Clinical Pharmacology and Drug Treatment in the Elderly. Ed. K. O'Malley. Churchill Livingstone. 1984. 122–138.

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Hypertension in the elderly: epidemiology, pathophysiology and management

Life expectancy in the developed world has increased by 20 years since the turn of the century. More people now survive 65 years or more and this group is arbitrarily defined as the elderly. At present there are 23 million elderly persons in the United States and the number is expected to rise to 55 million early in the next century (Bureau of the Census, 1976). Consequently, care of the elderly shall demand an increasing proportion of medical resources in the future. The importance of hypertension in the elderly is highlighted by the fact that it is the single most important risk factor for cardiovascular and cerebrovascular disease, which account for more than half of the total mortality in this age group.

DEFINITIONS

Blood pressure is a continuous variable and the risk associated with it rises continuously. Thus, there is no clearly identifiable critical or safe level. It follows that cut-off points between normal and hypertensive levels must be arbitrary. However, in practice certain limits are defined for the diagnosis of hypertension. Such limits are based on two types of evidence. One is epidemiological data of a high risk above such limits. The second is the demonstration that lowering pressure above certain levels is associated with improved prognosis.

Hypertension, as defined by the World Health Organization (1978) is a systolic blood pressure equal to or greater than 160 mmHg and/or a diastolic blood pressure (Korotkoff phase V) equal to or greater than 95 mmHg. Blood pressure in excess of these limits is associated with more than three times the risk of stroke and coronary artery disease than lower pressure (Kannel et al, 1970).

The Hypertension Detection and Follow-Up Program (1979) in the United States has provided evidence that prognosis is improved when mild hypertension is treated and they recommend 160/90 as the lower limit of hypertension.

It is now recognised that systolic blood pressure is a more potent predictor of the risk of all clinical sequelae of hypertension than diastolic pressure (Kannel et al, 1980). The importance of elevation of systolic levels is reflected is newer terminology which stresses raised systolic pressure. 'Disproportionate systolic hypertension' exists when systolic blood pressure (SBP) is exaggerated when

compared to the diastolic blood pressure (DBP) and it has been defined by Koch-Weser (1973a) as:

$$SBP > (DBP - 15) \times 2$$

This definition includes cases where the systolic blood pressure alone is raised while the diastolic pressure is normal. This situation is referred to as 'isolated systolic hypertension' but unfortunately it is not subject to uniform definition because of disagreement about the upper limit of normal systolic and diastolic blood pressures. Koch-Weser (1973a) has defined systolic pressure as greater than 150 mmHg with a diastolic pressure below 90 mmHg and Dyer et al (1977) defined it as a systolic pressure in excess of 159 mmHg while the diastolic pressure remains below 95 mmHg.

BLOOD PRESSURE AND AGE

Prevalence data indicate that blood pressure tends to rise with age in Western society. In the Framingham Study blood pressure behaviour has been studied in relation to age (Fig. 7.1). Analysis of cross-sectional data reveals different trends for the sexes. Both men and women show increasing systolic and diastolic pressures until the fifth decade. During this time pressures in women are lower than in males. In men, systolic pressure rises with age until the seventh decade when it peaks and then declines. The diastolic pressure in males peaks in the fifth decade and then declines. In females, systolic and diastolic pressures rise more steeply than in males. While initially lower than in males they are about equal at age 60 and progressively increase. This cross-over is apparent for both systolic and diastolic pressures.

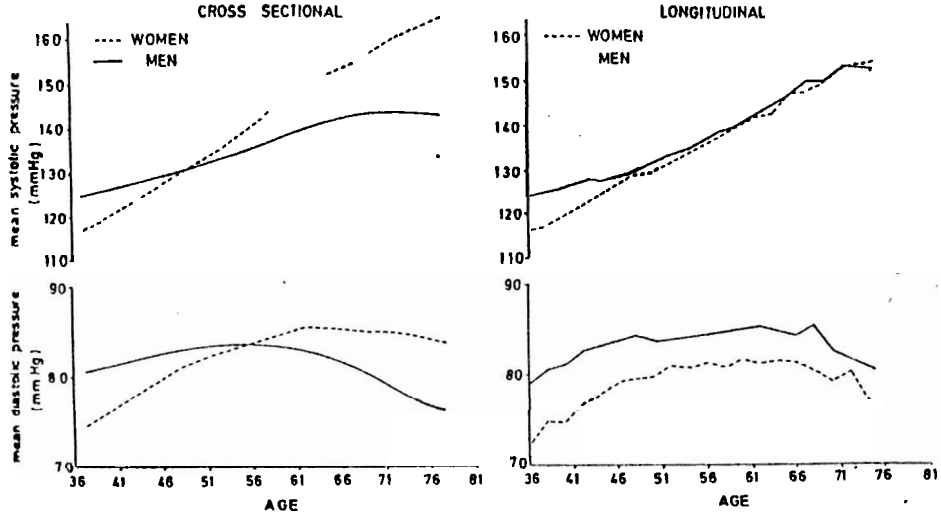

Fig. 7.1 Average age trends in blood pressure levels for men and women based upon cross sectional and longitudinal data on participants in the Framingham Study (Kannel & Gordon, 1978).

