Control of blood pressure and risk of first acute myocardial infarction: Skaraborg hypertension project

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Abstract

Objective—To analyse the relation between treated blood pressure and concomitant risk factor and morbidity from acute myocardial infarction.

Design—Prospective longitudinal study. Treated blood pressures and other variables were used to predict acute myocardial infarction.

Setting—Primary health care in Skaraborg, Sweden.

Subjects—1121 men and 1453 women aged 40–69 years at registration at outpatient clinics, 1977–81, with no evidence of previous myocardial infarction were followed up for an average of 7.4 years. Subjects were undergoing treatment with drugs to lower blood pressure or had blood pressure that exceeded the systolic or diastolic limits, or both, for diagnosis ($>170/>105$ mm Hg (patients aged 40–60 years) and $>180/>110$ mm Hg (older than 60 years)) on three different occasions, or both.

Main outcome measures—First validated event of fatal or non-fatal acute myocardial infarction.

Results—In men but not in women there was a negative relation between treated diastolic blood pressure and risk of acute myocardial infarction. Left ventricular hypertrophy and smoking were contributory risk factors in both sexes, as was serum cholesterol concentration in men. In men with normal electrocardiograms ($n=345$) risk increased with increasing diastolic blood pressure ($P=0.047$), whereas the opposite was found in men with electrocardiograms suggesting ischaemia or hypertrophy, or both ($n=499$, $P=0.009$). In those with a reading of 95–99 mm Hg the relative risk was 0.30 ($P=0.034$); at ≥ 100 mm Hg it was 0.37 ($P=0.027$). No similar relations were seen in women or for systolic blood pressure.

Conclusion—It may be hazardous to lower diastolic blood pressure below 95 mm Hg in hypertensive men with possible ischaemia or hypertrophy, or both. Electrocardiographic findings should be considered when treatment goals are decided for men with hypertension.

Introduction

The risk for acute myocardial infarction among people with hypertension is related to blood pressure, other concomitant risk factors, and the extent of established arteriosclerotic disease.^{1–9} The prognosis is generally regarded to be influenced by the effectiveness of control of blood pressure combined with the impact on other risk factors.^{10,11} Though the risk of myocardial infarction will decrease the lower the blood pressure, there may be a point beyond which reduction is dangerous (the J curve phenomenon).¹² Further knowledge about this is of utmost importance for how individual treatment goals are set in clinical practice.

Results from clinical trials cannot be directly extra-

polated to patients in routine care because of selected bases for recruitment of participants. Therefore it is important to know the relative impact of various factors on the risk of complications in unselected groups of patients. Such information can be used for the development of practice guidelines for how to treat hypertension.

Our aim was to analyse risk factors for myocardial infarction, including blood pressure during ongoing treatment, that may influence the prognosis in a large cohort of men and women with hypertension treated in primary health care.

Subjects and methods

SKARABORG HYPERTENSION PROJECT

The Skaraborg hypertension project implemented guidelines for the detection, management, treatment, and follow up of hypertensive patients aged 40–69 years at particular nurse based outpatient clinics in the primary health care of six municipalities in Skaraborg county.¹³ It targeted all subjects with hypertension among the 46 234 (at 1 January 1977) residents who were aged 40–69 years.

A patient was eligible for inclusion and given the diagnosis of hypertension if he or she was being treated for hypertension or had a blood pressure reading that fulfilled certain diagnostic criteria, or both. For people aged 40–60 the limits used for diagnosis were $>170/>105$ mm Hg and in older subjects $>180/>110$ mm Hg. Systolic or diastolic limits, or both, had to be exceeded on three different occasions. Treatment aimed at normalising blood pressure to $<160/<95$ (40–60 years) and $<170/<105$ (>60 years).

Patients were recruited in two ways. Firstly, general practitioners and specialists referred patients who were already being treated. Secondly, during a two year period the blood pressure was measured routinely in all primary care patients aged 40–69 years who attended any outpatient clinic, irrespective of the reason for visit.

