CHAPTER 20 - HYPERTENTION I II & III

CONCEPTS IN HYPERTENSION

Hypertension is an area of my specific interest, so I add this chapter for what it is worth.

Concept:
Hypertension should now largely to be seen as a risk factor for large vessel atheroma and/or superimposed thrombosis. This has two important consequences. First, hypertension should only be seen in the context of other atheroma risk factors such as the oral contraceptive pill, hypercholesterolaemia, diabetes, cigarette smoking, stress, etc. Second, in treating hypertension we are doing to prevent large vessel disease such as strokes, heart attacks, claudication etc. Actually, to me recent findings have raised a fundamental question which will also eventually have to be addressed. It is this: in view of the emerging evidence that the reversal of hypertension by drug treatment is associated with only a reduction of stroke by less than one half, and heart attacks by less than one quarter, when we treat high blood pressure are we aiming at a more fundamental problem of the increased 'cardiovascular drive,' or are we merely treating what we can best measure, blood pressure? For the moment this provocative question is merely rhetorical, but it is one which may become increasingly important in future.

ESSENTIAL HYPERTENSION

Definition
                140/90 mmHg is a maximum acceptable B.P in normals; 130/80 in diabetics
Diastolic is now defined as the disappearance (Phase V) of auscultatory sounds during blood pressure measurement. Casual readings are usually taken as being valid, but particularly in mild hypertension, (diastolic 90-100 mm Hg.) observe blood pressure for a period of weeks or months to see how it averages out. Where you suspect that coming to your surgery may have an effect on blood pressure ('white coat effect') thave the patient to measure home or pharmacy blood pressure readings; good automated B.P machines are now widely available. Take blood pressure with the arm at heart level. Use the broad cuff in obese patients. Always centre the rubber part of the cuff over the brachial artery.

Pseudo-hypertension should be thought of in the elderly. This occurs where the arterial wall has been thickened by arteriosclerosis in long-standing hypertension, thus becoming difficult to compress with the sphygmomanometer cuff. One clue can be an unusually high pulse pressure. Another is when the measured blood pressure seems high in the face symptoms of postural dizziness. The hypertension is usually of systolic type, with a low diastolic BP. Osler's manoeuvre may also help in some cases. This is done by occluding the radial artery (proximally) at the wrist with firm finger pressure, and then palpating the artery immediately distal. Normally the arterial wall cannot be felt in this situation, but in

pseudohypertension it is typically readily palpable. Pseudo-hypertension is important, and often missed in the elderly. If in doubt, don't treat before getting an echocardiograph - absence of LVH is the clue. Anti-hypertensives can cause significant postrual dizziness and is counterproductive.

Essential Hypertension

This is what we find in 90-95% of clinical cases. The clue to essential hypertension is a positive family history in the absence of any evidence of secondary cause on physical examination. Indeed, in mild hypertension this is sufficient for a working diagnosis.

Pathophysiology

We do not yet understand this fully, but some aspects are becoming clearer. First, most studies have now shown increased sympathetic drive, at least in the early stages. Later on this becomes more difficult to detect, but secondary changes may account for this (see below). Haemodynamically, essential hypertension in the teens and twenties is usually mild and labile, and this phase is associated with an increased cardiac output rather than peripheral resistance. Towards middle age, we see hypertension more 'fixed' BP elevations, and with a completely different haemodynamic pattern, viz. high peripheral resistance and a normal or even reduced cardiac output. Because of this, it was once thought unlikely that labile hypertension of youth was probably not related to the established essential hypertension of middle age, but young subjects with labile hypertensives over the many years do actually go on to develop 'fixed' hypertension. Moreover, in doing so, they convert from the early high cardiac pattern to a later high peripherial resistance pattern.

A clue about the pathogenesis of hypertension (and its changing haemodynamics) may come from the observation that many forms of clinical and experimental hypertension which start out being due to some obvious cause such as renal artery stenosis, finish up by being relatively fixed and independent of the initiating cause, i.e. maintained even when the stimulus is withdrawn, e.g. correction of the renal artery stenosis. This probably also holds for essential hypertension. There, in the early years, the elevated sympathetic drive seems the likely initiator of the hypertension.

