Five steps in the management of high blood pressure

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Check up for high blood pressure (HBP) is one of the most common encounters in general practice. The prevalence of hypertension increases with advancing age to the point where over half of the people 60-69 year of age and about three-fourths of those over 70 years of age are affected. The primary goal of treating patients with HBP is to prevent complications and reduce the long-term total risk of cardiovascular morbidity and mortality. This requires treatment of all the reversible risk factors identified (smoking, dyslipidaemia or diabetes) and the appropriate management of associated clinical conditions, besides treatment of the raised BP per se.

During the last few years numerous international guidelines on the management of hypertension have been proposed in an effort to improve our approach in managing HBP [1-6]. But these guidelines do not agree amongst themselves as they cater for different populations and give different importance to different studies. This article is an attempt to look at these guidelines and try to adapt them to the local scene in five simple steps.

Step 1: Blood Pressure Measurement

Historically more emphasis has been placed on diastolic (DBP) than systolic blood pressure (SBP) as a predictor of cerebrovascular and cardiovascular disease. Nevertheless, observational studies [7,8] confirm a direct and independent relationship between SBP and DBP and risk of end organ damage. Of importance is the fact that SBP rises throughout the adult age range whereas DBP peaks at about age 60 years in men and 70 years in women, and falls gradually thereafter [9,10]. This fact identifies elderly patients with isolated systolic hypertension as being at particularly high risk. Thus, contrary to what was previously thought, SBP is considered by many to be a better predicator than DBP of cardiovascular disease. In practice, both SBP and DBP should continue to be used for the purposes of definition and classification (Tables 1and 2), risk assessment, and guidance of treatment thresholds of hypertension (Table 4).

BP is characterized by large variations both within and between days. Therefore, the diagnosis of hypertension should be based on multiple BP measurements, taken on separate occasions. If BP is only slightly elevated, repeated measurements should be obtained over several months. If a patient has a more marked BP elevation, evidence of hypertension-related organ damage or a high cardiovascular risk profile, repeated measurements should be obtained over shorter periods of time, such as weeks or days.

BP can be measured by the doctor or by the nurse in the clinic, by the patient at home, or automatically over a 24 hour period.

Category	Systolic	Diastolic
Optimal	<120	<80
Normal	120–129	80–84
High normal	130–139	85–89
Mild hypertension Grade 1	140–159	90–99
Moderate hypertension Grade 2	160–179	100–109
Severe hypertension Grade 3	≥ 180	≥ 110
Isolated systolic hypertension	≥ 140	≥ 90

Table 1: WHO/ESH Classification of BP levels (mmHg)

Clinic BP measurements

BP can be measured by a mercury sphygmomanometer or other non-invasive devices (auscultatory, oscillometric or aneroid devices). When measuring BP, care should be taken to:

- Allow the patients to sit for several minutes in a quiet room.
- Take two measurements spaced by 1–2 min.
- Use a standard cuff (12–13 cm wide and 35 cm long) but have a larger and a smaller cuff available for fat and thin arms, respectively.
- Have the cuff at the heart level, whatever the position of the patient.
- Use phase I and V (disappearance) Korotkoff sounds to identify SBP and DBP respectively.
- Measure BP in both arms at first visit; take the higher value as the reference one.
- Measure BP 1 and 5 min after assumption of the standing position in the elderly and diabetic patients, for orthostatic hypotension.
- Measure pulse rate for 30 seconds after the second measurement in the sitting position.
- Clinicians should avoid unnecessarily frequent BP check to worried well patients as these give false reassurance (Box 1).

Home BP measurements

Self-measurements of BP at home can provide information on BP on different days in settings as close to daily life conditions as possible. These values have been shown to have no white-coat effect and to be more predictive of the presence and progression of organ damage than are clinic values [11]. Therefore, home BP measurements for suitable periods before and during treatment can also be recommended because this relatively cheap procedure may improve patient's adherence to treatment [12].Care should be taken to:

- Advise only the use of validated devices (wrist devices are not validated) and semi-automatic rather than mercury sphygmomanometric devices should be recommended;
- Instruct the patients to make measurement seated after several minutes of rest, and inform them of spontaneous BP variability;
- Avoid excessive number of measurements and ensure that some are made before drugs are taken to provide information on duration of the treatment effect;
- Note that normality values are lower for home compared with clinic pressures (Table 2);
- Instruct patients to keep proper record of the measured values and to avoid self-alterations of the treatment.