The diagnostic protocol at baseline included a structured medical history obtained by specially trained nurses according to predefined criteria for acute myocardial infarction, angina pectoris, stroke, intermittent claudication, heart failure, diabetes mellitus, and smoking habits.^{14,15} A 12 lead electrocardiogram was recorded and classified according to the Minnesota code.¹⁵ Laboratory tests included measurement of total serum cholesterol concentration with a direct enzymatic method,¹⁶ measurement of serum creatinine concentration, and a test of albuminuria. Supine (5 minutes' rest) systolic and diastolic (phase V) right brachial arterial pressure were recorded to the nearest 2 mm Hg by specially trained nurses. Height (to the nearest 1 cm) and weight (to the nearest 0.1 kg) were also recorded. A detailed description of the method has been reported elsewhere.¹⁷ Except for electrocardio-

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grams, the baseline procedure was repeated once a year up to 1981.

Drug prescription followed a stepped care schedule¹⁷ starting with a β blocker (initially propranolol and from 1979 metoprolol) or a thiazide diuretic (bendrofluzide). If needed, treatment was continued by the combination of the two. Hydralazine could be added as a third step.

STUDY POPULATION

During the five years up to December 1981, 3240 patients (1428 men and 1812 women) were included. They are 7% of the targeted population. Most (2367) were referred to the project with ongoing treatment, and hypertension was detected in 873 previously untreated patients. Of the initial recruits, 1196 men and 1495 women completed their first annual check up before January 1982, when formal follow up of the cohort ended. The present study includes a follow up of morbidity among those patients from their first annual check up to December 1987.

Table I gives the characteristics of the study population. At the start of the follow up 825 men (69%) and 894 women (60%) were taking a β blocker alone or in combination. Corresponding figures for treatment with a thiazide diuretic were 638 (53%) and 929 (62%), respectively.

TABLE I—Some characteristics of study population as recorded at first annual check up unless stated otherwise

Characteristics	Men (n=1196)	Women (n=1495)
Mean SD:		
Age (years)	58 (7)	59 (7)
Systolic blood pressure (mm Hg)	155 (18)	159 (19)
Diastolic blood pressure (mm Hg)	92 (9)	90 (9)
Body mass index	27.6 (3.5)	28.6 (5.0)
Serum cholesterol (mmol/l)	6.2 (1.2)	6.7 (1.3)
Serum creatinine (mmol/l)	94 (18)	78 (18)
No (%):		
Proteinuria (>200 mg/l)	80 (7)	56 (4)
Current smokers*	369 (31)	174 (12)
Diabetes mellitus	47 (4)	58 (4)
Angina pectoris	141 (12)	164 (11)
Previous acute myocardial infarction	75 (6)	42 (3)
Left ventricular hypertrophy*†	142 (12)	101 (7)
Heart failure	91 (8)	84 (6)
Intermittent claudication	45 (4)	54 (4)
Previous stroke	38 (3)	26 (2)
Treatment:		
Thiazide diuretic only	236 (20)	435 (29)
β blocker only	357 (30)	362 (24)
Thiazide diuretic and β blocker	224 (19)	322 (22)
Thiazide, β blocker, and hydralazine	111 (9)	96 (6)
Other combination or drug	198 (16)	205 (14)
None	70 (6)	75 (5)

*Data from baseline examination one year before start of follow up.

†Minnesota code 3.1 or 3.3 and 4.1-4.3 and/or 3.1 or 3.3 and 5.1-5.3.

METHODS

The systolic and diastolic blood pressures recorded at the first annual check up were used as independent variables in univariate and multivariate analyses. They were grouped into five categories of systolic (<150, 150-159, 160-169, 170-179, $\geq$ 180 mmHg) and diastolic blood pressure (<85, 85-89, 90-94, 95-99, $\geq$ 100 mmHg) but were also used as continuous variables. Categories were chosen based on measurements often referred to in clinical practice. Besides the linear variables, a quadratic term was added to investigate the existence of a non-linear relation between achieved diastolic blood pressure and risk. The concentrations of serum cholesterol and body mass index achieved on this occasion were also used for the analyses. Patients were categorised as current smokers or non-smokers according to the baseline interview. Prevalent diabetes mellitus was based on interviews at baseline and at the first annual check up, while left ventricular hypertrophy was determined from the coded electrocardiograms at baseline.