Folkow's work has helped us understand possible mechanisms whereby initiating stimuli for hypertension may become obscured in the later phases. Hypertension from any cause leads to secondary structural arteriolar resistance changes which tend to perpetuate the hypertension. Folkow pointed out that this could be caused by an increase in smooth muscle cell bulk in the arteriolar wall leading to increased vascular reactivity merely from a geometric change in the wall:lumen area ratio so as to increase arteriolar resistance. This hypertrophy of medial smooth muscle, together with the elaboration of other ground substance and connective tissue within the media, intima and adventitia (? from haemodynamic damage) tends to grow in such a way as to encroach on the lumen thus narrowing it even in its basal state, thereby increasing basal peripheral resistance. As hypertension progresses, these changes 'remodel' the arteriole, and become less reversible. Correspondingly, I have suggested, the arteriolar changes become more pathlogical than physiological, and hence

eventually quite inappropriate to the level of blood pressure originally set by the initiating stimulus. And if feedback mechanisms remain intact, this might well suppress that initiating stimulus itself, e.g. sympathetic nervous activity (including the initially increasing cardiac output).

So perhaps this is why we can't find any evidence of increased sympathetic activity (or cardiac output) in the chronic phase of essential hypertension in man - it becomes totally suppressed.

In my view, the factor likely to be driving the increased sympathetic activity in essential hypertension in our 'advanced' societies is psychological stress, though of course this is controversial.

Another important factor not to be neglected is a genetic predisposition to essential hypertension, because a family history of high blood pressure is common in this condition. This may represent a genetic predisposition to react to any stress more by increased cardiovascular drive than than by other organ aspects of sympathetic outflow.

On the other hand, many believe that sodium retention is important in essential hypertension. Perhaps it is, and maybe the increased renal sympathetic drive decreases renal blood flow and GFR, and increases tubular reabsorption of sodium, and thus helps promote such Na+ retention. This retained Na+ can then sensitise the blood vessels to the sympathetic drtive, and so combine to aggravate the hypertension.

Clinical Essential Hypertension.

Usually found on routine examination; otherwise mild to moderate hypertension is symptomless until it strikes in the forms of angina, heart attacks, stroke or other secondary arterial (atheromatous) vascular complications. Of course, it has sequelae such as left ventricular hypertrophy and renal impairment. But rarely do we see moderate hypertension (e.g. diastolic up to 120 mm Hg.) leading to severe heart failure or renal impairment. One important corollary of this is if you see the combination of renal failure and moderate hypertension, think of the renal disease as being a possible cause of the hypertension rather than vice versa.

Severe or Malignant Hypertension.

Now relatively rare. B. P. > 230/130 mm Hg. May present with symptoms. Headache is one, the classical presentation being that of waking with severe headache usually with an occipital component, and gradual clearing during the day. There may also be symptoms of hypokalaemia including numbness, tingling, polyuria etc., because in malignant hypertension there is a pressure natriuresis leading to renal sodium loss, and therefore secondary hyperaldosteronism with a reduction of plasma K+. With very severe hypertension, focal neurological manifestations, papilloedema, confusion and even fitting may occur, i.e. hypertensive encephalopathy. Untreated malignant hypertension has a grave prognosis.

SECONDARY HYPERTENSION.

This makes up about 5% of hypertension. Remember especially the reversible secondary causes of hypertension, such as unilateral renal arterty stenosis.

Diagnosis depends on having a high index of suspicion. In this regard, be particularly suspicious in the following circumstances: young patient; no family history of hypertension; severe hypertension; &/ or hypertension poorly controlled by drug therapy.

1. Adrenal Causes.

a). Adrenocortical steroid causes.

(i) Cushing's Syndrome - increased plasma cortisol. Suspicions usually alerted clinically by moon face etc. Then establish presence by lack of diurnal rhythm of plasma cortisol and then anatomy by C.T. scan and further studies of pituitary - adrenal axis function.

(ii) Primary hyperaldosteronism.

Conn's syndrome is the classic case (aldosterone producing adrenocortical ademoma), but there are an increasing number of sub-types in this category, including bilateral adrenal cortical hyperplasia/ adenomata, various forms of glucocorticoid-suppressible primary hyperaldosteronism, as well as other syndromes including 'apparent mineralocorticoid excess' - see Ch. 17.

