

Chapter I: Hypertension

Definition

Hypertension is defined as a diastolic blood pressure of 90mmHg or higher and/or a systolic blood pressure of 140mmHg or higher.

Classification

Category	Systolic	Diastolic
Normal	< 130	< 85
High normal	130-139	85-89
Mild hypertension	140-159	90-99
Moderate hypertension	160-179	100-109
Severe hypertension	180-209	110-119
Very severe hypertension	> 210	> 120

Burden

- Prevalence of hypertension is 26.3% of Egyptian adults (≥ 25 years).
- Hypertension causes high morbidity and mortality and is a leading risk factor for:
 - Coronary heart disease.
 - Congestive heart failure.
 - Stroke.
 - Ruptured aortic aneurysm.
 - Renal disease.
 - Retinopathy.

Screening test

Office sphygmomanometry (the blood pressure cuff).

Blood pressure measurement:

- Use a device with validated accuracy that is properly maintained and calibrated.
- Patient should be seated with the arm at the level of the heart.
- The size of bladder inside the cuff should be adjusted for the arm circumference.
- Place the cuff appropriately on the upper arm.
- Start with the palpatory method to avoid underinflation or overinflation.
- The bladder inside the cuff is inflated to a pressure 20 to 30 mm Hg above the level previously determined by palpation, then deflated at 2 mm/second.
- The blood pressure measured to the nearest 2 mm Hg.
- Diastolic pressure is recorded as disappearance of the sounds (phase V).
- At least two measurements should be made at each of several visits to determine blood pressure thresholds.

Diagnosis

Hypertension can be diagnosed after more than one elevated reading is obtained on each of three separate visits over a period of one to several weeks.

Recommendations for prevention

• Screening for hypertension is recommended for all children and adults as follows:

- Periodic screening for hypertension is recommended for all persons ≥ 21 years of age:

- The optimal interval for blood pressure screening is left to clinical discretion.

- Normotensive adults should receive blood pressure measurements at least once every 2 years if their last diastolic and systolic blood pressure readings were below 85 and 140 mm Hg, respectively, and annually if the last diastolic blood pressure was 85-89 mm Hg.

- Measurement of blood pressure during clinic visits is recommended for children and adolescents.

• Routine counseling to promote physical activity and a healthy diet for the primary prevention of hypertension is recommended for all children and adults.

Management

- Use non-pharmacological measures in all hypertensive and borderline hypertensive people
- Initiate antihypertensive drug treatment in people with sustained systolic blood pressure ≥ 160 mm Hg or sustained diastolic blood pressure ≥ 100 mm Hg
- Decide on treatment in people with sustained systolic blood pressure between 140 and 159 mm Hg or sustained diastolic blood pressure between 90 and 99 mm Hg according to the presence or absence of target organ damage, cardiovascular disease, or diabetes.
- Optimal blood pressure treatment targets are systolic blood pressure < 140 mmHg and diastolic blood pressure < 85 mm Hg; the minimum acceptable level of control (audit standard) recommended is $< 150 / < 90$ mm Hg
- In the absence of contraindications or compelling indications for other antihypertensive agents, low dose thiazide diuretics or β blockers are preferred as first line treatment for the majority of hypertensive people; compelling indications and contraindications for all antihypertensive drug classes are specified below
- Other drugs that reduce cardiovascular risk must also be considered; these include aspirin and statins

Burden of Suffering

Prevalence in Egypt²

- o Prevalence of hypertension is 26.3% of Egyptian adults (≥ 25 years).
- o Age related prevalence:
 - Prevalence in the category (25- to 34-years-old) is 7.8%,
 - Prevalence in the category (75 years or older) is 56.6%,
 - Peak of prevalence is in the category (55- to 64-years-old), which is 59.4%.
- o Gender related prevalence: Prevalence in women is 26.9% and in men is 25.7%.
- o Geographical related prevalence:
 - Cairo prevalence rate is (31%),
 - In rural areas the prevalence is (25%),
 - In frontiers (Oases) the prevalence is (19.9%).