The Minnesota coded electrocardiograms were cate-

gorised as follows: a Q wave suggesting myocardial infarction—1.1 or 1.2; left ventricular hypertrophy—3.1 or 3.3 and 4.1-4.3 and/or 3.1 and 3.3 and 5.1-5.3; ST depression—4.1-4.3; negative T waves—5.1-5.3; high voltage—3.1 or 3.3. Patients with a Minnesota code of zero in all positions were defined as having a normal electrocardiogram. Those who had either ST depression or negative T wave or high voltage or any combination of the three were classified as having ischaemic-hypertrophic electrocardiograms.

Serum creatinine concentrations and albuminuria were determined at the start of follow up. The absence of angina pectoris, heart failure, intermittent claudication, and previous stroke was based on combined information from the recordings at baseline and at the first annual check up. Body mass index was calculated as weight (kg)/(height (m))².

The end point of this study was the first acute myocardial infarction during follow up; fatal and non-fatal cases were analysed together.¹⁸ Two sources of information were used: the computerised inpatient register covering all three hospitals in the county and the national mortality register. All registered files that included International Classification of Diseases codes 410-411 were extracted from the hospitals. By using predefined diagnostic criteria,¹⁸ the inpatient diagnoses were validated against their hospital records and all events not fulfilling the diagnostic criteria were excluded. For fatal cases the underlying cause of death according to the national mortality register was checked and corrected according to hospital records when available. After the validation, an end point register was created for each subject including data on any first event of a definite acute myocardial infarction during the complete follow up.

In all analyses patients with any evidence of a previous myocardial infarction (medical history, a Q wave on the baseline electrocardiogram, or an event in the end point register during the year between baseline and first annual check up) were excluded.

STATISTICAL METHODS

All analyses were stratified by sex. Cumulative incidence (risk) was calculated with the Kaplan-Meier method.¹⁹ The multivariate analyses with Cox's proportional hazards model were based on blood pressure as a continuous and a categorised variable.²⁰ Significance was in all analyses presumed when $P < 0.05$. All tests were two sided.

Results

RISK OF ACUTE MYOCARDIAL INFARCTION IN RELATION TO BLOOD PRESSURE

After the exclusion of subjects with previous myocardial infarction, 1121 (94%) men and 1453 (97%) women remained. Table II gives descriptive data according to category of blood pressure. There were only minor differences between the categories in duration of follow up, age, treatment, body mass index, serum cholesterol concentration, and percentage of smokers, diabetic patients, or left ventricular hypertrophy.

Table III shows the percentage risks adjusted for differences in the duration of follow up at seven years. There was an increasing risk of myocardial infarction with decreasing diastolic blood pressure for men. A similar trend was observed for increasing systolic blood pressure in women.

Table IV presents adjusted estimates of relative risk for the various categories of blood pressure. The lowest categories were used as reference. For two of the four higher categories of diastolic blood pressure in men, the 95% confidence interval did not include 1.0, indicating a significantly lower risk than in the reference

TABLE II—Occurrence of acute myocardial infarction and other characteristics of patients in relation to sex and systolic and diastolic blood pressure at start of follow up on treatment at one year. Data are means when not otherwise indicated