Ambulatory BP measurements

Several devices are available which permit the automatic monitoring of BP in patients allowed to conduct a near normal life. It has been shown that ambulatory BP correlates with hypertensive target organ damage and predicts the cardiovascular risk more closely than clinic BP [13,14]. Ambulatory BP is usually several mmHg lower than clinic BP (Table 2).

24-hour ambulatory BP monitoring may be considered of additional clinical value, but the technique and its cost may limit its use in routine BP check.

Step 2: Assessment for Risk factors

Diagnostic procedures are aimed at identifying secondary causes of hypertension and evaluating the overall cardiovascular risk by searching for risk factors, target organ damage and accompanying clinical conditions. The diagnostic procedures comprise medical history, BP measurements, physical examination and investigations.

Guidelines for family and clinical history

A comprehensive family history should be obtained, with particular attention to hypertension, dyslipidaemia, diabetes, coronary heart disease, stroke, or renal disease.

1. Duration and previous level of HBP
2. Indications of secondary hypertension:
   (a) family history of renal disease (polycystic kidney)
   (b) renal disease, urinary tract infection, haematuria, analgesic abuse (parenchymal renal disease)
   (c) drug/substance intake: oral contraceptives, liquorice, carbenoxolone, nasal drops, cocaine, steroids, non-steroidal anti-inflammatory drugs, amphetamines, erythropoietin, cyclosporin
   (d) episodes of sweating, headache, anxiety, palpitation (phaeochromocytoma)
   (e) episodes of muscle weakness and tetany (aldosteronism)
3. Risk factors:
   (a) family and personal history of hypertension and cardiovascular disease
   (b) family and personal history of hyperlipidaemia
   (c) family and personal history of diabetes mellitus
   (d) smoking habits
   (e) dietary habits
   (f) obesity; and amount of physical exercise
   (g) personality
4. Symptoms of organ damage:
   (a) brain and eyes: headache, vertigo, impaired vision, transient ischaemic attacks, sensory or motor deficit
   (b) heart: palpitation, chest pain, shortness of breath, swollen ankle
   (c) kidney: thirst, polyuria, nocturia, haematuria
   (d) peripheral arteries: cold extremities,intermittent claudication

	SBP/DBP (mmHg)	Recommended follow-up*
Optimal BP	<120 / <80	1-2 years
Normal BP	120-129/80-89	6-12months
Mild HT	140-159/90-99	1-3months
Moderate HT	160-179/100-109	1-4 weeks
Severe HT	≥180 / ≥110	Immediate treatment
BP treated & controlled	120-140 / 80-90	3-6 months*

** Modify the scheduling of follow-up according to past BP measurements, cardiovascular risk factors, target organ isease, or concomitant conditions*

Box 1: Recommendations for follow-up BP check

	SBP	DBP
Clinic BP	140	90
Home (self) BP	135	85
High normal	130–139	85–89
24-hr ambulatory BP	125	80

Table 2: BP thresholds (mmHg) for definition of hypertension with different types of measurement

5. Previous antihypertensive therapy: drugs used, efficacy and adverse effects
6. Personal, family, and environmental factors

Guideline for physical examination

In addition to BP measurement, physical examination should search for evidence of additional risk factors (in particular abdominal obesity), for signs suggesting secondary hypertension, and for evidence of organ damage.

1. Signs of secondary hypertension and organ damage:
   (a) Features of Cushing syndrome.
   (b) Skin stigmata of neurofibromatosis (phaeochromocytoma).
   (c) Palpation of enlarged kidneys (polycystic kidney).
   (d) Auscultation of abdominal murmurs (renovascular hypertension).
   (e) Auscultation of precordial or chest murmurs (aortic coarctation or aortic disease).
   (f) Diminished and delayed femoral and reduced femoral BP (aortic coarctation, aortic disease).
2. Signs of organ damage:
   (a) Brain: murmurs over neck arteries, motor or sensory defects.
   (b) Retina: fundoscopic abnormalities.
   (c) Heart: location and characteristics of apical impulse, abnormal cardiac rhythms, ventricular gallop, pulmonary rales, dependent oedema.
   (d) Peripheral arteries: absence or reduction of pulses cold extremities, ischaemic skin lesions.