Complications

- o Hypertension causes high morbidity and mortality and is a leading risk factor for:
 - Coronary heart disease.
 - Congestive heart failure.
 - Stroke.
 - Ruptured aortic aneurysm.
 - Renal disease.
 - Retinopathy.
- o Successful efforts to lower blood pressure could have substantial impact on population morbidity and mortality.
- o Milder forms of hypertension predict progression to more severe elevations and development of cardiovascular disease.^{1,3,4}
- o Treatable (also known as secondary) causes of hypertension such as aortic coarctation or renovascular disease also may be associated with severe consequences, including congestive heart failure, aortic rupture, or stroke.⁶⁻⁹

Accuracy of screening test

Screening test

- o Office sphygmomanometry (the blood pressure cuff) is the most appropriate screening test for hypertension in the asymptomatic population.

Blood pressure measurement

- o Use a device with validated accuracy that is properly maintained and calibrated.

- o At least two measurements should be made at each of several visits to determine blood pressure thresholds.
- o Seated blood pressure recordings are generally sufficient, but standing blood pressure should be measured in elderly or diabetic patients to exclude orthostatic hypotension.
- o Ambulatory blood pressure monitoring may be helpful in the following situations:
 - When clinic blood pressure shows unusual variability
 - Hypertension is resistant to drug treatment (three or more drugs)
 - When symptoms suggest the possibility of hypotension
- o Technique of measurement of hypertension:¹⁰
 - The intent and purpose of the measurement should be explained to the subject in a reassuring manner and every effort made to put the subject at ease.
 - The sequential steps for measuring the blood pressure in the upper extremity, as for routine screening and monitoring purposes, should include the following:
 1. Have paper and pen at hand for immediate recording of the pressure.
 2. Seat the subject in a quiet, calm environment with his or her bared arm resting on a standard table or other support so the midpoint of the upper arm is at the level of the heart.
 3. Select an appropriately sized cuff:
 - The bladder inside the cuff should encircle 80% of the arm in adults and 100% of the arm in children less than 13 years old.
 - If in doubt, use a larger cuff. If the available cuff is too small, this should be noted.
 4. Place the cuff appropriately on the upper arm:
 - Palpate the brachial artery and place the cuff so that the midline of the bladder is over the arterial pulsation,
 - Wrap and secure the cuff snugly around the subject's bare upper arm,
 - Avoid rolling up the sleeve in such a manner that it forms a tight tourniquet around the upper arm,
 - Loose application of the cuff results in overestimation of the pressure,
 - The lower edge of the cuff should be 1 inch (2 cm) above the antecubital fossa (bend of the elbow), where the head of the stethoscope is to be placed.
 5. Place the manometer so the center of the mercury column or aneroid dial is at eye level and easily visible to the observer and the tubing from the cuff is unobstructed.
 6. Palpatory method:
 - Inflate the cuff rapidly to 70 mm Hg, and increase by 10 mm Hg increments while palpating the radial pulse.

- Note the level of pressure at which the pulse disappears and subsequently reappears during deflation.
- This procedure, the palpatory method, provides a necessary preliminary approximation of the systolic blood pressure to ensure an adequate level of inflation when the actual, auscultatory measurement is made.
- The palpatory method is particularly useful to avoid underinflation of the cuff in patients with an auscultatory gap and overinflation in those with very low blood pressure.