Characteristic	Category of diastolic blood pressure (mm Hg) at start of follow up					Category of systolic blood pressure (mm Hg) at start of follow up				
	≤84	85-89	90-94	95-99	≥100	≤149	150-159	160-169	170-179	≥180
<i>Men</i>										
No of patients	227	153	334	175	232	427	220	238	140	96
No with acute myocardial infarction	31	10	33	10	16	31	20	24	16	9
Duration at follow up (months)	86	92	89	87	90	91	87	88	86	89
Age (years)	60	59	58	58	57	56	57	59	62	62
Systolic blood pressure (mm Hg):										
At baseline registration	160	162	164	170	172	154	164	171	180	188
At start of follow up	143	148	155	159	168	137	153	163	173	190
Diastolic blood pressure (mm Hg):										
At baseline registration	92	94	98	102	105	96	98	100	100	102
At start of follow up	80	87	91	97	104	88	92	94	95	101
≥ Three drugs (%)	11	8	12	15	14	11	10	12	15	19
Body mass index	26.9	27.5	27.7	27.5	28.1	27.6	27.4	27.7	27.5	27.5
Total serum cholesterol (mmol/l)	6.1	6.2	6.2	6.2	6.1	6.1	6.3	6.2	6.1	5.9
Smokers (%)	33	25	30	32	33	30	28	29	36	35
Diabetes mellitus (%)	5	4	3	3	4	3	1	4	6	8
Left ventricular hypertrophy (%)	9	11	13	10	13	8	10	11	22	16
<i>Women</i>										
No of patients	386	232	471	167	197	461	302	291	193	206
No with acute myocardial infarction	18	9	18	13	11	13	9	22	11	15
Duration at follow up (months)	89	91	91	93	90	91	90	91	92	88
Age (years)	60	59	59	57	57	56	58	60	61	62
Systolic blood pressure (mm Hg):										
At baseline registration	165	166	169	175	178	155	167	171	181	192
At start of follow up	150	154	159	167	176	139	154	163	173	191
Diastolic blood pressure (mm Hg):										
At baseline registration	88	93	96	100	103	92	95	95	97	99
At start of follow up	79	87	91	97	104	85	89	91	93	96
≥ Three drugs (%)	9	6	6	13	14	5	7	10	7	20
Body mass index	28.1	28.5	28.6	28.9	29.4	28.1	28.4	29.0	29.2	28.7
Total serum cholesterol (mmol/l)	6.6	6.6	6.7	6.7	6.8	6.5	6.6	6.9	6.8	6.9
Smokers (%)	10	14	11	11	14	15	11	11	11	8
Diabetes mellitus (%)	7	3	2	2	5	3	3	5	4	4
Left ventricular hypertrophy (%)	7	6	4	9	10	4	5	7	5	16

TABLE III—Seven year risk (percentage) of first acute myocardial infarction in men and women by category of blood pressure on treatment at one year

	Diastolic pressure (mm Hg)					Systolic pressure (mm Hg)				
	≤84	85-89	90-94	95-99	≥100	≤149	150-159	160-169	170-179	≥180
Men	12.9	6.1	9.9	6.2	7.1	7.1	9.7	9.7	11.1	8.7
Women	4.5	3.6	3.5	8.0	6.1	3.0	3.1	6.4	5.6	7.3

group. No other relative risk estimate excluded 1.0.

Achieved diastolic blood pressure, entered as a continuous linear term in the Cox's proportional hazards model, did not reach significance, for men or women (table V). The same was true when a quadratic term was added. Instead, left ventricular hypertrophy was the strongest predictor for myocardial infarction followed by age in both men and women. Serum cholesterol concentration (men) and smoking (both sexes) were also significant risk factors. Substituting systolic blood pressure for diastolic changed the results only marginally.

IMPACT OF ELECTROCARDIOGRAPHIC FINDINGS IN MEN

The higher risk for men of myocardial infarction incurred by a low diastolic blood pressure was further explored by separating men by electrocardiographic findings at baseline. Two subgroups of patients were created, those with normal electrocardiograms (n=345) and those with ischaemic/hypertrophic

electrocardiograms (n=499), and analysed separately by the model used for the total group of hypertensive patients. Table VI presents characteristics of the two groups. There were only marginal differences between the blood pressure strata.

There was a J shaped relation between diastolic blood pressure and seven year risk of myocardial infarction in patients with normal electrocardiograms. Those with ischaemic/hypertrophic electrocardiograms had a negative relation (table VII).

The relative risks associated with each category of diastolic blood pressure did not differ significantly in men with normal electrocardiograms (table VIII). With diastolic blood pressure entered in the Cox's model as a continuous variable there was, however, a significant positive relation between diastolic blood pressure and risk (P=0.047). An added quadratic term did not reach significance.