Longitudinal data from the same study show a slightly different pattern. Systolic pressure in females is initially lower than in males but rises rapidly with age and equals male values at age 60 years but never exceeds them. Diastolic pressures are more or less parallel in the sexes, female levels being lower. Diastolic pressures peak at the end of the fifth decade and decline thereafter.

The differences between cross-sectional and longitudinal trends in blood pressure behaviour probably relfects differences in these two methods of analysis. Longitudinal data refers to individual patients. At higher ages longitudinal data is confined to those patients who have survived and there may be a bias towards lower pressures.

Assessing trends in blood pressure specifically in the elderly, Master et al (1958) examined blood pressure status in a cross sectional study of 5757 healthy white individuals with ages ranging from 65 to 106 years. However, those with cardiovascular disease were excluded from the study. Systolic and diastolic blood pressure in this age group did not show a consistant rise with age as it does below 50 years. The mean systolic blood pressure continued to rise in both sexes until age 70–74 years after which it declined in females while remaining constant in males. Diastolic blood pressure remained essentially constant in both sexes after age 65 years, women having a slightly higher level than males, the difference being 2 mmHg.

Therefore, in general, mean systolic and diastolic pressures tend to rise with age in both sexes until the end of the fifth decade when diastolic pressure reaches a plateau, while systolic pressure continues to rise and peaks in the seventh decade, after which it remains constant or declines. Such trends explain the common finding of disproportional hypertension in the elderly.

PREVALENCE

The prevalence of hypertension in the elderly depends on the definition of hypertension used, the number of recordings made and the interval between them, as well as the circumstances in which such measurements are taken.

Population studies have revealed differences between the pattern of hypertension in the elderly compared to that in younger age groups. Combined systolic and diastolic hypertension is less common in the elderly and when it exists the systolic pressure tends to be disproportionately elevated. Isolated systolic hypertension is common in the elderly while it is rare before middle-age.

The U.S. National Health Survey (1966), in which 160/95 mmHg was accepted as the lower limit of hypertension revealed an overall prevalence of hypertension of 40 per cent in the elderly while 11 per cent of those aged 35–45 years were hypertensive. The prevalence of combined systolic and diastolic blood pressure in the elderly was approximately 20 per cent when assessed in the Community Hypertension Evaluation Clinic Program (1977). In both studies findings were based on single blood recordings.

Other studies have investigated the prevalence of isolated systolic hypertension. The U.S. National Health Survey (1960–62) revealed it to be almost non-existent until age 44 years after which the prevalence increased with age and was 30 per cent for the elderly. Similarly, the Framingham Study (Kannel et al, 1980) shows an

increasing prevalance of isolated systolic hypertension with age after middle-age in both sexes, the rise among females being somewhat steeper than that in males (Fig.7.2).

In the clinic setting Koch-Weser (1978) found disproportionate systolic hypertension in 43 per cent of elderly patients, about half of whom had isolated systolic hypertension, compared to 13 per cent of the 45–64 year age group, of whom only 1 per cent had isolated systolic hypertension. However, repeated readings after an interval of days or weeks may yield a lower prevalence. Isolated systolic hypertension (systolic greater than 159 mmHg, diastolic lower than 90 mmHg) in a population of retired people of whom 70 per cent were over 65 years, was present in 14 per cent when blood pressure was first taken but the prevalence fell to 2.7 per cent at subsequent clinic visits (Colandrea et al, 1970).

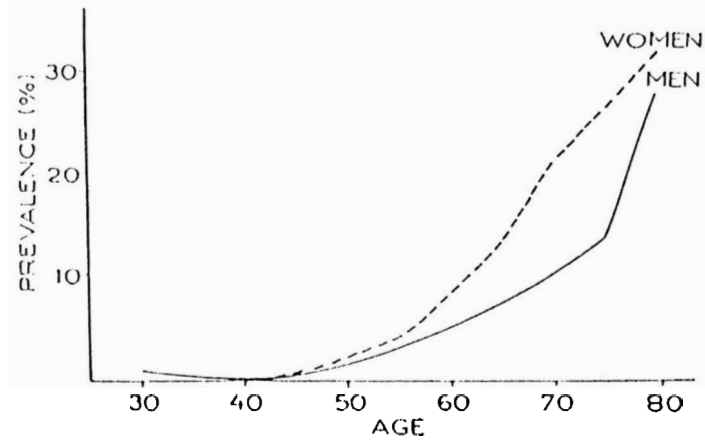

Fig. 7.2 Prevalence of isolated systolic hypertension by age and sex. The Framingham Study (Kannel et al, 1980).