7. Auscultatory method:

- Place the earpieces of the stethoscope into the ear canals, angled forward to fit snugly.
- Switch the stethoscope head to the low-frequency position (bell).
- The setting can be confirmed by listening as the stethoscope head is tapped gently.
- Place the head of the stethoscope over the brachial artery pulsation, just above and medial to the antecubital fossa but below the lower edge of the cuff, and hold it firmly in place, making sure that the head makes contact with the skin around its entire circumference.
- Wedging the head of the stethoscope under the edge of the cuff may free up one hand but results in considerable extraneous noise.
- Inflate the bladder rapidly and steadily to a pressure 20 to 30 mm Hg above the level previously determined by palpation, then partially unscrew (open) the valve and deflate the bladder at 2 mm/second while listening for the appearance of the Korotkoff sounds.
- As the pressure in the bladder falls, note the level of the pressure on the manometer at the first appearance of repetitive sounds (Phase I) and at the muffling of these sounds (Phase IV) and when they disappear (Phase V).
- During the period the Korotkoff sounds are audible, the rate of deflation should be no more than 2 mm per pulse beat, thereby compensating for both rapid and slow heart rates.
- After the last Korotkoff sound is heard, the cuff should be deflated slowly for at least another 10 mm Hg, to ensure that no further sounds are audible, and then rapidly and completely deflated, and the subject should be allowed to rest for at least 30 seconds.
- The systolic (Phase I) and diastolic (Phase V) pressures should be immediately recorded, rounded off (upwards) to the nearest 2 mm Hg.
- In children, and when sounds are heard nearly to a level of 0 mm Hg, the Phase IV pressure should also be recorded.
- All values should be recorded together with the name of the subject, the date and time of the measurement, the arm on which the measurement was made, the subject's position, and the cuff size (when a nonstandard size is used).
- The measurement should be repeated after at least 30 seconds, and the two readings averaged.
- In clinical situations additional measurements can be made in the same or opposite arm, in the same or an alternative position.

Errors in measuring blood pressure

- o Instrument errors:
 - Manometer dysfunction.
 - Pressure leaks.
 - Stethoscope defects.
 - Cuffs of incorrect width or length for the patient arm size.
- o Observer errors:
 - Sensory impairment (difficulty in hearing Korotkoff sounds or in reading the manometer).
 - Inattention.
 - Inconsistency in recording Korotkoff sounds.
 - Subconscious bias (e.g., preconceived notions of normal pressures).
- o Patient errors:
 - Posture factors (i.e., lying, standing, and sitting) and arm position in relation to the heart can affect results by as much as 10 mm Hg.¹¹
 - Biologic factors including anxiety, meals, tobacco, alcohol, temperature changes, exertion, pain and full bladder.

Difficulties in children (especially when testing infants and children under 3 years)¹²⁻¹⁵

- Increased variation in arm circumference, requiring greater care in selection of cuff sizes.
- Anxiety and restlessness of the patient.
- Disappearance of Korotkoff sounds (Phase V) is often difficult to be heard in children.
- False (erroneous) Korotkoff sounds can be produced inadvertently by the pressure of the stethoscope diaphragm on the antecubital fossa.
- The definition of pediatric hypertension has been uncertain because of confusion over normal values during childhood. The definition of hypertension in children is essentially arbitrary, based on age-specific percentile.

Effectiveness of early detection

- o There is a direct relationship between the magnitude of blood pressure elevation and the benefit of lowering pressure.
 - In persons with malignant hypertension (Clinical syndrome of markedly high blood pressure with retinal hemorrhage and exudates, and often including confusion, headaches, vomiting and visual disturbances), the benefits of intervention are most dramatic; treatment increases 5-year survival from near zero to 75%.¹⁶
 - The efficacy of treating hypertension is clear in adults with diastolic blood pressures ranging from 90 to 129 mm Hg.²⁰⁻²⁵
- o Treatment of hypertension is associated with multiple benefits, including reduced coronary heart disease and vascular deaths, but it produces the largest reductions in cerebrovascular morbidity and mortality.^{17-19,26,27}

- o The detection of high blood pressure during childhood is of potential value in identifying those children who are at increased risk of primary hypertension as adults and who might benefit from earlier intervention and follow-up.
 - A relatively high proportion of children with hypertension have secondary hypertension (e.g., renal parenchymal disease, coarctation of the aorta).²⁸
 - Many causes of secondary hypertension in childhood are detectable by careful history-taking or physical examination e.g.:^{28,29}
 - Preterm birth, ● Umbilical artery catheter, ● Chronic pyelonephritis,
 - Renal disease, ● Bronchopulmonary dysplasia, ● Symptoms of cardiac, renal, endocrinologic, or neurologic disease,
 - Murmur, ● Decreased femoral pulses, ● Abdominal bruit.