Among the ischaemic/hypertrophic patients, those with a diastolic blood pressure ≥95 mm Hg had a significantly lower adjusted relative risk of developing myocardial infarction than those belonging to the group with the lowest blood pressure (table VIII). There was also a significant negative relation with diastolic blood pressure used as a continuous variable (P=0.009). An added quadratic term did not reach significance.

No significant relation between achieved diastolic blood pressure and risk of acute myocardial infarction

TABLE IV—Relative risks* (95% confidence intervals) for acute myocardial infarction related to category of systolic and diastolic blood pressure on treatment at one year in men and women

	Category of diastolic blood pressure (mm Hg) at start of follow up					Category of systolic blood pressure (mm Hg) at start of follow up				
	≤84	85-89	90-94	95-99	≥100	≤149	150-159	160-169	170-179	≥180
Men (n=1105)†	1.0	0.46‡	0.72	0.44§	0.54	1.0	1.15	1.18	0.97	0.84
		(0.23 to 0.95)	(0.44 to 1.19)	(0.21 to 0.90)	(0.29 to 1.00)		(0.65 to 2.03)	(0.69 to 2.03)	(0.52 to 1.83)	(0.39 to 1.81)
Women (n=1432)†	1.0	0.82	0.82	1.72	1.08	1.0	0.99	1.98	1.33	1.76
		(0.37 to 1.84)	(0.42 to 1.61)	(0.83 to 3.56)	(0.49 to 2.39)		(0.42 to 2.33)	(0.98 to 4.03)	(0.56 to 3.16)	(0.81 to 3.85)

*Adjusted for differences in age, duration of follow up, serum cholesterol concentration, body mass index, diabetes mellitus, left ventricular hypertrophy, and smoking.

†16 Men and 21 women excluded from multivariate analysis because of incomplete data.

‡P=0.035, §P=0.024, and ||P=0.051 for no difference from 1.0.

was seen in the 277 men who had neither normal nor ischaemic/hypertrophic electrocardiograms. Neither could any similar relation be shown for women or for achieved systolic blood pressure in men and women.

TABLE V—Relative risks* for first event of acute myocardial infarction analysed with Cox proportional hazards model

Variable in model	Relative risk (95% confidence interval)	
	Men (n=1105)†	Women (n=1432)†
Age (by 10 years)	1.95 (1.43 to 2.67)	2.01 (1.35 to 2.99)
Diastolic blood pressure (by 5 mm Hg)	0.91 (0.81 to 1.01)	1.06 (0.93 to 1.22)
Body mass index (by kg/m ²)	0.95 (0.89 to 1.01)	0.99 (0.94 to 1.04)
Serum cholesterol (by mmol/l)	1.29 (1.14 to 1.46)	1.18 (1.00 to 1.39)
Smoking (yes/no)	1.60 (1.06 to 2.41)	2.61 (1.42 to 4.80)
Diabetes mellitus (yes/no)	1.59 (0.64 to 3.95)	1.76 (0.63 to 4.90)
Left ventricular hypertrophy (yes/no)	2.48 (1.56 to 3.93)	2.87 (1.52 to 5.42)

*Relative risk adjusted for differences in age, duration of follow up, diastolic blood pressure on treatment at one year, body mass index, serum cholesterol concentration, smoking, diabetes mellitus, and left ventricular hypertrophy.

†16 Men and 21 women excluded from multivariate analysis because of incomplete data.

TABLE VI—Occurrence of acute myocardial infarction and other characteristics of patients in relation to diastolic blood pressure at start of follow up on treatment at one year and electrocardiographic findings. Data are means unless otherwise indicated