Guidelines for laboratory investigations

Laboratory investigations are directed at providing evidence of additional risk factors, searching for secondary hypertension and assessing absence or presence of target organ damage. The minimum laboratory investigations needed are a matter of debate. However, it is agreed that investigations should progress from the most simple to the more complicated.

Major risk factors
• Levels of systolic and diastolic BP
• Men>55 years
• Women>65 years
• Smoking
• Dyslipidaemia(total cholesterol. 6.5 mmol/l, or LDL-cholesterol. 4.0 mmol/l, or HDL-cholesterol M , 1.0,W, 1.2 mmol/l)
• Family history of premature CVD(at age , 55 years M, 65 years W)
• Abdominal obesity(circumference M>102 cm, W>88 cm)
Target organ damage (TOD)
• Left ventricular hypertrophy
• Ultrasound evidence of arterial wall thickening or atherosclerotic plaque
• Slight increase in serum creatinine (M 115-133,W 107-124 umol/l);
• Microalbuminuria(30-300mg/24h; albumin-creatinine ratio M >22, W >31 mg/g; M > 2.5,W > 3.5 mg/mmol)
Diabetes Mellitus
• Fasting plasma glucose ≥7.0 mmol/l
• Postprandial plasma glucose >11.0 mmol/l
Associated clinical conditions (ACC)
• Cerebrovascular disease: ischaemic stroke; cerebral haemorrhage; transient ischaemic attack• Heart disease: myocardial infarction; angina; coronary revascularization; congestive heart failure
• Renal disease: diabetic nephropathy; renal impairment (serum creatinine M. >133, W.124 >mol/l) proteinuria (>300 mg/24 h)
• Peripheral vascular disease• Advanced retinopathy: haemorrhages or exudates, papilloedema
M, men; W, women; LDL, low-density lipoprotein; HDL, high-density lipoprotein

Table 3: Factors influencing prognosis

1. Routine tests:
   (a) Fasting plasma glucose
   (b) Serum total cholesterol
   (c) Serum HDL-cholesterol
   (d) Fasting serum triglycerides

Risk factors and disease history	Normal BP SBP 120-129 or DBP 80-84	High Normal BP SBP 130-139 or DBP 85-89	Mild HT SBP 140-159 or DBP 90-99	Moderate HT SBP 160-179 or DBP 100-109	Severe HT SBP >180 or DBP>110
No risk factors	Average risk	Average risk	Low added risk	Moderate added risk	High added risk
1–2 risk factors ≥ 3 risk factors,	Low added risk	Low added risk	Moderate added risk	Moderate added risk	Very high added risk
TOD or DM	Moderate added risk	High added risk	High added risk	Very high added risk	Very high added risk
ACC	High added risk	Very high added risk	Very high added risk	Very high added risk	Very high added risk

ACC, associated clinical conditions; TOD, target organ damage; HT, hypertension; DM, diabetes mellitus

Table 4: Stratification of risk to quantify prognosis

(e) Serum uric acid
(f) Serum creatinine
(g) Serum potassium
(h) Haemoglobin and haematocrit
(i) Urinalysis
(j) Electrocardiogram

2. Recommended tests:
(a) Echocardiogram
(b) Carotid (and femoral) ultrasound
(c) C-reactive protein
(d) Microalbuminuria (essential in diabetics)
(e) Quantitative proteinuria (if dipstick positive)
(f) Fundoscopy (in severe hypertension)

Step 3: Classification and Stratification

The relationship between BP levels and risk of end organ damage is continuous and this makes any numerical definition and classification of hypertension arbitrary. The real threshold for treating hypertension must be a flexible one resulting from evidence of cardiovascular risk profile of each individual. The new guidelines introduced a new classification that includes high normal BP (ESH [3]) or prehypertension (JNC 7 [2]).

This new designation is intended to identify those individuals who would benefit from preventive measures such as lifestyle change or early intervention.

On these bases, a classification using stratification for total cardiovascular risk (Table 4) was suggested in the WHO/ISH[4] and ESH/ESC[3] guidelines. The terms low, moderate, high and very high added risk are calibrated to indicate an approximate absolute 10-year risk of cardiovascular disease of,15%, 15–20%, 20–30% and >30%, respectively, according to Framingham criteria [15], or an approximate absolute risk of fatal cardiovascular disease<4%, 4–5%, 5–8%, and >8% according to the SCORE chart [16].