PATHOPHYSIOLOGY OF AGEING — ITS RELATIONSHIP TO HYPERTENSION

The ageing process is associated with anatomical, physiological and biochemical changes. Some of these changes may be important in the pathogenesis of hypertension in the elderly or influence management.

The arteries

Ageing is associated with increased rigidity of the aorta and its branches due to loss of elastic fibres in the media, an increase in collagen and calcium content and the presence of atheroma in the intima (Hass, 1943). The functional consequence of these changes is a loss of compliance (Hallock & Benson, 1937; Kohn, 1978) (Fig. 7.3). The stiffened large vessels behave more like rigid tubes than distensible vessels. During systole, the normal aorta distends to accomodate the stroke volume storing part of the energy of left ventricular ejection and dampening the elevation of systolic pressure. In diastole, the distended aorta recoils, releasing its stored energy as a force that tends to maintain arterial diastolic pressure. Thus aortic distensibility reduces the work load of the left ventricle by reducing impedance.

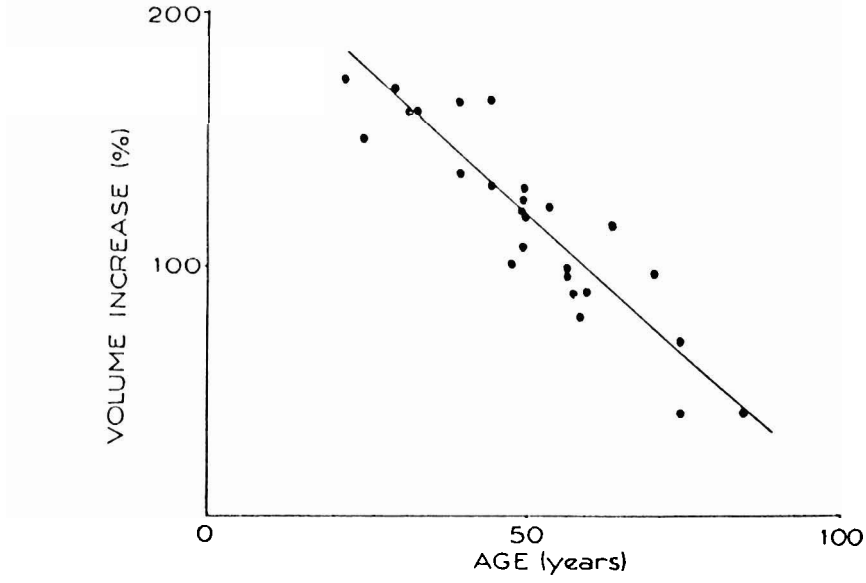

Fig. 7.3 Volume increase of human thoraic aorta under standard pressure as a function of age (Kohn, 1978).

In less compliant vessels the systolic pressure generated in the left ventricle is transmitted to the arterial tree with very little buffering. There is a rise in systolic pressure with diastolic pressures remaining largely unaltered. The effects of ageing on the pre-capillary arteriole is not known but the total peripheral resistance tends to rise (Amery et al, 1978c).

It has been postulated recently that the increased rigidity of peripheral arteries with age may affect the accuracy of indirect blood pressure measurement. Spence et al (1980) compared indirect blood pressure with direct intra-arterial pressure in 24 elderly hypertensive patients and 16 young hypertensive patients. These patients were investigated because of the clinical suspicion that their indirect blood pressure was falsely elevated. Such patients came to light because they had no evidence of target organ damage despite their high blood pressure. It was found that 50 per cent of the elderly group and 25 per cent of the younger group had a direct diastolic blood pressure 30 mmHg or more lower than the corresponding indirect diastolic pressure. However, a small cuff (10 cm × 14 cm) was used to measure indirect blood pressure and this may have led to a falsely high pressure estimation — so called 'cuff hypertension' (Short, 1976). When a larger cuff (20.5 cm × 13 cm) was used only five of 24 elderly patients and two of 16 younger patients now had an indirect diastolic pressure significantly higher than direct diastolic pressure. The term 'pseudohypertension in the elderly' has been coined for this 'condition' but because of defects in the study, the effect of ageing and by implication of arterial rigidity on blood pressure measurement awaits further study.

