.

The results of a separate comparison between a control group of obese normotensive patients following the same dietary programme and the group of dieting obese hypertensive patients are also presented. Attendance rates and weight loss achieved were significantly better for the hypertensive group than for the normotensive group after 12 months.

Weight reduction appears to be an effective first-line therapy for approximately 50% of obese patients with mild to moderate hypertension, and raised blood pressure appears to provide motivation for such patients to attend a dietitian's clinic and to lose weight.

Introduction

OVERWEIGHT patients face a number of potential medical problems,[1] one of which is hypertension.[2] Weight reduction is commonly recommended as the first step in the treatment of the obese hypertensive patient, and yet two recent randomized trials of weight loss in previously untreated hypertensive patients reached conflicting conclusions as to its effect.[3,4] The first controlled study in general practice of the influence of weight loss on blood pressure is presented here.

Weight reduction is difficult to achieve and general practitioners are pessimistic about its value.[5] However, the impetus which might be given to the dieter by the presence of a complication of obesity such as raised blood pressure has not been studied. The influence of this motivation to lose weight is the subject of the second controlled comparison presented here.

The aims of this study were (1) to examine the effect of weight reduction on blood pressure in newly diagnosed obese hypertensive patients and (2) to investigate whether weight reduction is more successful in hypertensive dieters than in normotensive dieters.

P.R. Croft, Research Fellow in General Practice and General Practitioner, D. Brigg, Dietitian, S. Smith, dietitian and C.B. Harrison, Practice Nurse, Department of Postgraduate Medicine, University of Keele and The Surgery, Wolstanton; A. Branthwaite, Lecturer in Psychology, University of Keele; and M.F. Collins, Medical Statistician, North Staffordshire Royal Infirmary.

© *Journal of the Royal College of General Practitioners,* 1986, **36**, 445-448.

Method

Patients

A screening programme was carried out over a period of 18 months in an urban group practice with approximately 10 000 patients in a broad spread of social classes. Patients aged between 35 and 60 years were invited by letter to attend for blood pressure measurement.

The practice nurse recorded two seated blood pressure readings, five minutes apart, using a Hawksley random-zero sphygmomanometer and a cuff appropriate to the arm circumference of each patient. Patients with systolic blood pressure of more than 140 mmHg and/or diastolic of more than 90 mmHg returned at weekly intervals for two further readings. If their blood pressure remained above these levels, they were defined as hypertensive for the purpose of this study and were interviewed and examined by the general practitioner (P.R.C.) who also recorded their blood pressure — this value was used as the entry pressure for the study.

All patients taking hypotensive drugs and all those with systolic blood pressure of more than 200 mmHg or diastolic of more than 114 mmHg were excluded from the study. Patients who had had a myocardial infarction or stroke within the previous three months, who had concurrent serious disease, who had conditions requiring diets or who were taking medication likely to influence weight or blood pressure were also excluded.

The weight and height of the patients (without shoes or jacket) were also measured at the screening session. For the purpose of the study, patients were defined as overweight if their body mass index (weight (kg)/height^2 (m^2)) was over 25.

Three groups of obese patients entered the study. Hypertensive patients from the screening programme were randomly allocated to a dieting or non-dieting group. The patients in the dieting group were invited to attend a weight reduction clinic at the surgery. The control patients in the non-dieting group did not receive weight reduction advice. The third group of obese patients was selected (using random number tables) from patients found to be normotensive at screening. These patients were also invited to attend the weight reduction clinic at the surgery.

Dietary protocol

The patients attending the clinic were given active dietary advice for weight reduction by two dietitians working at the surgery. The groups were given identical advice, but the importance of weight reduction for blood pressure control was emphasized to the hypertensive patients.

The hypertensive patients who did not attend the weight reduction clinic were seen only by the general practitioner. They

were told that for six months their blood pressure would be checked periodically before any decision about specific treatment was taken. If patients in this group indicated that they intended to lose weight, they were not discouraged but were given no specific advice or diet sheets. Their plan to lose weight was recorded.