Step 4: Therapeutic Strategy

Primary prevention and Lifestyle changes

Primary prevention entails that all patients should be screened for HBP and increased cardiovascular risk. Whereas, patients with increased risk or on treatment should be encouraged to attend for regular check-ups, the worried well should be reassured and discouraged from doing frequent BP check-ups (Box 1). On the other hand, clinicians should take every opportunity not to miss those patients who attend clinic infrequently and are not aware of their BP and cardiovascular status.

Adopting a healthy lifestyle by all persons is critical for the prevention of HBP and is an indispensable part in the management of hypertension. Each encounter for BP check-up should be an opportunity to advise patients on healthy lifestyle. Lifestyle advice is appropriated for all patients with or without HBP or on antihypertensive therapy. The lifestyle measures that are widely agreed to lower BP and cardiovascular risk are indicated in Table 5.

Secondary prevention and medical intervention

Guidelines for initiating antihypertensive treatment are based on two criteria: the level of SBP and DBP (Tables 1 and 2) and the total level of cardiovascular risk (Table 4). The total level of cardiovascular risk has become a more important indicator than

Lifestyle change	Reduction in SBP	Other benefits
Smoking cessation	Not quantified	The single most powerful lifestyle measure for the prevention of non-cardiovascular and cardiovascular diseases
Weight reduction	5-20mmHg/10kg	Improve associated risk factors such as insulin resistance, diabetes, hyperlipidaemia and left ventricular hypertrophy
Regular physical activity	4–9 mmHg	Same as above
Healthy eating plan	8-14mmHg	Same as above
Moderation of alcohol intake	2–4 mmHg	Associated with a high risk of stroke particularly so for binge drinking
Reduction of dietary salt	2–8 mmHg	

Table 5 - Lifestyle modification and reduction in BP

(Adapted from ESH/ESC guidlines)

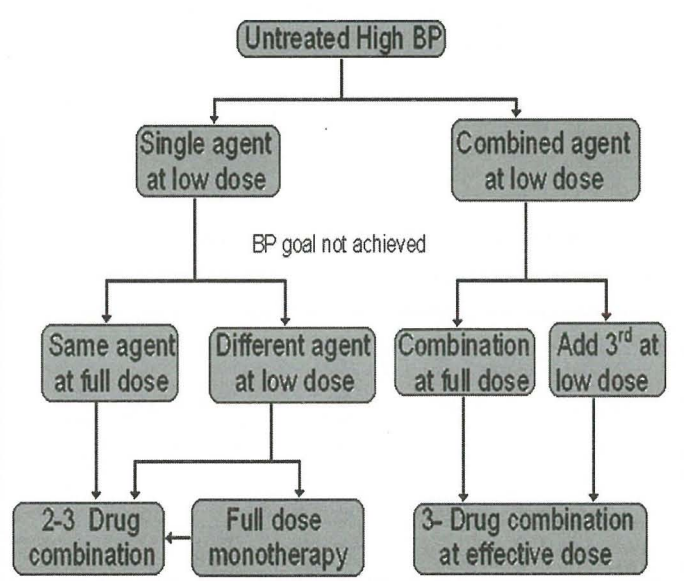
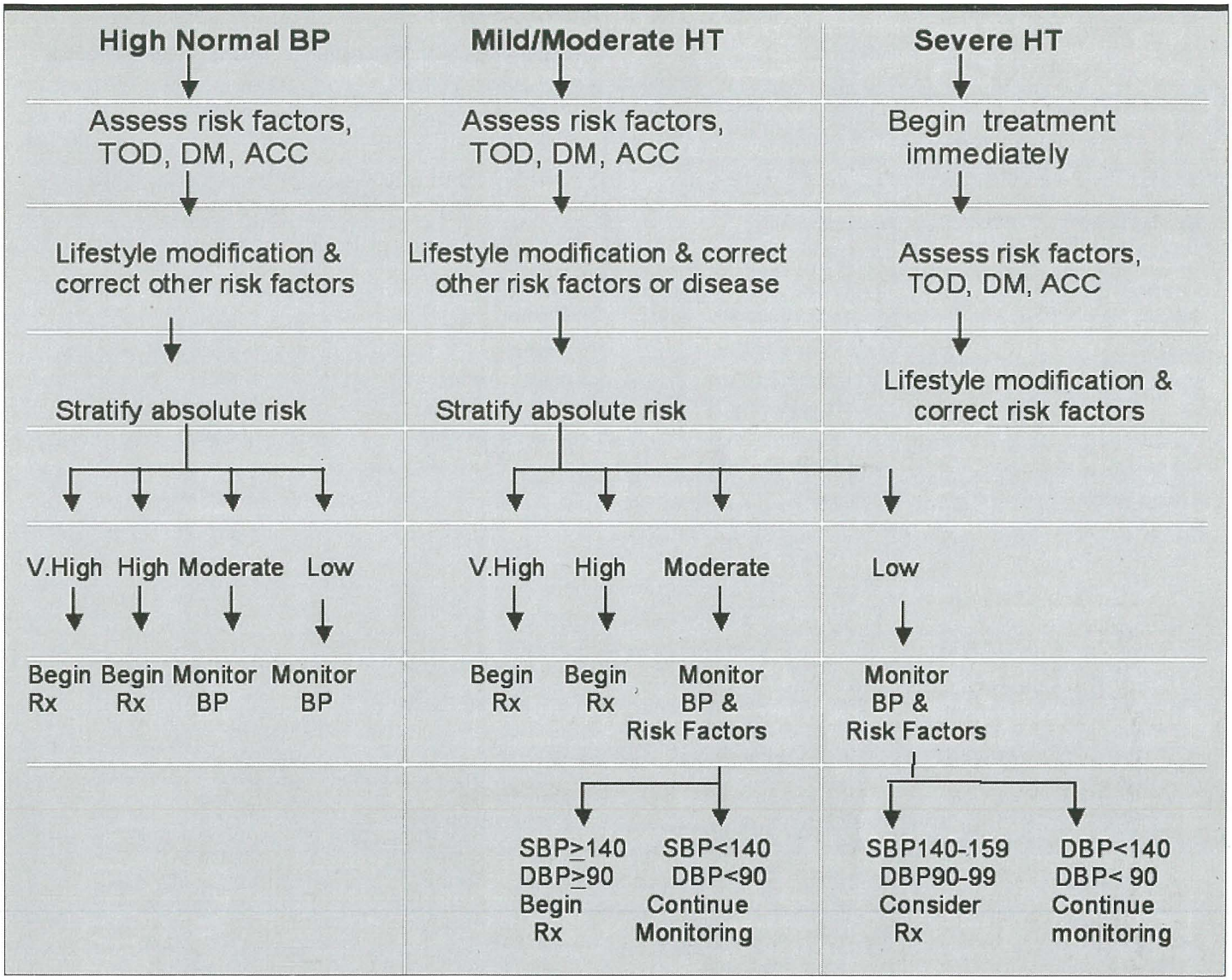