The heart

Cardiac index diminishes with age due to a fall in stroke volume with little change

in the heart rate (Strandell, 1976). It is not clear if the decrease in stroke volume is due to a biochemical change in the myocardial fibre or to myocardial changes secondary to coronary artery disease. The rise in impedance in the great vessels coupled with the age related rise in total peripheral resistance, as well as causing an increase in systolic pressure, will also tend to reduce cardiac output. Messerli et al (1981) studied haemodynamics and intravascular volume in 18 elderly patients with hypertension and compared them with sex and mean arterial pressure matched young hypertensives. Cardiac index was significantly lower in the elderly as was total intravascular volume. Left ventricular ejection rate was lower in the elderly while peripheral vascular resistance was increased. Pulse pressure divided by stroke volume, an index of aortic elasticity, was significantly decreased in the elderly. Although mean arterial pressure was similar in both groups the findings indicate different pathophysiological mechanisms in young and elderly patients with hypertension.

Renin-angiotensin system

The renin-angiotensin aldosterone system also undergoes changes with age, low renin essential hypertension being more common in the elderly. Weidmann et al (1975) have shown that plasma renin concentration, plasma renin activity and aldosterone concentrations are lower in the elderly. At all ages there is an inverse relationship between serum renin levels and blood pressure and some authors (Niarchos & Laragh, 1980) suggest that the decrease in serum renin in the elderly is a feedback inhibition induced by their higher arterial pressures. Low renin levels in elderly patients with hypertension would suggest that anti-renin agents e.g. angiotensin II antagonists and anti-renin sympatholytic agents such as beta adrenoceptor blocking drugs would be less effective in lowering blood pressure in the elderly than in younger patients.

Neurocirculatory reflexes

Baroreflex function is diminished in hypertensive (Bristow et al, 1969) and with increasing age up to 65 years (Gribbin et al, 1971). The combined effects of age and hypertension might be expected to have a striking effect on baroreflex activity and McGarry et al (1981) have shown a marked decrease in baroreflex response to nitroprusside-induced blood pressure reduction in elderly hypertensives.

Due to the increase in great vessel rigidity with age the main baroreceptors in the carotid and aorta may not be distorted as much by changes in arterial pressure. Their response to changes in blood pressure is attenuated and a higher blood pressure is required to achieve 'normal' afferent nerve activity (Horrobin, 1966). Cowley et al (1973) studied blood pressure in dogs whose carotid and aortic baroreceptors were destroyed and found that de-afferentiation did not produce sustained arterial hypertension. These animals showed unchanged average resting blood pressure but the pressure became quite labile and tended to rise markedly when the animals were approached by the investigators. This suggests that diminished baroreflex function is not a primary cause of sustained arterial hypertension but could contribute to the large variability seen in systolic blood pressure in the elderly.

RISKS OF HYPERTENSION IN THE ELDERLY

Blood pressure is the major risk factor for cardiovascular disease at all ages, but this is particularly so in the elderly (Fig. 7.4) where it has strong associations with mortality, stroke, cardiac failure and coronary artery disease.

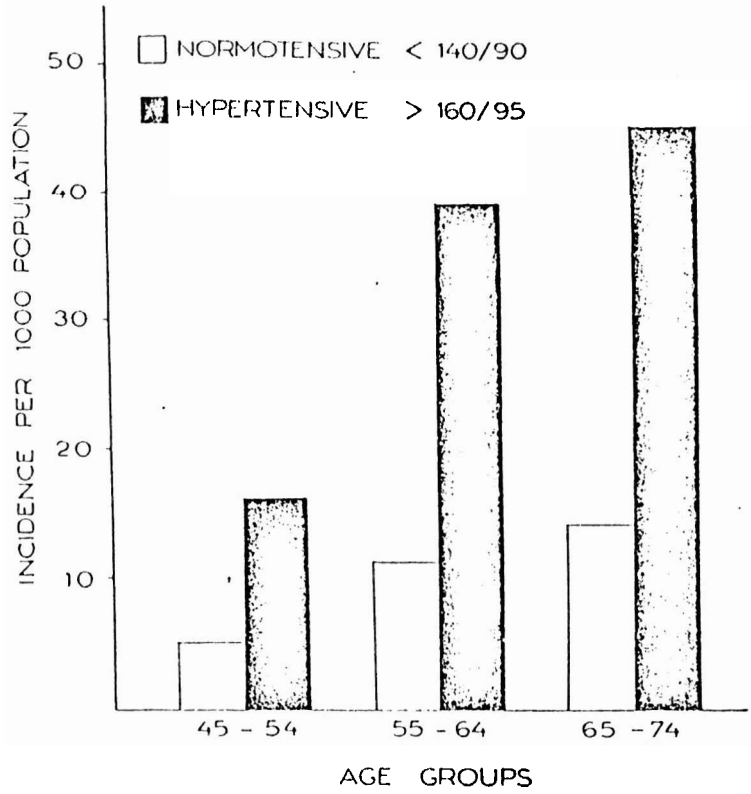

Fig. 7.4 Incidence of cardiovascular disease in relation to blood pressure and age (Kannel & Gordon, 1978).