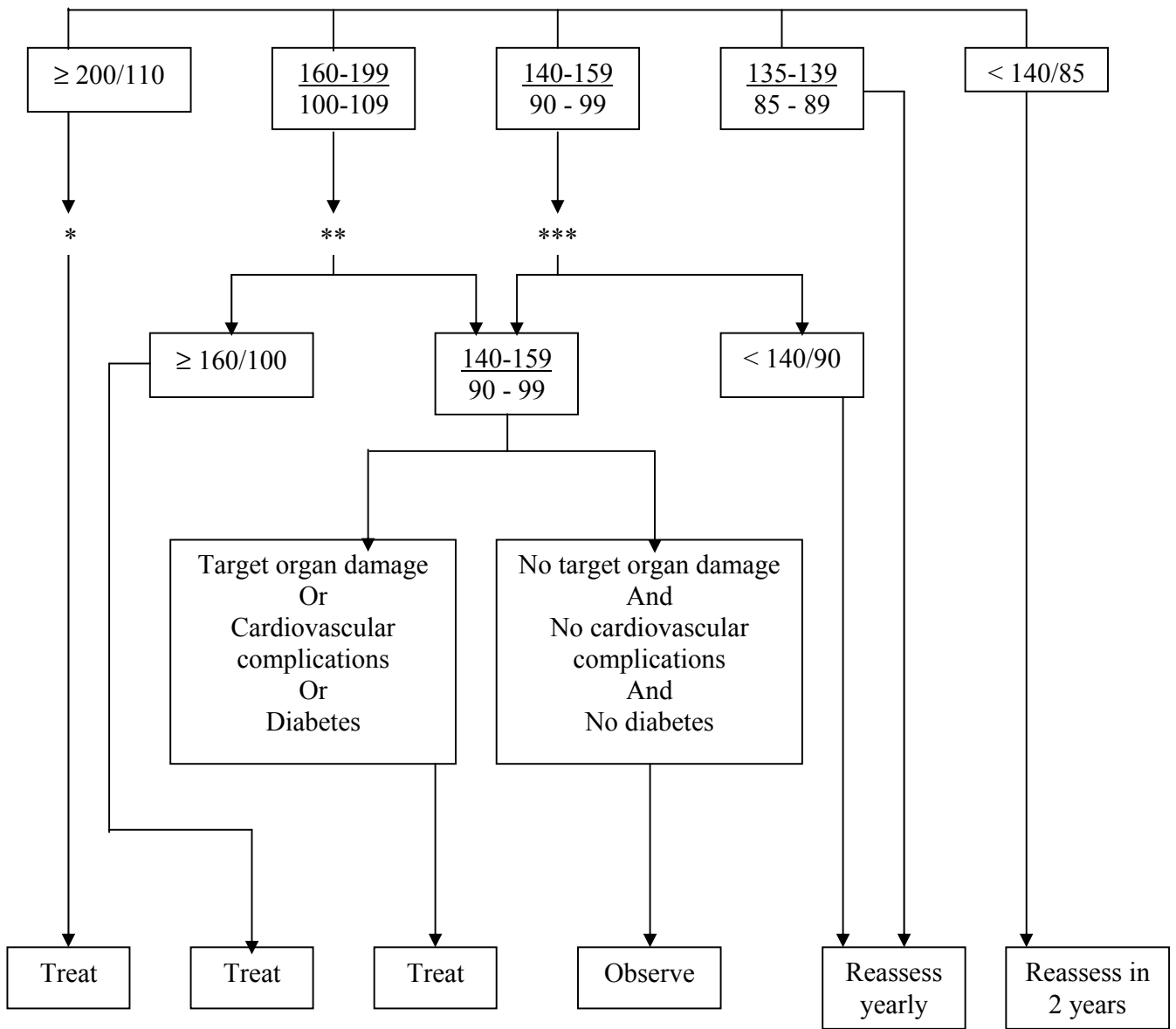
Clinical Intervention

Screening

- o Periodic screening for hypertension is recommended for all persons ≥ 21 years of age:
 - The optimal interval for blood pressure screening is left to clinical discretion.
 - Normotensive adults should receive blood pressure measurements at least once every 2 years if their last diastolic and systolic blood pressure readings were below 85 and 140 mm Hg, respectively, and annually if the last diastolic blood pressure was 85-89 mm Hg.¹
- o Sphygmomanometry should be performed in accordance with recommended technique.¹
- o Hypertension should not be diagnosed on the basis of a single measurement; elevated readings should be confirmed on more than one reading at each of three separate visits.
- o In adults, current blood pressure criteria for the diagnosis of hypertension are an average diastolic pressure of 90 mm Hg or greater and/or an average systolic pressure of 140 mm Hg or greater.¹
- o Measurement of blood pressure during clinic visits is recommended for children and adolescents.
 - This recommendation is based on the proven benefits from the early detection of treatable causes of secondary hypertension.
 - There is insufficient evidence to recommend for or against routine periodic blood pressure measurement to detect essential (primary) hypertension in this age group.
 - Sphygmomanometry should be performed in accordance with the recommended technique for children, and hypertension should only be diagnosed on the basis of readings at each of three separate visits.¹⁴
 - In children, criteria defining hypertension vary with age.¹⁴
- o Routine counseling to promote physical activity and a healthy diet for the primary prevention of hypertension is recommended for all children and adults.

*Management*³²

Initial Blood Pressure (mm Hg)



* Unless malignant phase, or hypertensive emergency, confirm over 1-2 weeks, then treat.

** If cardiovascular complications, target organ damage, or diabetes is present, confirm over 3-4 weeks, then treat; if absent, remeasure weekly and treat if blood pressure persists at these levels over 4-12 weeks.

*** If cardiovascular complications, target organ damage, or diabetes is present, confirm over 12 weeks, then treat; if absent, remeasure monthly and treat if these levels are maintained.

Evaluation of hypertensive patients

- o All hypertensive patients should have a thorough history and physical examination, but need only a limited number of routine investigations (box 1).
- o The purpose of the evaluation is to assess the cause of the hypertension, associated cardiovascular risk factors, evidence of target organ damage, and comorbid diseases, all of which may influence treatment decisions.
- o More complex investigations may require specialist referral (box 2).