Figure 1: Monotherapy or combination therapy

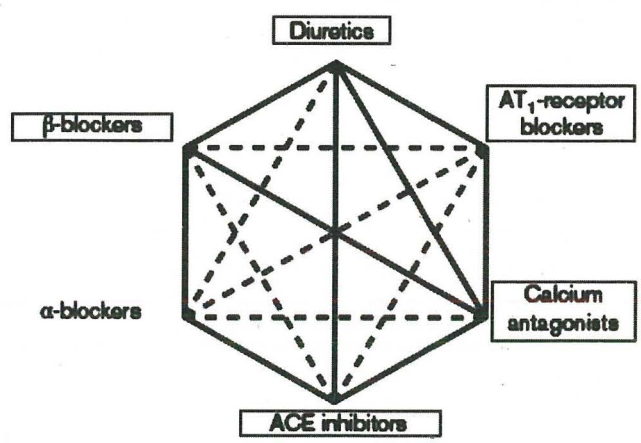


Box 2: Recommended Therapeutic Strategy

the BP level for intervention. Box 2 includes recommendations about initiation of treatment in patients with all grades of hypertension.

The evidence of BP lowering benefits in patients with high normal BP is so far limited to subjects with stroke, coronary artery disease and diabetes. Antihypertensive treatment within high normal BP range can only be recommended for patients who are at least at high risk. Close monitoring of BP is recommended for patients at low or moderate risk, who are considered to benefit mostly from lifestyle modification measures and correction of other risk factors.

In patients with mild to moderate hypertension, it is recommended to check BP values on several occasions, initiate lifestyle measures and stratify absolute risk. Antihypertensive drug treatment should be initiated promptly in subjects classified as at high or very high risk, whereas in subjects at moderate or low added risk BP, as well as other cardiovascular risk factors, should be monitored for extended periods (at least 3 months) with only non-pharmacological treatment. If after extended observation,



Possible combination of different classes of antihypertensive agents. The most rational combinations are represented as thick lines. ACE, angiotensin-converting enzyme. The frames indicate classes of antihypertensive agents proven to be beneficial in controlled intervensional trials.