Conn's Syndrome - the classic clue is still persistent hypokalaemia, but must have patients off diuretics (which lower plasma K+) as well as angiotensin converting enzyme inhibitors (which increase it), before this can be assessed. You should always do urea, electrolytes, creatinine etc. on your patient at first visit, before starting any treatment. Stowasser and Gordonh have highlighted the fact that many patients with Conn syndrome have normal plasma K+. so, in any suspicious case, plasma aldo: renin ratio clinches the diagnosis. Localise adenoma by CT scan and catheterisation of the adrenals for aldosterone: cortisol levels. Unilateral adenomata are amenable to surgery; cases due to bilateral adrenal hyperplasia can be corrected with spironolactone.

See Chapter 17 on K+ for further discussion on diagnosis of primary hyperaldosteronism.

b). Adrenal medullary causes.

Phaeochromocytoma. Typically, labile or intermittent hypertension. Free 24 hour urine catecholamines, and if necessary plasma metanephrines, may give the diagnosis. But these tests

may be normal in between attacks, so if in doubt repeat or even use provocation tests. CT scanning, and nuclear medicine scanning with MIBG (methyl-iodo-benzyl guanidine) can be useful in localisation. Adrenal phaeochromocytomas may secrete adrenaline, dopamine, noradrenaline and other catecholamines, but those arising elsewhere, e.g. in the paravertebral sympathetic chain, only secrete noradrenaline.

2. Other Steroid Causes (particularly the contraceptive pill).

The oral contraceptive pill may precipitate or aggravate hypertension in those so predisposed (ask about family history). Best is partner vascetomy, but if not acceptable, change from low dose oestrogen pill to progesterone only pill will decrease cardiovascular risk.

3. Vascular Causes

a). <u>Renal Causes.</u> We are particularly looking for reversible causes, and therefore mostly for unilateral renal disease which can be cured surgically. However, there are at least some forms of bilateral renal disease that arrestable if not reversible, when the causative agent is removed, and these include gout, hypercalcaemia, vesico-ureteric reflux causing pyelonephritis, tuberculosis. Think of an underlying renal cause when there is any significant renal impairment associated with mild to moderate hypertension.

In trying to separate unilateral from bilateral renal disease, a good guideline is that if the plasma creatinine (reflecting glomerular filtration) is elevated more than two fold, the patient has lost at least 50% of renal function, i.e. there is more than unilateral disease

<u>Unilateral Renal Disease</u>

Most important is renal artery stenosis. The clue is a relatively young patient, lack of family history of hypertension, moderately severe hypertension and/or hypertension difficult to control. On examination there is typically a long, loud, high pitched epigastric bruit which has not only a systolic but a diastolic component. A bruit of such nature in young people is a very good indicator of renal artery stenosis, though in older patients coeliac and mesenteric artery atheromatous narrowings can cause confusion. Ultrasound will typically show a small kidney on the affected side. Comparison of left vs. right renal vein vs peripheral venous renins is also valuable; if greater than 2.0 the stenosis is almost certainly functionally significant and will benefit from surgical intervention. If less than 1.6, improvement is much less likely, but the ground in between is difficult so decision must be made in combination with other factors.

A special difficulty with the renal artery stenosis is when there are bilateral stenoses, or branch stenosis; then renal scans, renal vein renins etc. may not be helpful at all. Therefore it is important to listen hard for bruits and to investigate by angiography any patients who are relatively young, have moderately severe hypertension, no family history, and/or poorly controlled hypertension, whatever

the results of less invasive investigations. Monitor plasma creatinine when treating severe hypertension, particularly with angiotensin converting inhibitors, because an undue rise is can be the clue to important underlying bilateral renal artery stenosis.

b). Coarctation of the aorta. Remember to feel the femoral pulses!