Box 1: Routine investigation of hypertensive people

- Urine strip test for blood and protein
- Blood electrolytes and creatinine
- Blood glucose
- Serum total:HDL cholesterol ratio
- 12 lead electrocardiograph (ECG)

Box 2: Indications for specialist referral

- Urgent treatment indicated: malignant hypertension, impending complications
- To investigate potential underlying causes of hypertension when initial evaluation suggests this possibility
- To evaluate therapeutic problems or failures
- Special circumstances: unusually variable blood pressure and pregnancy

Non-pharmacological measures

- o Non-pharmacological advice should be offered to all hypertensive people and those with a strong family history of hypertension.
- o Such measures may obviate the need for drug treatment or reduce the dose or number of drugs required to control blood pressure.
- o In patients with mild hypertension but no cardiovascular complications or target organ damage, the response to these measures should be observed during the initial 4-6 month period of evaluation.
- o When drug treatment has to be introduced more quickly, non-pharmacological measures should be instituted in parallel with drug treatment.
- o Good evidence from trials shows that several lifestyle modifications lower blood pressure:

- Weight reduction to achieve an ideal body weight via reduced fat and total calorie intake;
 - Regular physical exercise designed to improve fitness, this should be predominantly dynamic (brisk walking, for example) rather than isometric (weight training);
 - Limiting alcohol consumption
 - Reduced use of salt when preparing food and elimination of excessively salty foods from the diet;
 - Increased consumption of fruit and vegetables.
- o Lifestyle modifications that further reduce cardiovascular disease risk are:
 - Stopping smoking;
 - Reducing total intake of saturated fat, replacing it with polyunsaturated or monounsaturated fats;
 - Increased intake of oily fish; and
 - Regular physical exercise.
 - o Effective implementation of these non-pharmacological measures requires enthusiasm, knowledge, patience, and health education for patients and their families to emphasize healthy lifestyle.
 - o It is best undertaken by well trained health professionals and should be backed up by simple clear written information.

Beginning drug therapy^{1,30,31}

- o The decision to begin drug therapy may include consideration of:
 - The level of blood pressure elevation,
 - Age,
 - The presence of other cardiovascular disease risk factors (e.g., tobacco use, hypercholesterolemia),
 - Concomitant disease (e.g., diabetes, obesity, peripheral vascular disease), or
 - Target-organ damage (e.g., left ventricular hypertrophy, elevated creatinine).