Figure 2: Drug Combinations (Adapted from ESH/ESC guidlines)

Class	Indications	Compelling Contraindications	Possible Contraindications
Diuretics (thiazides)	Congestive heart failure; elderly hypertensives; isolated systolic hypertension; hypertensives of African origin	Gout	Pregnancy
Diuretics (loop)	Renal insufficiency; congestive heart failure		
Diuretics (anti-aldosterone)	Congestive heart failure; post-myocardial infarction	Renal failure; hyperkalaemia	
Beta-Blockers	Angina pectoris; post-myocardial infarction; congestive heart failure (up-titration); pregnancy; tachyarrhythmias	Asthma; chronic obstructive pulmonary disease; A-V block grade 2 or 3	Peripheral vascular disease; glucose intolerance; athletes and physically active patients
Calcium antagonists (dihydropyridines)	Elderly patients; isolated systolic hypertension; angina pectoris; peripheral vascular disease; carotid atherosclerosis; pregnancy		Tachyarrhythmias; congestive heart failure
Calcium antagonists (verapamil, diltiazem)	Angina pectoris; carotid atherosclerosis; supraventricular tachycardia	A-V block grade 2 or 3; congestive heart failure	
Angiotensin-converting enzyme (ACE) inhibitors	Congestive heart failure; LV dysfunction; post-myocardial infarction; non-diabetic nephropathy; type 1 diabetic nephropathy; proteinuria	Pregnancy; hyperkalaemia; bilateral renal artery stenosis	
Angiotensin II receptorantagonists (AT1-blockers)	Type 2 diabetic nephropathy; diabetic microalbuminuria; proteinuria; left ventricular hypertrophy; ACE-inhibitor cough	Pregnancy; hyperkalaemia; bilateral renal artery stenosis	
Alpha-Blockers	Prostatic hyperplasia (BPH); hyperlipidaemia	Orthostatic hypotension	Congestive heart failure

Table 6: Indications and contraindications for the major classes of antihypertensive drugs

systolic values >140 or diastolic values > 90 mmHg persist, antihypertensive drug treatment should be initiated in patients with moderate risk, and considered in patients with lower risk.

In patients with severe hypertension, the elevated BP values should be checked within a few days and treatment instituted quickly, without the preliminary need of establishing the absolute risk. Complete assessment of other risk factors, target organ damage, or associated disease can be carried out after treatment has been started, and lifestyle measures can be recommended at the same time as initiation of drug therapy.

Step 5: Choice of antihypertensive drugs

The main benefits of antihypertensive therapy are due to lowering of blood pressure per se and all the standard major classes of antihypertensive agents (fig 2) are equally suitable for first-line therapy as monotherapy or combination therapy, provided that there are no associated complications. There is also evidence that specific drug classes may differ in some effect, or in special groups of patients. When there is evidence of increased cardiovascular risk profile, target organ damage, clinical cardiovascular or renal disease or diabetes then, specific antihypertensive drugs with compelling indications (based on clinical trial) should be used (Table 6). Long-acting drugs or preparations providing 24-h efficacy on a once daily basis are generally preferred as they offer better BP control.

Within the array of available evidence, the choice of drugs will be influenced by many factors, including:

- previous experience of the patient with the agents;