4. Cerebral Causes of Hypertension

Not often seen in the chronic state, but acute rise in intracerebral pressure is usually associated with hypertension, partly reflexly, because if the intracranial pressure rises, then the blood pressure must rise to ensure brain may perfusion. Therefore, be very cautious about lowering mild to moderate elevations of blood pressure in acute intracranial problems, or you may stop cerebral blood flow and kill the patient. On the other hand, acute severe hypertension of other cause can lead to ischaemic brain damage (hypertensive encephalopathy) and in such cases blood pressure must be lowered as a matter of urgency. Therefore, admit any such patients to the intensive care unit and monitor both blood pressure but intracerebral pressure. As a corollary, when treating severe hypertension associated with head injury and cerebral oedema try and pick an agent which does not dilate the cerebral arterioles, because this may aggravate the problem by worsening the cerebral oedema. In this respect, brain arterioles are well supplied with sympathetic nerves, so that sympathetic blockade, particularly by centrally acting drugs like alpha methy-ldopa, can at least theoretically reduce sympathetic activity and blood pressure without causing this problem.

HYPERTENSION II : CLINICAL ASPECTS AND INVESTIGATION APPROACH TO THE INDIVIDUAL PATIENT

The general clinical approach is the following:

1. What is the severity of hypertension? If mild, observe for months before giving final judgement. Home BP measurements to get a mean if uncertain whether clinic readings are representative. Also other problems of obesity, 'white coat' hypertension (Clinic BPs > home BPs), pseudo-hypertension, discussed above.

2. What is the cause of the hypertension? Include a search for aggravating factors, e.g. obesity, alcohol, high salt intake, stress, etc.

3. What are the effects of the hypertension on this patient? E.g. secondary LVH, retinal vascular changes, secondary large vessel complications (e.g. angina); foot pulses

4. Since hypertension is to be viewed largely as a risk factor for large vessel disease what are the other risk factors for atherosclerosis?

More specifically we look as follows:

History: Look for evidence of secondary hypertension. Patients without a positive family history are unlikely to have essential hypertension, but the reverse does not hold, i.e. patients with a positive family history may have a secondary cause for hypertension; indeed patients with a family history of hypertension are more likely to react by developing hypertension at any given level of, say, renal disease. Look for evidence of headache, thirst, polyuria in severe hypertension, ask about secondary functional effects, such as angina, claudication, shortness of breath, (left heart failure) and visual impairment.

In the background ask about stress factors which can be important both to hypertension and some of its vascular complications e.g. myocardial infarction. Also ask about other atherosclerosis risk factors such as smoking, diabetes, oral contraceptive therapy, hypercholesterolaemia, etc.

Examination: Look for a cause (radio-femoral delay in coarctation; loud, long, high pitched bruit in epigastrium or loins in renal artery stenosis; steroid causes, etc.). Look for evidence of the effects of the hypertension in *this* particular patient, especially any evidence of left ventricular hypertrophy and overload such as thrusting LV apex, loud A2, soft S4. Examine pulses. Examine optic fundi and look particularly hard at the retinal arterioles and AV crossings. Special hallmarks of hypertension are an increased retinal arteriolar light reflex, narrowing of retinal arterioles, and an irregularity of their lumen calibre, seen well as you look along them. Also, short of complete AV nipping, kinkings and irregularity of veins at AV crossings are important. Grade 1 changes (arteriolar changes only) and Grade 2 (AV nipping in addition) are seen in moderately severe hypertension; rarely we see Grade 3 (blot, dot, and/or flamed-shaped haemorrhages, as well as soft "cotton wool" exudates - microinfarcts). Grade 4 - papilloedema in severe and malignant hypertension. Even moderate hypertension in combination with diabetes is especially damaging to blood vessels.

Investigations: Sometimes indicated by clinical clues to cause, e.g. moon face in Cushing's syndrome, intermittent hypertension suggesting phaeo etc. Routinely, when there is mild hypertension, only a few simple noninvasive investigations are needed - unless otherwise indicated clinically by patient's age, (being young), lack of family history, severe hypertension and/or blood pressure difficult to control.

Other investigations include urea, electrolytes (particularly plasma potassium if suspect Conn's syndrome) and creatinine (if twice normal then bilateral renal impairment is present). Urine examination to investigate for renal disease should include microscopy and, if red cells present, phase contrast microscopy to look for red cells of glomerular origin. If proteinuria, quantify, analyse type, and perform renal biopsy if persistant at > 1 g/l

Look for the presence of <u>secondary effects of hypertension</u>, particularly in moderate to severe hypertension e.g. ECG evidence of ischaemia, and ECG/Echocardiographic of left ventricular hypertrophy.