All three groups of patients were given advice about modest restriction of salt use and reduction of excessive alcohol intake. No advice was given about smoking or exercise.

Records cards were issued to all the patients in each group — the normotensive patients had a weight chart to record their weight at each visit; the hypertensive patients in the dieting group had a blood pressure chart alongside the weight chart so that they could follow the progress of both measurements; the hypertensive patients in the non-dieting group had a blood pressure chart only.

Blood pressure measurements

The blood pressure of the hypertensive patients in the dieting and non-dieting groups was measured by the general practitioner at eight-week intervals. Since it was felt that a clinical decision about active therapy for the patients in the non-dieting group had to be made after six months, follow-up of this group was complete after six months for the purposes of the study.

The blood pressure of the normotensive patients was re-checked after six and 12 months.

Hypertensive patients in the dieting and non-dieting groups whose systolic pressure was above 200 mmHg or whose diastolic pressure was above 114 mmHg on two consecutive occasions were given tablets (atenolol or an atenolol–thiazide combination, unless contraindicated).

Drop-outs

Any patient who failed to keep an appointment was sent details of a maximum of two further appointments — failure to attend these was classified as dropping out.

Analysis

The data was submitted to an 'intention to treat' analysis which included all entrants and assumed that no further change in weight or blood pressure occurred for drop-outs after the last occasion on which they attended. In addition an 'outcome of continued attendance' analysis was used which compared only those patients still attending after six months (for the hypertensive dieters and non-dieters) and also after 12 months for the dieting groups (hypertensives and normotensives). This enabled the relative benefits of attendance and the problems of drop-out to be considered. Drop-out and sex data were analysed using the chi-square test. Group data were tested for normal distribution and then within-group changes were analysed by paired t-tests, and between-group comparisons by independent t-tests.

Results

Comparison of the dieting and non-dieting hypertensive patients

Table 1 gives the numbers of men and women initially allocated to each group. Chi-square analysis showed no significant difference between the sex ratio in these two groups. Table 2 gives the mean initial weights and blood pressures for the two groups and independent t-tests showed there were no differences between the groups at the 95% level of confidence, although this is only just true for the mean initial weights.

Drop-outs. Significantly more hypertensive patients attending the dietitians dropped out: 5% of the non-dieting group defaulted before the six-month follow-up compared with 26% of the dieting group (Table 1).

Table 1. Attendance figures for the hypertensive dieting and non-dieting groups.

	No. of initial attenders			Total no. of patients attending after 6 months
	Female	Male	Total	
Hypertensive dieters	37	29	66	49
Hypertensive non-dieters	25	39	64	61
Significance	NS			$P<0.01$[a]

NS = not significant. [a]χ^2 = 9.5, 1 df.

Other changes. Two patients in the dieting group and five patients in the non-dieting group commenced drug therapy before the six-month follow-up. Six of the non-dieting group expressed a spontaneous wish to lose weight.

Table 2. Mean weight and blood pressure of all patients in the hypertensive groups at entry, and at six-month follow-up or point of drop-out ('intention to treat'); and of those patients still attending after six months ('outcome of treatment'), with 95% confidence intervals in parentheses.

	Mean weight (kg)		Mean systolic blood pressure (mmHg)		Mean diastolic blood pressure (mmHg)	
	Initial	Final	Initial	Final	Initial	Final
All initial attenders						
Hypertensive dieters ($n=66$)	86.7 (±3.8)	80.2 (±3.6)	161 (±3.5)	150 (±4.0)	98 (±2.2)	91 (±2.2)
Hypertensive non-dieters ($n=64$)	82.2 (±2.6)	82.0 (±2.6)***	161 (±3.5)	157 (±3.5)**	96 (±1.9)	95 (±2.0)***
Patients attending after 6 months						
Hypertensive dieters ($n=47$)[a]	84.1 (±4.5)	76.1 (±3.7)	160 (±3.9)	147 (±4.3)	97 (±2.5)	88 (±2.5)
Hypertensive non-dieters ($n=50$)[a]	81.8 (±3.1)	82.3 (±3.1)***	158 (±2.6)	155 (±3.7)**	94 (±2.1)	94 (±2.1)***

**$P<0.01$; ***$P<0.001$ for change among dieters versus change among non-dieters. [a]Those taking hypotensive drugs or those in the non-dieting group and attempting to lose weight have been excluded.