Mortality

The risk of death and cardiovascular disease is strongly determined by blood pressure level. Life insurance statistics show a direct correlation between mortality and blood pressure. This holds for systolic and diastolic pressures separately as well as combined (Society of Actuaries, 1959, 1960). The risk associated with elevated systolic pressure is no less than that with elevated diastolic pressure, a finding which is particularly relevant to the elderly where disproportionate systolic hypertension is common (Fig. 7.5).

Stroke

Strokes account for 11 per cent of all deaths in the U.S. and 75 per cent of stroke deaths occur in the elderly. Patients aged 65–74 years have the highest incidence with a rate at least twice that of any other age group (Kannel & Gordon 1978). The incidence of cerebrovascular disease in elderly hypertensives is three times higher than that in age matched normotensives. Even when allowance is made for the

incidence of cerebrovascular disease in elderly normotensive subjects, hypertension is still the most potent risk factor for stroke and the elderly are the most vunerable. Indeed there is a stronger association between systolic blood pressure and strokes than between age and strokes.

The role of hypertension in the development of atherothrombotic brain infarction has been examined in the Framingham Study (Kannel et al 1970, 1976). Hypertension is the most potent and most common precussor of atherothrombotic brain infarction, which occurs 4 to 30 times more often in those with asymptomatic casual hypertension than in normotensives. The risk correlated well with diastolic and mean pressures but even better with systolic alone.

Congestive cardiac failure

The relationship between blood pressure, especially systolic blood pressure, and congestive cardiac failure is even stronger than that between hypertension and stroke (Kannel et al, 1972). In the Framingham Study hypertension was the dominant risk factor at all ages. In the elderly group (aged 65–74 years) cardiac failure developed almost seven times more often in those with hypertension than those with normal blood pressure. The occurence of congestive cardiac failure carried a poor prognosis, with only 5 per cent surviving 5 years. Such findings are consistent with systolic blood pressure being a major determinant of left ventricular work.

Coronary artery disease

The risk of coronary artery disease is distinctly and impressively releated to antecedent blood pressure at all ages, including the elderly (Kannel et al, 1971;

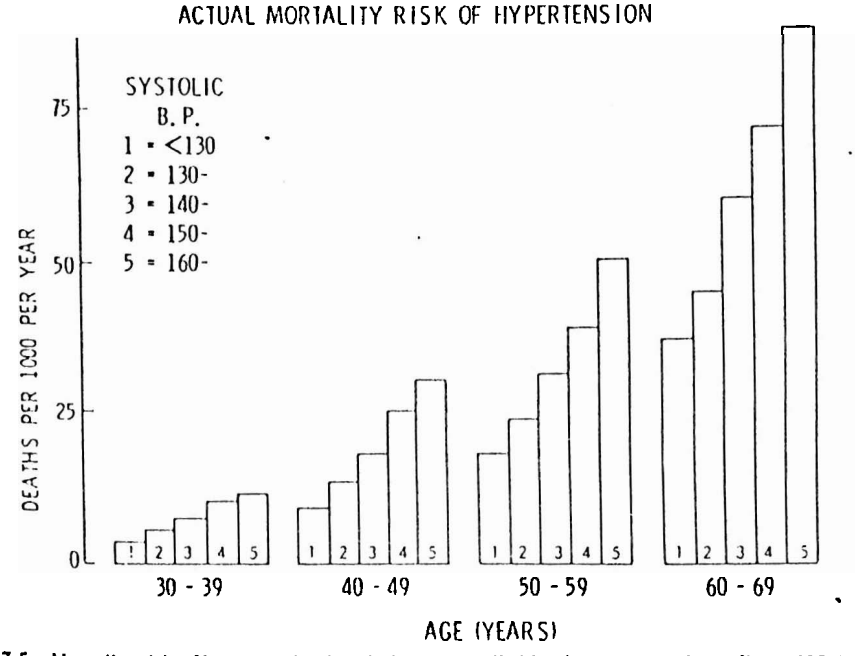

Fig. 7.5 Mortality risk of hypertension in relation to systolic blood pressure and age (Rose, 1980).

Kitchen & Milne, 1977). Prospective studies have convincingly demonstrated a substantial excess rate of development of coronary artery disease proportional to the elevation of arterial blood pressure, especially systolic pressure.

WHY TREAT HYPERTENSION IN THE ELDERLY?

It has been demonstrated that hypertension in the elderly is associated with excess risk of cardiovascular morbidity and mortality but before one can advocate the treatment of hypertension in elderly patients drug therapy must be shown to reduce blood pressure in this age group and pressure reduction must be seen to be associated with a reduction in morbidity and mortality. Many studies have been undertaken to assess the benefit of antihypertensive therapy in adults but they have not included sufficient numbers of older patients to draw definitive conclusions in regard to the elderly.