	Category of diastolic blood pressure (mm Hg) at start of follow up				
	<84	85-89	90-94	95-99	≥100
<i>Men with normal electrocardiogram</i>					
No of patients	70	59	101	54	61
No with acute myocardial infarction	4	2	5	4	7
Duration of follow up (months)	88	96	90	85	90
Age (years)	58	57	56	57	55
Systolic blood pressure (mm Hg):					
At baseline registration	157	157	156	163	167
At start of follow up	141	148	150	154	165
Diastolic blood pressure (mm Hg):					
At baseline registration	92	93	96	101	104
At start of follow up	80	87	91	97	104
≥ Three drugs (%)	10	7	6	13	11
Body mass index	27.3	27.5	27.9	27.8	27.8
Total serum cholesterol (mmol/l)	5.9	6.2	6.3	6.2	6.0
Smokers (%)	41	24	32	37	30
Diabetes mellitus (%)	7	0	2	2	5
Left ventricular hypertrophy (%)	—	—	—	—	—
<i>Men with ischaemic/hypertrophic electrocardiogram</i>					
No of patients	94	56	149	86	114
No with acute myocardial infarction	17	6	19	4	7
Duration of follow up (months)	82	85	88	88	90
Age (years)	61	61	59	58	58
Systolic blood pressure (mm Hg):					
At baseline registration	165	169	172	177	175
At start of follow up	146	150	158	161	170
Diastolic blood pressure (mm Hg):					
At baseline registration	93	96	100	103	106
At start of follow up	79	87	91	97	104
Taking ≥ 3 drugs (%)	14	7	19	19	17
Body mass index	26.6	27.3	27.7	27.5	28.0
Total serum cholesterol (mmol/l)	6.2	6.4	6.1	6.1	6.0
Smokers (%)	35	21	28	28	36
Diabetes mellitus (%)	4	9	4	2	4
Left ventricular hypertrophy (%)	21	30	28	21	27

TABLE VII—Seven year risk of first acute myocardial infarction by category of blood pressure on treatment at one year in men in whom electrocardiographic findings at start were normal or showed ischaemia or hypertrophy, or both

Electrocardiographic findings	Diastolic pressure (mm Hg)				
	≤84	85-89	90-94	95-99	≥100
Normal	6.9	3.6	5.2	7.6	11.7
Ischaemic/hypertrophic	18.6	9.3	13.0	4.7	6.2

TABLE VIII—Relative risks* (95% confidence interval) for acute myocardial infarction in men related to category of diastolic blood pressure on treatment at one year and electrocardiographic findings

Subjects	Category of diastolic blood pressure (mm Hg) at start of follow up				
	<84	85-89	90-94	95-99	≥100
Men with normal electrocardiogram (n=337)†	1.0	0.62 (0.11 to 3.43)	1.0 (0.26 to 3.84)	1.57 (0.38 to 6.55)	2.66 (0.76 to 9.26)
Men with ischaemic/hypertrophic electrocardiogram (n=494)‡	1.0	0.58 (0.22 to 1.49)	0.80 (0.41 to 1.55)	0.30§ (0.10 to 0.91)	0.37 (0.15 to 0.89)

*Relative risks adjusted for differences in age, duration of follow up, serum cholesterol concentration, body mass index, diabetes mellitus, and smoking.

†Eight men excluded because of incomplete data.

‡Five men excluded because of incomplete data.

§P=0.034 and ||P=0.027 for no difference from 1.0.

Discussion

The negative relation between achieved diastolic blood pressure and the risk of myocardial infarction in men was seen in those with electrocardiographic changes indicating left ventricular hypertrophy or myocardial ischaemia, or both.²¹ These signs indicate a less favourable prognosis.^{1, 22} The number of men with such electrocardiographic changes exceed the number who had a normal electrocardiogram. Most events occurred in the group with electrocardiographic abnormalities. This indicates that results of clinical trials, excluding subjects with evidence of overt ischaemic heart disease,^{4, 6, 23, 24} cannot easily be applied to an unselected population of hypertensive patients.