Treatment goals or “targets”

- o Optimal blood pressure for reduction of major cardiovascular events (based on an analysis of patients receiving treatment) was reported to be 139/83 mm Hg and reduction of blood pressure below this level caused no harm. However, patients whose blood pressure was below 150/90 mm Hg were not apparently disadvantaged.
- o An intention to treat analysis in hypertensive patients with diabetes showed that lowering blood pressure to below 80 mm Hg rather than below 90 mm Hg was advantageous.
- o Recommendations for target pressures during treatment are shown in (table 1). It is emphasised that even with best practice, these targets will not be achieved in all hypertensive people.

Table 1. Suggested target blood pressures during antihypertensive treatment. Both systolic and diastolic values should be attained, for example, <140/85 mmHg means less than 140 systolic and less than 85 diastolic

Blood pressure	Measured in clinic		Mean daytime ambulatory measurement or home measurement	
	No diabetes	Diabetes	No diabetes	Diabetes
Optimal	<140/85	<140/80	<130/80	<130/75
Audit standard	<150/90	<140/85	<140/85	<140/80

The audit standard reflects the minimum recommended levels of blood pressure control. Despite best practice, it may not be achievable in some treated hypertensive patients.

Choice of antihypertensive drug

- o For each class of antihypertensive drug there are compelling indications based on sound randomised controlled trial data for use in specific patient groups, and also compelling contraindications.
- o There are also indications and contraindications that are less clear-cut, and which are given different weight by different doctors (possible indications/contraindications). These indications and contraindications for each drug class are summarised in (table 2).
- o When none of the special considerations apply, the least expensive drug, with the most supportive trial evidence, a low dose of a thiazide diuretic, should be preferred.

Table 2. Compelling and possible indications and contraindications for the major classes of antihypertensive drugs

Class of drug	Indication		Contraindications	
	Compelling	Possible	Possible	Compelling
1. α blockers	o Prostatism	o Dyslipidaemia	o Postural hypotension	o Urinary incontinence
2. ACE inhibitors	o Heart failure o Left ventricular dysfunction o Type I diabetic nephropathy	o Chronic renal disease* o Type II diabetic nephropathy	o Renal impairment* o Peripheral vascular disease†	o Pregnancy o Renovascular disease
3. Angiotensin II receptor antagonists	o Cough induced by ACE inhibitor‡	o Heart failure o Intolerance of other antihypertensive drugs	o Peripheral vascular disease†	o Pregnancy o Renovascular disease
4. β blockers	o Myocardial infarction o Angina	o Heart failure§	o Heart failure§ o Dyslipidaemia o Peripheral vascular disease	o Asthma or chronic obstructive pulmonary disease o Heart block
5. Calcium antagonists (dihydropyridine)	o Isolated systolic hypertension in elderly patients	o Angina o Elderly patients		
6. Calcium antagonists (rate limiting)	o Angina	o Myocardial infarction	o Combination β with blockade	o Heart block o Heart failure
7. Thiazides	o Elderly patients		o Dyslipidaemia	o Gout

* Angiotensin converting enzyme (ACE) inhibitors may be beneficial in chronic renal failure but should be used with caution. Close supervision and specialist advice are needed when there is established and significant renal impairment.

† Caution with ACE inhibitors and angiotensin II receptor antagonists in peripheral vascular disease because of association with renovascular disease.

‡ If ACE inhibitor indicated.

§ β Blockers may worsen heart failure, but in specialist hands may be used to treat heart failure.

- o No consistent or important differences as regards antihypertensive efficacy, side effects, or quality of life were found when comparing the major classes of antihypertensive drugs (thiazide, β blocker, calcium antagonist, angiotensin converting enzyme inhibitor, and α blocker).
- o Differences in average response between drug classes are, however, related to age and ethnic group.
- o No consistent differences between regimens based on different drug classes were found on comparing different classes of drugs directly as regards reduction in cardiovascular events.
- o Controlled trials of dihydropyridine calcium antagonists have not supported earlier concerns about the safety of these drugs, although nifedipine in capsule form should no longer be prescribed.