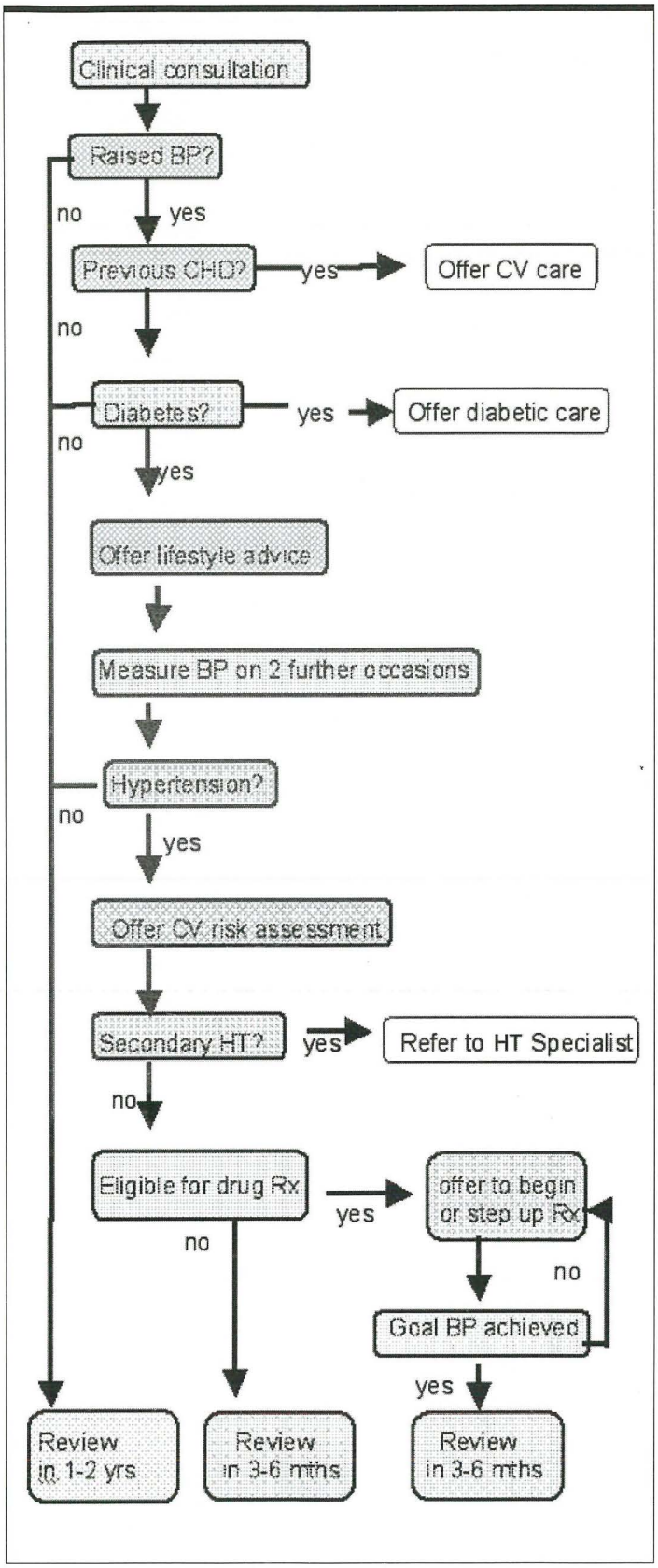


Figure 3: Management flow chart
(Adapted from North of England hypertention guidelines development group)

- cost of drugs;
- patient's preference;
- clinical indications

Monotherapy versus combination therapy

In most, if not all, hypertensive patients, therapy should be started gradually, and target BP values achieved progressively through several weeks. To reach target BP, it is likely that a large proportion of patients will require combination therapy with 2 or 3 agents. In mild hypertensives, monotherapy is likely to be successful more frequently. On the other hand, patients with moderate to severe hypertension or with concomitant disease, such as diabetes, are more likely to be controlled with combination therapy. According to the baseline BP and the presence or absence of complications, it appears reasonable to initiate therapy either with a low dose of a single agent or with a low-dose combination of two agents (figure 1). The advantage of starting with low dose monotherapy, is the ease to identify adverse effects and to find the drug to which any individual patient best responds. But the procedure is laborious and frustrating for both doctors and patients, and may lead to low compliance. An obvious disadvantage of initiating with two drugs is that of potentially exposing the patient to an unnecessary agent, but the advantages are that:

1. by using two drugs with different mechanisms of action, it is more likely that blood pressure and its complications are controlled;
2. by using combinations, both the first and second drugs can be given in the low dose range that is more likely to be free of side-effects;
3. fixed low-dose combinations allowing the administration of two agents within a single tablet, thus optimizing compliance.

Figure 2 shows the most commonly used drug combinations that were proved to be effective and tolerated by patients

Conclusion

It is now recognised that the management of hypertension must not be performed in isolation (Box 2, Fig 3). Full cardiovascular risk assessment of the patient is required. The patient should be considered holistically and all risk factors and associated clinical conditions must be assessed and managed. Despite major efforts to diagnose and to treat hypertension, this condition remains a leading cause of morbidity and mortality, and goal BP levels are seldom achieved. It is therefore highly desirable to improve this unsatisfactory delivery of care of such a common condition.

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