Left ventricular hypertrophy, which is commonly caused by hypertension,^{25, 26} increases oxygen demand in the myocardium. Narrowing of the coronary arteries caused by coronary atherosclerosis or hypertrophy (induced by hypertension) decreases coronary flow reserve.²⁷⁻³⁰ In the coronary circulation oxygen extraction is nearly maximal at rest. In the presence of left ventricular hypertrophy the lower end of the autoregulation may be shifted to the right. Coronary flow occurs during diastole. If the diastolic blood pressure gradient drops below a critical value myocardial ischaemia may develop, increasing the risk of infarction.²⁷⁻³⁰

Two early studies questioned the goal of the lower the better for the treatment of hypertension.³¹⁻³² Intense debate followed^{29, 33-36} when Cruickshank in 1987 showed a J shaped relation between diastolic blood pressure and risk of myocardial infarction in people being treated for hypertension who had established ischaemic heart disease.⁸ Other studies have confirmed his results among hypertensive subjects³⁷⁻⁴¹ and in the general population.⁴² A further study has suggested that change in pressure may need to be considered besides the absolute level of diastolic blood pressure.⁴³

In men with normal electrocardiograms at entry the relative risk of a myocardial infarction increased significantly with increasing diastolic blood pressure. This suggests that men in that subgroup would benefit from treatment to lower diastolic blood pressure, at least down to 85-90 mm Hg. Early detection and treatment of hypertension might prevent electrocardiographic changes and thus improve prognosis.

Other risk factors for myocardial infarction in men, besides the diastolic blood pressure and electrocardiographic abnormalities, were serum cholesterol concentration and smoking. In hypertensive men who already have signs of impaired coronary blood flow it might be more important to eliminate smoking and to lower blood cholesterol concentration than to induce a radical decrease of blood pressure.

Although serum cholesterol concentration was higher in women, it was not as strong a predictor for myocardial infarction as in men. Women were, however, just as vulnerable to smoking and left ventricular hypertrophy as men. Prevention of acute myocardial infarction in hypertensive women should perhaps concentrate on a reasonable reduction of blood pressure and stopping smoking.

Echocardiographically determined left ventricular hypertrophy has a substantially higher sensitivity^{44, 45} than that electrocardiographically determined,^{44, 46} and echocardiography is proposed to be included as a part of clinical management in some hypertensive subjects.³⁰ The specificity of the electrocardiogram is high,⁴⁴ however, and in the view of our results it may still be an important tool in the evaluation of hypertensive patients.

METHODOLOGICAL CONSIDERATIONS

Blood pressure measurements at the first annual check up were used as a measure of treatment effect.

Clinical implications

- As the gradient of diastolic blood pressure is a major determinant of coronary perfusion there may be a point beyond which reduction in diastolic blood pressure is harmful
- In this study hypertensive men with ischaemic/hypertrophic electrocardiograms had increased risk for a first myocardial infarction the lower the treated diastolic blood pressure
- The opposite was true in men with normal electrocardiograms
- No similar relations were found in women or for systolic blood pressure
- Important contributing risks for acute myocardial infarction came from smoking and left ventricular hypertrophy in both sexes and from the serum cholesterol concentration in men

Patients were continuously recruited during 1977-80. Thus, the individual number of check ups in each patient may vary from one to four. In order not to induce bias by the use of averaged blood pressures over the years we decided to base the study on data from the first annual check up. As a further justification there were only marginal improvements in control of blood pressure after the first year.⁴⁷

Our results build on observational data. Thus it cannot be completely excluded that the results may in part be caused by selection bias. Since there were only marginal differences between different categories of blood pressure with respect to multiple risk and morbidity at entry, this is, however, very unlikely. The consistency with previous studies also strongly suggests that the results are true reflections of different achieved blood pressures.

The present study includes patients with known hypertension in a well defined catchment area that was carefully evaluated for the presence of high blood pressure. The material should be representative of a general population of hypertensive subjects. Strict criteria were applied for the diagnosis, follow up, and treatment, simplifying a scientific follow up and offering opportunities to draw more representative conclusions of the impact of blood pressure control than those derived from traditional clinical trials of antihypertensive treatment.