If suspect renal artery stenosis, renal vein renin ratios. But if all these are negative and you are still suspicious e.g. young patient, severe hypertension, no family history, then do renal angiography (the patient may have bilateral renal artery stenosis or stenosis in a branch to one kidney).

Finally, investigate the <u>other risk factors for (atherosclerotic) vascular disease</u>, i.e. fasting serum lipids (particularly LDL cholesterol), glucose.

HYPERTENSION III

Hypertension Management

First define the cause as far as is possible, look for any effects of the hypertension, and establish other risk factors for other vessel disease independent of hypertension, e.g. cigarette smoking, high LDL cholesterol.

"Risk Factor" concept. Don't confuse predisposing "risk factors" for large vessel atheroma (this is the way we use the term) with predisposing factors to the hypertension itself. This can be confusing, since whilst some risk factors for atheroma are entirely independent of hypertension, others are partly dependent on it. For example, hypercholesterolaemia is entirely independent of hypertension as an atheroma risk factor, but the oral contraceptive pill predisposes not only to hypertension, but also independently to vascular disease (particularly arterial thrombosis through its oestrogen component). Also bear in mind that atheroma is not the sole factor involved in acute clinical vascular events complicating hypertension such as acute myocardial infarction. There, for obscure reasons, the atherosclerotic plaque becomes 'unstable' or 'complicated', often showing evidence of damage, haemorrhage etc., with superimposed thrombosis, even to the extent of arterial occlusion - and correspondingly dire consequences.

General Points

In secondary hypertension, the shorter the duration of hypertension, the more likely you are to get a cure by removing the original cause (because hypertension begets chronic structural arteriolar change and eventually the arteriolar narrowing becomes "fixed"). This is probably why we have much more success with surgical or transluminal angioplasty correction of renal artery stenosis in young patients (with fibromuscular dysplasia) than in older ones (usually with atheromatous narrowing and more long standing hypertension).

Approach to Management

In general, if hypertension mild, (diastolic 90-100 mm. Hg.), first repeat on at least two further occasions four weeks apart. If diastolic drops below 90 mm.Hg., further measurements at 3 month intervals for a year. If diastolic BP 90-100 mm.Hg, and no associated risk factors for atheroma, institute non-drug treatment and monitor BP.

B.P. >150/100. Treat diastolic BP persistently over 100. Above 50 years of age, take note of the systolic B.P. as well, and treat persistent elevation of <u>systolic BP above 150</u> even if diasolic below 90, provided you have excluded a 'white coat effect', and pseudo-hypertension (especially in elderly)

<u>B.P. < 150/100</u>. Follow over the next 6 months. At the end of that time:

<u>Diastolic BP 90-95 and no other cardiovascular "risk factors"</u>, continue non-drug treatment and monitor BP.

Attention to life style factors impinging on hypertension and other risk factors - overweight, glucose intolerance, cigarette smoking, dietary cholesterol lowering, exercise, alcohol etc

<u>Diastolic BP > 95 mm.Hg. without other risk factors</u> consider drug treatment.

<u>Diastolic > 95 mm.Hg</u>. with other risk factors, start drug treatment.

Treatment aim: to get B.P. below 140/90, below 130/80 in diabetes.

<u>Non-drug treatmen</u>t first - this includes reduced salt intake if high, relaxation/meditation if stress present, weight reduction in the obese, alcohol reduction where intake high, and exercise where the patient is unfit. Also, aim to modify the other large vessel (atheroma) risk factors of cigarette smoking, high LDL cholesterol, diabetes, oral contraceptive therapy. This gives you time to see where B.P. is going to level out. If BP consistently raised, drug treatment is indicated.

<u>Patient Adherence</u> to therapy. To get this, you must explain in simple terms what the general problem is, and how you are going about treating it. Broadly discuss along the following lines.

"The drugs we have available for treatment act in several different ways. First, the so-called <u>beta-blockers,</u> which reduce the pumping action of the heart to lower blood pressure. Second are the<u>inhibitors of the renin-angiotension system</u> of the kidney, a powerful system for maintaining the tone of blood vessels in the circulation. Third are the so-called <u>vasodilators</u> which open up the small (resistance) blood vessels in the various tissues and to allow the blood to flow them at lower pressure. Finally, there are drugs which lower salt and reduce the amount of blood within the circulation (<u>diuretics</u>). All of these drugs may be used alone but are often needed in combination.

