

Section 3 Hypertension

Chapter 17

Practical Guidelines for Hypertension Management

NR Rau, Satish K Nayak

Numerous studies have shown an increase in the risk of cardiovascular morbidity and mortality with raised blood pressure above 130/90 mm Hg.¹⁻³ Various international societies have defined hypertension keeping this in mind and are by and large arbitrary. Indian guidelines published by Association of Physicians of India (API) define hypertension as:

“Systolic blood pressure greater than 140 mm Hg and diastolic blood pressure greater than 90 mm Hg or any level of blood pressure in persons on antihypertensive medications” (Table 1).¹

ASSESSMENT OF A PATIENT WITH HYPERTENSION

The aim of this assessment is to look for secondary cause of hypertension, assess progression of the disease by looking for target organ damage and finally to look for associated comorbid condition, which influences the outcome in patients with hypertension (Table 2).

ASSESSMENT FOR TARGET ORGAN DAMAGE

- Cerebrovascular disease
 - Transient ischemic attacks
 - Stroke, hemorrhage or infarct.

- Hypertensive retinopathy
- Left ventricular dysfunction or hypertrophy
- Coronary artery disease
 - Acute coronary syndrome
 - Congestive heart failure.
- Chronic kidney disease
 - Hypertensive nephropathy
 - Albuminuria.
- Peripheral artery disease.

Presence of any of the target organ damage and comorbid condition is an independent prognostic indicator for hypertension-related morbidity and mortality.

ROLE OF ABPM AND HOME BLOOD PRESSURE MONITORING

Ambulatory blood pressure monitoring (ABPM) is recommended in special situations like:

- White coat hypertension
- Labile hypertension
- Nondippers
- Hypotension episode in hypertensive on treatment

TABLE 1 | Classification of blood pressure for adults age 18 and older^{3,9}

Category	Systolic (mm Hg)		Diastolic (mm Hg)
Optimal**	< 120	and	< 80
Normal	< 130	and	< 85
High-normal	130–139	or	85–89
Hypertension***			
Stage 1	140–159	or	90–99
Stage 2	160–179	or	100–109
Stage 3	≥ 180	or	≥ 110
Isolated systolic hypertension			
Grade 1	140–159	and	< 90
Grade 2	≥ 160	and	< 90

* Not taking antihypertensive drugs and not acutely ill. In addition to classifying stages of hypertension on the basis of average blood pressure levels, clinicians should specify presence or absence of target organ disease and additional risk factors.

** Optimal blood pressure with respect to cardiovascular risk is below 120/80 mm Hg. However, unusually low readings should be evaluated for clinical significance.

*** Based on the average of two or more blood pressure, readings taken at least on two visits after an initial screening.

Source: From second Indian guidelines for hypertension by Association of Physicians of India (API)

TABLE 2 | Assessment of a patient with hypertension

	Cause	Target organ damage	Comorbid condition
History	Look for secondary causes of hypertension—symptoms suggestive of thyroid diseases, Cushing's syndrome, OCP intake, steroid intake	History suggestive of stroke/TIA, coronary artery disease, CKD, nephrotic syndrome, retinopathy, peripheral vascular disease	Diabetes mellitus, dyslipidemia, hyperuricemia, smoking and tobacco abuse
Examination	Obesity, features suggestive of thyroid disorders, renal bruit	Peripheral pulses, vessel wall thickness, fundus examination	Xanthoma, xanthelasma
Investigations	TSH, cortisol, uric acid, urinary catecholamine, urinary VMA only when indicated	Urine protein, renal function tests, electrocardiogram, echocardiogram, arterial Doppler	Lipid profile, blood sugar, uric acid

Abbreviations: OCP, Oral contraceptive pills; TIA, Transient ischemic attack; CKD, Chronic kidney disease; TSH, Thyroid stimulating hormone; VMA, Vanillylmandelic acid

- Resistant hypertension not responding to antihypertensive therapy.

Presence of early morning rise in blood pressure has been linked to increased cardiovascular morbidity in hypertensives and can only be assessed by ABPM.⁵

However, high cost involved limits its routine use in all patients in resource limited settings. Awake BP: greater than 135 mm Hg systolic BP or greater than 85 diastolic BP, or 24-hour mean BP: greater than 130 systolic BP or greater than 80 diastolic BP is considered as hypertension.