Table 3. Attendance figures for dieting normotensive and hypertensive groups.

	No. of initial attenders			No. attending after 6 months			No. attending after 12 months		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Normotensive dieters	41	39	80	17	16	33	9	13	22
Hypertensive dieters	37	29	66	26	23	49	17	19	36
Significance	NS			$P<0.001$[a]			$P<0.001$[b]		

NS = not significant. [a]$\chi^2 = 17.4$, 1 df. [b]$\chi^2 = 12.2$, 1 df.

Weight changes. The mean weight loss during the six months of the study was 6.5 kg for all the dieting hypertensive patients (a significant change) and 0.2 kg for the non-dieting hypertensive patients (a non-significant change) (Table 2). The difference in weight change between the two groups was significant. The 'outcome of continued attendance' analysis showed similar results — a mean weight loss of 8.0 kg for dieters and a mean gain of 0.5 kg for non-dieters (Table 2).

Blood pressure changes. The mean fall in systolic blood pressure was 11 mmHg for all dieting hypertensive patients and 4 mmHg for all non-dieting hypertensive patients (Table 2). The mean fall in diastolic blood pressure was 7 mmHg for dieting patients and 1 mmHg for the non-dieting group. Paired t-tests showed the changes in the dieting group to be significant while those in the non-dieting group were not. Comparison between the groups showed significant reductions in both the systolic and diastolic blood pressure for the dieting group compared with the non-dieting group. The 'outcome of continued attendance' analysis showed similar results — a mean fall in systolic blood pressure of 13 mmHg for the dieters and of 3 mmHg for the non-dieters and a mean fall in diastolic blood pressure of 9 mmHg for the dieters and of 0 mmHg for the non-dieters.

Comparison of dieting normotensive and dieting hypertensive patients

Table 3 gives the numbers of men and women in each group. Chi-square analysis showed no significant difference in the sex ratio of these two groups. The mean initial weights (Table 4) of all the patients were normally distributed within the two groups and did not differ significantly between the groups.

Drop-outs. The numbers of patients attending after six and 12 months are shown in Table 3. After six months 59% of the normotensive patients had defaulted compared with 26% of the hypertensive patients, and after 12 months these figures had risen to 73% and 45% respectively. The differences between the two groups were significant at six and 12 months. 'Drop-out' curves constructed from each patient's attendance record showed that the difference between the two groups was established by six months and maintained thereafter.

Weight change. The mean weight loss during the first six months was 3.2 kg for all normotensive patients attending initially compared with 6.5 kg for hypertensive patients (Table 4). These changes were significant within each group. The mean weight change between six and 12 months was a loss of 0.1 kg for the normotensive patients and a gain of 0.1 kg for the hypertensive patients; neither change was significant, indicating that this was a period of weight maintenance rather than further loss or refractory gain.

Table 4. Mean weight of all patients entering the study in the normotensive and hypertensive dieting groups and of those patients still attending after six and 12 months, with 95% confidence intervals in parentheses.