Dosage and combination therapy

- o The drug or formulation used should ideally be effective when taken as a single daily dose.
- o An interval of at least four weeks to observe the full response should be allowed, unless it is necessary to lower blood pressure more urgently.
- o The dose of drug (except thiazide diuretics) should be increased according to manufacturers' instructions.
- o If the first drug is well tolerated but the response is small and insufficient, substitution of an alternative drug is appropriate when hypertension is mild and uncomplicated. In more severe or complicated hypertension it is safer to add drugs stepwise until blood pressure control is attained.
- o Treatment can be stepped down later if blood pressure falls substantially below the optimal level.
- o Most hypertensive people will require combinations of antihypertensive therapy to achieve optimal control.
 - Drugs from different classes generally have additive effects on blood pressure when they are prescribed together.
 - Submaximal doses of two drugs result in larger responses of blood pressure and fewer side effects than maximal doses of a single drug.
 - Rational drug combinations combine drugs with different modes of action that are additive, for example,
 - Diuretic with β blocker,
 - Diuretic with angiotensin converting enzyme inhibitor (ACEI),
 - β blocker with calcium antagonist,
 - Calcium antagonist with angiotensin converting enzyme inhibitor (ACEI).
- o Fixed dose combinations may be convenient for patients and are acceptable when monotherapy is ineffective, individual drug components are appropriate, and there are no major cost implications.

Elderly people with hypertension

- o Hypertension, including isolated systolic hypertension “ISH” ($\geq 160 / < 90$ mm Hg), is found in more than half of all people aged over 60.
- o These people have a higher risk of cardiovascular complications, including heart failure and dementia, than do younger people with hypertension, and antihypertensive treatment of diastolic hypertension and isolated systolic hypertension reduces this risk.
- o Antihypertensive treatment is beneficial until at least age 80, and regular screening of blood pressure should continue until this age.
- o Once treatment is started, it should be continued after the age of 80.
- o When hypertension is first diagnosed in people over 80, there is limited evidence to guide policy but treatment decisions should probably be based on biological rather than chronological age.
- o Drugs:
 - Low dose thiazides are the accepted first line treatment for elderly people.
 - β Blockers are less effective than thiazides as first line treatment; in a meta-analysis they were shown to reduce only stroke events.
 - Dihydropyridine calcium antagonists are suitable alternatives for elderly patients when thiazides are ineffective, contraindicated, or not tolerated.

Aspirin and hypertension

- o 75 mg aspirin daily reduced major cardiovascular events in hypertensive patients by 15%, but not fatal events.
- o The number of major bleeding episodes due to aspirin is similar to the number of cardiovascular events saved. Hence for primary prevention, aspirin should be considered only for hypertensive people who meet the criteria set out in box 3.

Box 3: Other measures to reduce cardiovascular risk

Patients with established cardiovascular disease or at high risk should be considered for aspirin and statin therapy as follows:

- For primary prevention, 75 mg aspirin is recommended for hypertensive patients aged 50 years or older who have satisfactory control of their blood pressure ($< 150 / 90$ mm Hg) and either target organ damage or diabetes.
- For primary prevention, statin therapy is indicated up to age 70 when serum total cholesterol is ≥ 5.0 mmol/l.
- For secondary prevention (when there is evidence of cardiovascular disease (angina or myocardial infarction)), statin therapy is indicated up to age 75 when total serum cholesterol is ≥ 5.0 mmol/l

Treatment with statins

- o Statin treatment reduces coronary events and all cause mortality and is safe, simple, and well tolerated in both secondary and primary prevention.
- o Statin treatment also reduces stroke risk substantially in patients who have coronary heart disease.
- o The main constraint on statin treatment at present is its cost.

Follow up

- o The frequency of follow up for treated patients with adequate blood pressure control depends on factors including:
 - Severity and variability of blood pressure,
 - Complexity of the treatment regimen,
 - Compliance, and
 - The need for non-pharmacological advice.
- o Three monthly review is sufficient when treatment and blood pressure are stable; the interval should not generally exceed six months.
- o The routine for follow up visits should be simple:
 - Measure blood pressure and weight;
 - Inquire about general health and side effects;
 - Reinforce non-pharmacological advice; and
 - Test urine for proteinuria annually.

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