HOME BLOOD PRESSURE ASSESSMENT

Mercury sphygmomanometer is slowly being replaced by oscillometric digital manometers. This has led to an increase in self home blood pressure measurement due to ease of use. Home blood pressure monitoring (HBPM) is a useful method to diagnose white coat hypertension, masked hypertension and to look for variation in blood pressure, which may otherwise be difficult to diagnose by office blood pressure. Persistent home blood pressure levels more than 135/85 mm Hg should be investigated further and treatment initiated.

MANAGEMENT

Treatment should be initiated after risk stratification (Table 3).

- In low- and medium-risk condition
 - Lifestyle modification is started initially and frequently reassessed. If blood pressure target is not achieved, pharmacologic therapy is initiated.
- In high- and very high-risk conditions
 - Lifestyle modification and drug therapy are initiated simultaneously to achieve rapid control of blood pressure.
- Hypertension management includes lifestyle modification and drug therapy.
- Annual follow-up of patients with high normal blood pressure is recommended as 10% develop hypertension each year.

Lifestyle Modification

- Weight reduction:** Significant decrease in blood pressure is observed following weight reduction in obese or overweight individuals with hypertension.
- Physical exercise:** Aerobic physical exercise for 20–30 minutes per day for at least 5 days per week improves blood pressure and reduces cardiovascular morbidity.
- Quit smoking:** Tobacco abuse in any form is found to increase blood pressure.
- Decrease alcohol use:** Moderation of alcohol consumption is advised.

TABLE 3 | Risk stratification of patients with hypertension

Stage	Other risk factors and disease history	Blood pressure (mm Hg)		
		Stage 1	Stage 2	Stage 3 (severe hypertension)
		SBP 140–159 or DBP 90–99	SBP 160–179 or DBP 100–109	SBP ≥ 180 or DBP ≥ 110
I	No other risk factors	Low-risk	Medium risk	High-risk
II	1–2 risk factors	Medium risk	Medium risk	Very high-risk
III	Three or more risk factors or TOD or diabetes	High-risk	High-risk	Very high-risk
IV	Comorbid-conditions: diabetes mellitus, CKD, CAD, CVD	Very high-risk	Very high-risk	Very high-risk

Risk strata (typical 10-year risk of stroke or myocardial infarction):

Low-risk = less than 15%
 Medium risk = about 15–20%
 High-risk = about 20–30%
 Very high-risk = 30% or more

Source: Indian guidelines for hypertension by API.¹

Abbreviations: SBP, Systolic blood pressure; DBP, Diastolic blood pressure; TOD, Target organ damage; CKD, Chronic kidney disease; CAD, Coronary artery disease; CVD, Cardiovascular disease

Dietary Modification

- Low sodium diet:** No added salt diet is usually advocated in hypertensives. Typical Indian food provides 4–5 gm of sodium per day. Pickles, salted vegetables and canned fish are rich in sodium and should be avoided. Intake of 2.3 gm of sodium or less is recommended as per dietary approaches to stop hypertension (DASH) (Table 4).⁶
- Diet rich in vegetables and fruits:** These are rich in potassium content and improve blood pressure.
- Low fat content:** Diet low in saturated fats should be used.

Drug Therapy

Drug therapy is initiated when:

- Lifestyle modification alone is not sufficient to achieve the target blood pressure.

- Rapid control of blood pressure is needed as in urgencies and emergencies.

Class of Antihypertensives Used (Table 5)

- Angiotensin converting enzyme (ACE) inhibitors
- Angiotensin receptor blockers (ARBs)
- Calcium channel blockers
- β -blockers
- Diuretics
- α -blockers
- Centrally acting drugs.

TABLE 4 | Dietary approaches to stop hypertension (DASH) diet

Daily Nutrient Goals used in the DASH Studies (for a 2,100 Calorie Eating Plan)

Total fat	27% of calories	Sodium	2,300 mg*
Saturated fat	6% of calories	Potassium	4,700 mg
Protein	18% of calories	Calcium	1,250 mg
Carbohydrate	55% of calories	Magnesium	500 mg
Cholesterol	150 mg	Fiber	30g

* 1,500 mg sodium was a lower goal tested and found to be even better for lowering blood pressure. It was particularly effective for middle-aged and older individuals. African Americans, and those who already had high blood pressure.