	Mean initial weight (kg)	Mean weight (kg) After 6 months	Mean weight (kg) After 12 months
All initial dieters			
Normotensive ($n=80$)	88.3 (±3.4)	85.1 (±3.3)	85.0 (±3.3)
Hypertensive ($n=66$)	86.7 (±3.8)	80.2 (±3.6)***	80.3 (±3.5)***
Dieters attending after 6 months			
Normotensive ($n=33$)	89.2 (±5.1)	83.1 (±4.9)	–
Hypertensive ($n=49$)	84.1 (±4.5)	76.1 (±3.7)	–
Dieters attending after 12 months			
Normotensive ($n=22$)	89.5 (±5.6)	–	82.2 (±5.5)
Hypertensive ($n=36$)	85.4 (±4.6)	–	76.3 (±4.3)

***$P<0.001$ for change among hypertensive dieters versus change among normotensive dieters.

Comparison of the two groups, including those who dropped out, on an 'intention to treat' basis showed that mean weight loss in hypertensive group was significantly greater than in the normotensive group.

Those normotensive patients still attending the dietitians after six months lost a mean of 6.1 kg while the hypertensive patients lost 8.0 kg (Table 4). Those normotensive patients who continued to attend for 12 months lost a mean of 7.3 kg while the hypertensive patients lost 9.1 kg. The differences between the two groups were not significant. As would be expected, these changes are greater than the corresponding means calculated in the 'intention to treat' analysis.

Discussion

The weight loss achieved by obese hypertensive patients randomly allocated to a weight reduction programme in general practice was associated with significant reductions in both systolic and diastolic blood pressure when compared with a control group of obese hypertensive patients who were not dieting. The blood pressure changes achieved by the dieting group in this study are comparable with those reported in other studies — pooled data give a decrease in systolic pressure of 21 mmHg and in diastolic

pressure of 13 mmHg corresponding to a mean weight reduction of 12 kg.[6]

The present study followed dieting hypertensive patients for 12 months, and found that the early changes achieved in both weight and blood pressure were maintained. This confirms suggestions from community studies that longer term effects on blood pressure levels can result from dietary intervention even if ideal weight targets are not achieved[7] and even if some of the early weight loss is regained.[8]

Weight loss may not be the only explanation for the blood pressure changes in the dieting group; these patients may also be complying more closely with the general advice on alcohol reduction and salt restriction.[9,10] It is also possible that the well-being experienced by successful dieters may influence blood pressure, as may enthusiasm for the idea of controlling blood pressure by diet. However, the pragmatic conclusion remains that lower blood pressures were achieved by the group who lost weight.

There was found to be a problem with compliance and the drop-out rate in the dieting group of obese hypertensive patients was significantly higher (26%) than in the non-dieting group (5%). If this were to result in the defaulting patients being lost to follow-up of their high blood pressure, then a weight reductin programme might expose obese hypertensive patients to greater hazards than treatment by drugs alone. Stunkard and McLaren-Hume[11] made the same point in their study of 100 referrals to an obesity clinic from other hospital departments. However, drug treatment of hypertension also carries problems of drop-out and poor compliance. Some of the obese hypertensive patients studied here were given drug treatment — after six months 20% had either defaulted from follow-up or discontinued their tablets as a result of adverse effects (personal observation). In the Medical Research Council trial[12] the comparable figure after one year was 15% and this continued to rise. The low drop-out rate found here among the controls, who were simply asked to return for a blood pressure check, underlines the point that a drop-out problem can be created by electing to treat.

The 12-month comparison of normotensive and hypertensive obese patients following the same weight reduction programme has shown that drop-out rates are lower and the mean weight loss achieved is greater in the hypertensive group. These results suggest that making obese hypertensive patients aware of the association between weight loss and blood pressure reduction can motivate them to continue to attend for advice on weight-reducing and to achieve significant weight loss. This is the first controlled study of the influence of medical motivation to lose weight on drop-out rates from diet clinics. Seaton and Rose[13] reported on 1000 consecutive referrals to an outpatient clinic for weight reduction, and found that only the presence of diabetes correlated with a lower drop-out rate, and they attributed this to the longer time spent educating diabetic patients. The difference in drop-out rates between the groups in this study may have another explanation. The regular blood pressure checks for the hypertensive group may have provided the motivation for the better achievement of this group. However, these consultations were about blood pressure and its relationship to weight, and the wish to control their blood pressure may well be motivating the dieting hypertensive patients to attend. Among patients who continue to attend, weight loss is a measure of compliance with dietary advice, and it may be that obese hypertensive patients continue to attend for blood pressure measurements but lose no weight. However, the 'intention to treat' analysis showed that this was not the case — the hypertensive group lost significantly more weight than the normotensive group. Using raised blood pressure to motivate weight reduction improves attendance at a dietitians' clinic, and this attendance is associated with significant weight loss. Such motivation may also directly influence the amount of weight loss but the 'outcome of attendance' analysis suggests that this influence is not significant.