The Veterans Administration study

This study (1967, 1970, 1972) was the first large prospective study undertaken to assess the benfits of treatment of hypertension. However, it only included males and many patients had complications of hypertension and other illnesses prior to randomisation into control and treatment groups. Patients were divided into two groups; those with diastolic pressures in the range 90–114 mmHg or 115–129 mmHg. In the 90–114 mmHg group there were 81 patients (21.3 per cent) aged 60 years or over. The incidence of major complications of hypertension during the study rose with age with 48 per cent of events occuring in those over 60 years. In the untreated group 15.2 per cent under 50 years developed morbid events compared to 62.9 per cent of those over 59 years, with treatment the incidence fell to 6.9 per cent and 28.9 per cent respectively (Fig. 7.6).

When the 90–114 mmHg group was subdivided into those with diastolic pressures 90–104 mmHg and 105–114 mmHg it was found that though an improvement was seen in both groups it was only statistically significant in the 105–114 mmHg group.

In the 115–129 mmHg group treatment was beneficial at all ages. There was a high incidence of complications prior to entry in the elderly patients. The presence of previous cardiovascular disease greatly increased the risk of developing morbid events after randomisation and in the elderly this was most likely to be stroke or congestive cardiac failure whereas in the younger group malignant hypertension or progressive renal impairment was more common. Coronary artery disease occured in all age groups but was more common in the elderly.

The incidence of stroke and congestive cardiac failure was reduced by treatment but coronary artery disease did not appear to be affected. Treatment was more effective in those patients with complications on entry.

Hypertension Detection and Follow-up Program (HDFP)

The five year findings of the Hypertension Detection and Follow-up Program (1979a, b) are particularly pertinent. In this community based randomised controlled trial involving over 10 000 hypertensives, mortality figures were

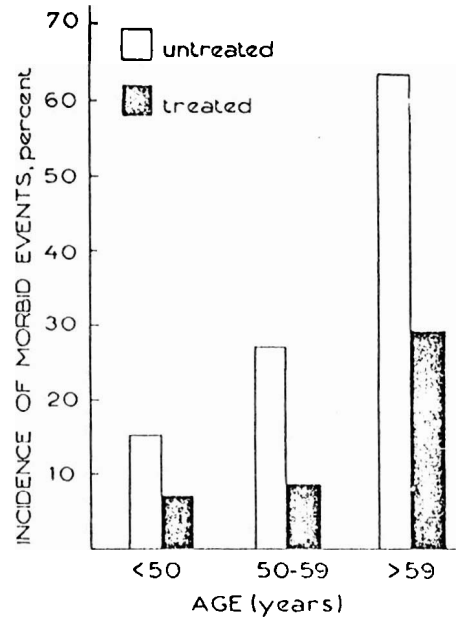

Fig. 7.6 Incidence of morbid events in relation to treatment and age (Veterans Administration Co-operative Study Group).

compared for patients allocated to a systematic antihypertensive treatment programme (stepped care) and those referred to community medical therapy (referred care). The stepped care group was offered antihypertensive therapy in special centres free of charge with a maximum effort to encourage patient compliance with the management regimen. Drug treatment was increased step-wise to achieve and maintain reduction of blood pressure at or below set goals. The referred care group were treated at their usual source of care.

There were 2376 patients aged 60–69 included in the study. In this age group there was a 16.4 per cent reduction in mortality in the stepped care group although the net difference in average diastolic blood pressure between the groups at the end of five years was a mere 5.1 mmHg.

Interpretation of the HDFP study results is difficult. This study was of differences between two health delivery systems and it is more difficult to identify the factors responsible for these differences than in treatment versus non-treatment studies. As non-cardiovascular deaths were reduced by 14 per cent in the stepped care group it is likely that there was an important contribution from better general medical care.

The European Working Party on High Blood pressure in the Elderly

On multicentre study, the European Working Part on High Blood Pressure in the Elderly (EWPHE), is currently assessing the role of antihypertensive therapy in elderly hypertensives (Amery et al, 1977). It has set out to compare morbidity and mortality in patients treated with an antihypertensive regimen consisting of a combination of thiazide diuretic and triamterene with or without alpha methyldopa

with that of a similar group treated with placebo. Though no reports of differences in mortality or morbidity have yet emerged, evidence is available regarding the antihypertensive efficacy and side effects of treatment.

A significant blood pressure difference of about 25/10 mmHg was obtained between groups and maintained during 5 years of follow-up. No major disturbance in serum potassium or sodium were noted but during the initial phase increases in serum creatinine and serum urate were noted in the actively treated group and this was maintained in later years. Drug treatment also produced a significant deterioration in glucose tolerance which persisted with treatment although clinical diabetes mellitus was rare.