CONCLUSIONS

The prognosis for the hypertensive cohort has recently been compared with the population from which they were recruited. The risk of myocardial infarction⁴⁸ and total mortality⁴⁹ did not differ from that of the population, and the risk of stroke was lower than expected.⁴⁹ Thus, the main impression is that the prognosis for this cohort was better than expected and on average the intervention should have been beneficial. The results of the present study are consistent with these findings. The relative risks between different segments of the distribution of treated blood pressure showed small differences. The distribution of blood pressure was concentrated around a mean for which risks are low. In other words, this should be regarded as a well treated population. Furthermore, the blood pressures for diagnosis and treatment of hypertension were higher than current recommendations.⁵⁰

In conclusion, we suggest that a low achieved diastolic blood pressure in men with abnormal electrocardiographic findings may be hazardous. Future trials of antihypertensive agents should focus on including a wide variety of risks including left ventricular hypertrophy.

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First step in managing bulimia nervosa: controlled trial of therapeutic manual

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Abstract

Objective—To test the short term efficacy of a self directed treatment manual for bulimia nervosa.

Design—Randomised controlled trial of the manual against cognitive behavioural therapy and a waiting list.

Setting—Tertiary referral centre.

Subjects—81 consecutive referrals presenting with bulimia nervosa or atypical bulimia nervosa.

Main outcome measures—Frequency of binge eating, vomiting, and other behaviours to control weight as well as abstinence from these behaviours.

Results—Cognitive behavioural treatment produced a significant reduction in the frequency of binge eating, vomiting, and other behaviours to control weight. The manual significantly reduced frequency of binge eating and weight control behaviours other than vomiting, and there was no change in the group on the waiting list. Full remission was achieved in five (24%) of the group assigned to cognitive behavioural treatment, nine (22%) of the group who used the manual, and two (11%) of the group on the waiting list.

Conclusions—A self directed treatment manual may be a useful first intervention in the treatment of bulimia nervosa.

Introduction

Bulimia nervosa is increasing in prevalence among young women,¹ and the lifetime prevalence ranges from 4% to 8% in women. Physical and psychological health is impaired,² as well as social functioning.³ Whereas psychological treatment is generally the most successful for bulimia nervosa,⁴ it is often costly in terms of time and training of the therapist. Treatments with drugs can be administered more easily and cheaply, but their effects are less profound,⁵ are short lasting, and are associated with more side effects.⁷

A brief course of psychoeducation within a group with an emphasis on management of symptoms produced an abstinence from binge eating and vomiting in 20% of patients in the short term.⁸ It was less effective than full cognitive behavioural therapy at follow up but only in a more severely affected subgroup.⁹ Such group approaches, however, can pose organisational problems, and a lack of skilled staff

may make it difficult to use in non-specialist centres.¹⁰

Books, computers, videotapes, and audiotapes, which require even less contact with a therapist than group treatment, have been shown to be effective in the treatment of depression, anxiety, phobias, and problem drinking and can considerably improve standard treatment by general practitioners of panic disorder and generalised anxiety disorder,¹¹⁻¹⁶ with therapeutic gains being maintained at two years' follow up.¹⁷ These approaches are cost effective and in line with the recommendations of the King's Fund Report that "the users should be empowered to master their own illness and problems."¹⁸

We devised a problem oriented self help manual¹⁹ for the treatment of bulimia nervosa with the aim of improving the cost effectiveness of treatment, reducing the amount of contact with a therapist, and arming non-specialist centres with a usable and effective tool. The manual incorporates information and education with skills training including self monitoring, goal setting, assertiveness, cognitive restructuring, problem solving, and strategies to prevent relapse and was written to be easily comprehensible, according to the criteria of Albert and Chadwick.²⁰

In an uncontrolled study we found significant reductions in bulimic symptoms and an increase in knowledge about the origins of the condition and the factors that maintain it.²¹

We present the results of a comparison of the manual with the first stage (sessions 1-8) of a course of 16 sessions of cognitive behavioural therapy and a control group from the hospital waiting list, by using a randomised controlled trial. This period was considered suitable for comparison as the first eight sessions of cognitive behavioural therapy are designed to produce symptomatic control.⁵ Our hypotheses were, firstly, that cognitive behavioural therapy would be considerably more effective than the manual and, secondly, that the manual would be considerably more effective than being on the waiting list at reducing bulimic symptoms.

Subjects and methods

SUBJECTS

One hundred and twenty five patients attending the Maudsley Hospital and fulfilling criteria for bulimia

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