They occasionally cause side-effects and you must tell me if you notice any change in any aspect of your well-being - including any change in sexual potency".

DRUG THERAPY

1. Diuretics

Thiazides normally first line treatment over 50 years of age. Use in lowest effective in low dose to avoid hypokalaemia. Particularly useful in combination with the blockers of the renin-angiotension system, which tend to increase plasma K+.

Note that low thiazide dosage has the important consequence that if plasma K+ does fall to below normal, then think again of Conn's syndrome.

Diuretics reduce circulating plasma volume to some extent, but also act by having a mild effect to dilate peripheral arterioles; this also enhances the effect of other more direct arteriolar vasodilators.

2. Beta-blockers. First line treatment in the young, particularly if obviously stressed with a high heart rate. We usually choose one of the more cardioselective (beta-1) blockers, e.g. atenolol or metoprolol. Beta-blockade is contra-indicated in asthma and intermittent claudication, and relatively contra-indicated in Raynaud's syndrome and diabetes (beta-2, and to a lesser extent beta-1, blockers tend to mask hypoglycaemic symptoms). Also, avoid beta blockers in patients who play strenuous competitive sport.

Thus with mild to moderate hypertension, we usually start with a diuretic in the over 50 age group, and a beta blocker less than 50 years.

3. Renin-Angiotensin system bolckade. Includes the converting enzyme inhibitors (ACEI such as enalapril ramapril) and the angiotensin receptor blockers (ARBs - irbesarten, telmisartan, valsartan, etc). The ACEI drugs may cause cough, so ask about this; if present, switch to an ARB. Use these drugs with caution in patients with impaired renal function; monitor creatinine, and if it rises, think again about renal artery stenosis. ACE inhibitors also increase plasma potassium (by lowering plasma angiotensin and therefore aldosterone); therefore monitor plamsa K+, again especially in patients with renal impairment. Because of this effect on K+, these drtugs are often used in combination with thiazide diuretics.

4. Vasodilators

(i). <u>Calcium channel blockers</u>. The most potent are the <u>dihydropyridine</u> calcium channel blockers e.g. felodipine, nifedipine amlodipine, lercandipine. These are powerful vasodilators, and are now preferred over the older drugs such as prazosin, methyl dopa and clonidine described below. As always with drug treatment, start low and go slow. Side effects include flushing, ankle oedema. Avoid in early pregnancy.

(ii) <u>Hydrallazine</u> is an old drug which fell into disfavour because of its erratic absorption and the side effects of palpitations and headache. To some extent these can now be overcome by the concurrent use of beta-blockers, so occasionally hydrallazine is added when all else is failing. However, one rare side effect of hydrallazine therapy long term is serious, viz. systemic lupus erythaematosis (SLE), so now rarely used except in an emergency, and in pregnancy

5. Alpha-adrenergic blockers.

(i). <u>Prazosin</u> is an alpha 1 adrenergic post-junctional antagonist for the nor-adrenergic receptor on the vascular smooth muscle. Because it is a sympatholytic agent, it commonly interferes with the baroceptor control of BP and may therefore result in postural hypotension, particularly in the elderly. Therefore, if you use it, take BP in upright as well as recumbent position.

(ii). <u>Centrally acting alpha adrenergic agents</u>. If the third line vasodilator therapy has not worked, then the centrally acting adrenergic agonists may be added. These include methyldopa, clonidine and the newer moxonidine. Unfortunately, these compounds often have side effects including dry mouth and lethargy.

Note: With some anti-hypertensives, aim at no more than a twice daily drug regime; otherwise adherence to treatment becomes a real problem.

Hypertension and angina

The calcium antagonists can be effective in this situation. Nifedipine, felodipine, amlodipine, diltiazem and verapamil can all be tried because they act to dilate both the coronary arteries and the peripheral arterioles to improve angina (particularly unstable angina) and lower blood pressure. The first three are powerful vasodilators, and do not have the marked reflex sympathetic effects (tachycardia etc.) of earlier vasodilators, particularly when given in slow-release formulation.