Conclusion

A general practitioner suggested in 1975 that because the present methods of treatment are so inefficient weight reduction programmes in general practice are worthless.[5] The present study has reached a different conclusion: that one way of making the treatment of obesity worthwhile is to concentrate on those patients who have blood pressure control as a goal for their weight reduction. Weight reduction appears to be an effective and useful first-line treatment of hypertension in obese patients in general practice. However, its usefulness appears to be limited to about half of the patients who start treatment, and follow-up of defaulters must be made a part of such a programme. It may be that other medical penalties of obesity can be used in a similar way in general practice to motivate obese patients to diet.

References

1. Royal College of Physicians. Obesity: a report. *J R Coll Physicians Lond* 1983; **17:** 5-65.
2. Chiang BN, Perlman LV, Epstein FH. Overweight and hypertension. *Circulation* 1969; **39:** 403-421.
3. Haynes RB, Harper AC, Costley SR. Failure of weight reduction to reduce mildly elevated blood pressure. *J Hypertension* 1984; **2:** 535-539.
4. MacMahon SW, Macdonald GJ, Bernstein L. Comparison of weight reduction with metroprolol in treatment of hypertension in young overweight patients. *Lancet* 1985; **1:** 1233-1236.
5. Bolden KJ. Against the active treatment of obesity in general practice. *Update* 1975; **11:** 339-348.
6. Hovell MF. The experimental evidence for weight loss treatment of essential hypertension. *Am J Public Health* 1982; **72:** 359-368.
7. Eliahov HE, Iaina A, Gaon T, *et al.* Body weight reduction necessary to attain normotension in the overweight hypertensive patient. *Int J Obes* 1981; **5:** (suppl. 1) 157-163.
8. Farquhar JW. In: Bray G (ed). *Recent advances in obesity research.* Volume 2. London: Newman Publishing, 1978: 313.
9. Gillum RF, Prineas RJ, Jeffery RW, *et al.* The independent effects of weight reduction and sodium restriction in overweight borderline hypertensive patients. *Am Heart J* 1983; **105:** 128-133.
10. Fagerberg B, Andersson OK, Bjorntorp B, *et al.* Blood pressure control during weight reduction in obese hypertensive men. *Br Med J* 1984; **288:** 11-14.
11. Stunkard AJ, McLaren-Hume M. The results of treatment of obesity: a review of the literature and report of a series. *Arch Intern Med* 1959; **103:** 79-85.
12. Medical Research Council Working Party. MRC trial of treatment of mild hypertension: principal results. *Br Med J* 1985; **291:** 97-104.
13. Seaton DA, Rose K. Defaulters from a weight reduction clinic. *J Chronic Dis* 1965; **18:** 1007-1011.

Acknowledgements

We thank Professor G.M. Aber and Dr A.K. Ross of the Department of Postgraduate Medicine, University of Keele, the partners and staff of the Wolstanton practice, Mrs Angela Harvey and the Departments of Cardiology, Biochemistry and Haematology of the North Staffordshire Medical Centre. This research was supported by a grant from the West Midlands Regional Research Committee.

Address for correspondence

Dr P.R. Croft, The Surgery, Palmerston Street, Wolstanton, Newcastle, Staffordshire ST5 8BN.