The Hypertension-Stroke Co-operative Study group (1974)

The Veterans Administration study showed that the incidence of stroke in patients with high blood pressure was reduced by antihypertensive therapy. However, controversy surrounds the benefit of therapy on the incidence of stroke recurrence. The Hypertension Stroke Co-Operative study assessed the benefit of therapy in 452 hypertensive stroke survivors, almost half of whom were elderly, in a double-blind prospective study. The incidence of stroke recurrence was not altered by antihypertensive therapy but the incidence of congestive cardiac failure was reduced in the treated group.

Therefore, whereas antihypertensive therapy reduces the incidence of primary stroke in patients with high blood pressure there is less evidence of benefit in hypertensive patients who have already suffered a stroke. This most probably is because the pathological process is well established in cerebral vessels at the time of the primary stroke and such structural changes are most unlikely to resolve with treatment of hypertension.

WHOM TO TREAT

There is general agreement that, regardless of age, patients with a sustained diastolic pressure of 115 mmHg or more should receive therapy. However, in those with milder hypertension the decision is more difficult and to some degree is based on personal experience and bias. We consider carefully giving treatment to elderly patients whose blood pressure is greater than 160/100 on two occasion. We treat patients with diastolic blood pressures in the range 100–110 mmHg in the presence of complications or a systolic blood pressure greater than 180 mmHg (O'Malley & O'Brien 1980).

The elderly patient with isolated systolic hypertension presents a special problem. Though this entity has been shown to be associated with an increased risk of cardiovascular mortality and morbidity (Colandrea, 1970; Kannel et al, 1980) there is little evidence on the benefit of therapy. Indeed, effective treatment for isolated systolic hypertension may be quite difficult (Koch Weser, 1973b). Vasodilators which lower blood pressure by increasing arterial compliance (Simon et al, 1979) have shown promise but there is as yet insufficient information to make confident recommendations.

Serum uric acid also rises in patients receiving thiazide diuretics. In the EWPHE study thiazide diuretics induced a 25 per cent increase in serum urate but clinical gout was extremely rare.

Beta adrenoceptor blocking drugs

Beta adrenoceptor blocking drugs are effective antihypertensive agents in young and middle aged subjects (Simpson, 1974) but their role in treatment of hypertension in elderly subjects is not clear because little data is available on their efficacy or limitations. Many aspects of the pharmacology of beta adrenoceptor blocking drugs are different in the elderly when compared to younger subjects. The pharmacokinetics of propranolol are altered in the elderly, in whom plasma levels are higher than in younger subjects following a similar dose (Castleden & George, 1975). Distribution to tissues is slower and there is an increase in bioavailability due to diminished first pass metabolism. The incidence of side effects due to propranolol is increased in the elderly (Greenblatt & Koch-Weser, 1973). Metoprolol has the same mean plasma half-life in elderly patients as in young healthy volunteers (Lundberg & Steen, 1976) but the elderly displayed higher peak values (Kendall et al, 1977).

While these pharmacokinetic differences would suggest a potential for increased drug effect in the elderly, there is evidence of an age-related decrease in sympathetic responsiveness to beta adrenoceptor agonists and blocking drugs (Conway et al, 1971; Vestal et al, 1979; Dillon et al, 1980). Therefore it appears that on one hand plasma levels of some beta blockers are increased in the elderly but on the other that sympathetic nervous system is less responsive to their action. The degree to which these factors offset each other is not clear. In addition to these changes there is a preponderance of low renin hypertension in the elderly. This has led to speculation that beta adrenoceptor blocking drugs may be less effective in this age group (Niarchos & Laragh, 1980).

As in young patients beta adrenoceptor blocking drugs are contra-indicated in patients with bronchospasm and care should be taken when prescribing the medication for patients with chronic obstructive airways disease. The cardioselective agents such as metoprolol and atenolol are less likely to precipitate bronchospasm. Because they have a negative inotropic effect, beta adrenoceptor blockers may precipitate cardiac failure in patients who are predisposed. If cardiac failure develops while on therapy, some patients respond to diuretic therapy but in most cases it is best to discontinue beta adrenoceptor blocking drugs.

Beta adrenoceptor blockade may further impair peripheral perfusion in patients with peripheral vascular disease and is thus contra-indicated in patients with severe or worsening claudication. Any deterioration in mild claudication while on therapy warrants discontinuation.

Beta adrenoceptor blockers cause sinus bradycardia and care must be taken if patients with initially slow rates are commenced on therapy. Severe bradycardia is less likely with oxprenolol or pindolol, which have intrinsic sympathomimetic activity (Kirkendall, 1980).