Combination Therapy

This is often necessary in treating hypertension. The reason probably is that the blood pressure eventually becomes "reset" at the new high level, so that when it is lowered by blocking one particular mechanism others may become activated to take up the balance. Thus, diuretics will lead to renin release and beta blockers especially (beta 1 blockers) are useful in preventing this, so that is one

good combination. Also with vasodilators, the increased pressure in the capillary from arteriolar dilatation tends to lead to oedema, and combination with diuretics can be helpful.

Hypertensive Crises

If high blood pressure very high, e.g. greater than 130 mm Hg diastolic, it needs urgent lowering, and for this purpose any of the following drugs can be used:

1. Nifedipine. 10 mg (non-slow release), swallowed or dissolved under the tongue, is rapidly effective in "taking the top off" the blood pressure (e.g. down to levels of < 120 mm Hg diastolic). This is all you usually need to do initially in an acute crisis, because plunging blood pressure right back to normal may compromise organ blood flow to any vascular bed with already established structural arteriolar narrowing or, at the larger artery level, with significant focal atheromatous narrowings. Serious consequences may especially arise in the brain which is so very sensitive to even transient ischaemia. Certainly, bringing blood pressure rapidly back to normal levels in the elderly is well recognised to cause problems as serious as stroke and blindness. Subendocardial myocardial infarction (non-STEMI) is also a risk. So getting the diastolic blood pressure down to levels of approx. 120 mm Hg diastolic is all that is usually required in the first few hours, particularly where 'accelerated' severe hypertension has arisen on a background of pre-existing moderately severe hypertension. Fine tuning of BP further back towards normal then can be done over time.

A golden rule: Give parenteral antihypertensive therapy if there is a real clinical emergency e.g. symptomtic patient with hypertensive encephalopathy, fitting, severe hypertension, left heart failure, eclampsia.

2. Sublingual captopril (25 mg) may also be effective in hypertensive emergencies, producing a BP fall within a few minutes and a continuing effect for a few hours.

3. Diazoxide can be given as a 75 mg IV bolus; wait for five minutes, if no effect repeat after 20 minutes, then at 1-4 hourly intervals, as required. Severe hypotension is a recognised side effect, so go carefully if you use this.

4. Hydrallazine 5-10 mg I.V. stat., then 2-20 mg hourly as an infusion, or 5 mg boluses every 20 minutes can be very useful. However, onset and duration of action are unpredictable, so this is no longer first line treatment (except in pregnancy hypertension - see below). If used, I.V. beta-blockers can help, as outlined above. Oral atenolol is also fairly rapidly active. I.V. frusemide can also be oa valuable addition.

5. Nitroprusside I.V. is very useful in severe hypertension resisitant to the above approaches.

Hypertension in Pregnancy. For mild hypertension of pregnancy the safest drug we know is alpha methyldopa. Beta blockers are probably also safe. Diuretics are probably best avoided in pre-

eclampsia. For severe hypertension occurring suddenly in pregnancy (usually late), I.V. hydrallazine is usually the best first approach, having been long used and found not to interfere with mother or foetus.

Be particularly careful about abrupt lowering of blood pressure in pregnancy (especially late) unless the patient has symptoms (e.g. eclampsia or severe pre-eclampsia); otherwise placental blood flow, and with it foetal viability, may be compromised. Calcium channel blockers should be avoided early in pregnancy (teratrogenic), and angiotensin converting enzyme inhibitors late in pregnancy (they give both foetal and maternal problems). Calcium channel blockers such as nifedipine are generally acceptible in late pregnancy, although they may inhibit uterine contraction, and therefore labour.

Summary

Hypertension should be regarded as one among a number of risk factors for large vessel (atheromatous) disease and the patient should understand that. They should also understand that attacking all aspects of hypertension and other risk factors is a combined job to be done by doctor and patient together.

The patient must understand the importance of always keeping a check on blood pressure (prefer home B.P.s) - even if some doctor subsequently takes them off therapy. They must never be led to believe that their blood pressure has been 'cured'. Essential hypertension never is, and even though we sometimes see blood pressure staying down for months after stopping therapy (probably due to partial reversal of structural arteriolar change with therapy over time), it usually does gradually pick up over the subsequent months, so the patient must not be led into any false sense of security.

Finally, always be on the lookout for side effects (especially impotence which patients often do not tell you about). Again, particularly in a condition which does not cause symptoms, our principle must be:

First do no harm.