Vasodilators

Thiazide diuretics and beta adrenoceptor blocking drugs are considered the first

line drugs in the treatment of hypertension. If a combination of these agents does not produce reasonable blood pressure control, the addition of a vasodilator must be considered. Hydrallazine acts on arteriolar smooth muscle producing vasodilation with consequent reduction of peripheral vascular resistance, but the hypertensive effect is at least partially counteracted by an increase in cardiac output and sodium retention (Kirkendall, 1980). When first administered, hydrallazine may produce headache and flushing, particularly when high doses are employed. Zacest et al (1972) observed that about 25 per cent of hypertensive patients developed angina, severe headache or palpitation when hydralazine was added to maintenance diuretic therapy in the absence of a sympatholytic agent.

However, the elderly may not respond to vasodilatation with so large an increase in heart rate as younger subjects because of decreased baroreflex response. McGarry et al (1981) has observed a diminished reflex tachycardia in response to nitroprusside in elderly patients (Table 7.1), because of poor baroreflex function. Perhaps other orally effective vasodilators may be effective in the treatment of hypertension in the elderly when administered alone.

Nitroprusside increases arterial compliance and thereby reduces systolic pressure in patients with systolic hypertension over the age of 35 years (Simon et al, 1979). Vasodilators with similar actions when administered orally, hold promise for the treatment of systolic hypertension in the elderly.

Table 7.1 Heart rate response to 20 per cent reduction in mean arterial pressure with nitroprusside in young and elderly hypertensive patients (McGarry et al, 1981)

	Baseline heart rate (beats/min)	Increase (beats/min)
Young hypertensives	87.8 ± 1.4	13.0 ± 2.2
Elderly hypertensives	76.1 ± 4.0	8.1 ± 2.1

Values are mean ± SEM

Centrally acting antihypertensive drugs

Alpha methyldopa and clonidine act centrally to reduce blood pressure. They primarily stimulate alpha$_2$ adrenoceptors in the brain stem vasomotor centre which inhibit sympathetic outflow, thus reducing systemic arterial pressure. Ramsay (1981) prefers to avoid these agents in the elderly because of their central nervous system effects, such as drowsiness and depression, which can be insidious and debilitating. Such adverse effects required the withdrawal of treatment in a quarter of patients, though the elderly did not appear more prone to adverse effects than younger patients.

SUMMARY

Hypertension in the elderly is the major risk factor for cardiovascular and cerebrovascular disease which account for half the deaths in this age group. The number of elderly patients in western countries is increasing and therefore

hypertension in the elderly shall assume increasing importance in terms of overall health care in the future.

Population studies show that blood pressure rises with advancing age. Diastolic blood pressure rises until the fifth decade after which it levels off. On the other hand systolic blood pressure increases until the seventh decade after which it declines. However, the lower pressures at the highest extreme of age may merely reflect greater longevity in patients with lower pressures. The tendency towards increased systolic blood pressure with advancing age can be explained by the age related decrease in aortic compliance due to stiffening of arterial walls. In addition to this it has been suggested that stiffened peripheral arteries may lead to overestimation of indirect blood pressure in the elderly — so called 'pseudohypertension'. However, despite a physiological basis for increased systolic blood pressure in the aged there is no lessening of the risks of hypertension in this age group. Blood pressure is the major risk factor for stroke, cardiac failure and coronary artery disease at all ages but particularly so in the elderly.

Before one can advocate drug treatment of hypertension in the elderly one must prove that such therapy can effectively reduce blood pressure and that such a reduction improves prognosis. This has been proven in cases of severe hypertension but results are less clear for mild to moderate hypertension. Reviews of available data suggests that treatment is beneficial.

Thiazide diuretics are effective antihypertensive agents in the elderly, though they may cause biochemical changes. Beta adrenoceptor blocking drugs are also effective, though theoretical considerations would suggest that they may be less effective in the elderly than in younger subjects. Little evidence is available on the efficacy of vasodilators in the elderly. Though effective, we tend to avoid the use of centrally acting agents such as alpha methyldopa because of central side effects such as drowsiness and depression.

We carefully consider drug therapy in elderly patients with repeated blood pressure recordings in excess of 160/100. We recommend a thiazide diuretic or beta adrenoceptor blocking drug as first line therapy provided no contraindications exist. If single drug treatment does not afford adequate blood pressure control, these drugs may be combined. Hypertension resistant to this combination may respond to the addition of a vasodilator.

Many aspects of hypertension in the elderly demand further investigation, particularly the efficacy of certain drug regimens for the treatment of systolic hypertension which is found particularly in the elderly. We advocate a policy of cautious intervention in high blood pressure in the elderly in the hope that this will attenuate the associated morbidity and mortality.

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