Source: Adapted from Dietary approaches to stop hypertension (DASH) eating plan, National Heart, Lung and Blood Institute (NHLBI), National Institutes of Health (NIH).⁶

TABLE 5 | Class of antihypertensives

Class	Examples	Indicated in	Contraindications	Adverse effects
ACE inhibitors	Enalapril Ramipril Lisinopril Perindopril	<ul style="list-style-type: none"> • Young individuals • Hyperreninemic hypertension • Diabetes • Post MI 	<ul style="list-style-type: none"> • Renal failure • Hyperkalemia • Renal artery stenosis • Pregnancy and lactation 	<ul style="list-style-type: none"> • Dry cough • Hyperkalemia
ARBs	Losartan Telmisartan Olmesartan Valsartan	<ul style="list-style-type: none"> • Young individuals • Hyperreninemic hypertension • Diabetes • Post MI • ACE-induced cough 	<ul style="list-style-type: none"> • Renal failure • Hyperkalemia • Renal artery stenosis • Pregnancy and lactation 	
β -blockers	Metoprolol Nebivolol Atenolol Bisoprolol	<ul style="list-style-type: none"> • Young individuals • Associated coronary artery disease 	<ul style="list-style-type: none"> • Asthma • Conduction blocks • Peripheral vascular disease 	<ul style="list-style-type: none"> • Impotence
Calcium Channel blockers	Amlodipine Nifedipine Cilnidipine Verapamil Diltiazem	<ul style="list-style-type: none"> • Elderly • Isolated systolic hypertension 	<ul style="list-style-type: none"> • Conduction blocks for verapamil and diltiazem 	<ul style="list-style-type: none"> • Pedal edema • Flushing
Diuretics	Hydrochlorothiazide Indapamide Amiloride Spironolactone	<ul style="list-style-type: none"> • Heart failure • Isolated systolic hypertension 	<ul style="list-style-type: none"> • Gout and dyslipidemia 	<ul style="list-style-type: none"> • Gout
α -blockers	Prazosin Terazosin	<ul style="list-style-type: none"> • Elderly with BPH 		<ul style="list-style-type: none"> • Postural hypotension
Centrally acting drugs	α -methyl dopa Clonidine Hydralazine	<ul style="list-style-type: none"> • Resistant hypertension • Pregnancy 		<ul style="list-style-type: none"> • Postural hypotension • Rebound hypertension

Abbreviations: ACE, Angiotensin converting enzyme; ARBs, Angiotensin receptor blockers; MI, Myocardial infarction; BPH, Benign prostatic hyperplasia

Change of Medications

Antihypertensive drugs are generally well tolerated when selected properly. Nevertheless some patients do require change in the antihypertensive medication in following circumstances:

- If adequate blood pressure is not achieved by a drug, a new class of drug may be added or drug may be changed
- In cases of adverse reactions.

Maintenance Therapy and Reassessment (Flow chart 1)

Drug combinations

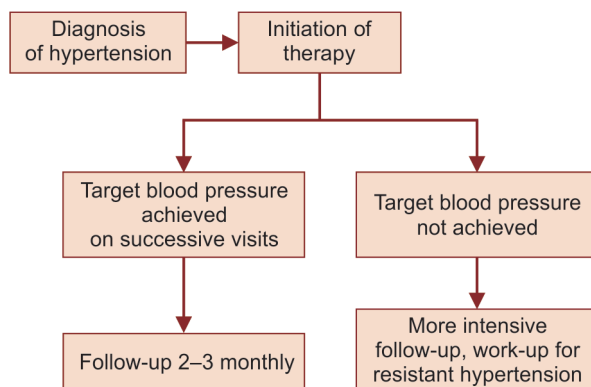
- Fixed drug combinations should be avoided in the initial stages till optimal control is achieved as fine adjustment in dosage of individual components may be required.
- Once the patient is on a stable maintenance dose of drugs, combination therapy may be used to improve compliance.
- Some drug combinations should be avoided:
 - Two drugs of same class
 - *Diuretics with β -blockers*: Reported to increase incidence of new onset diabetes mellitus
 - *β -blockers with verapamil*: Precipitates conduction blocks.

Special Situations

Hypertension in Heart Disease

- ACE inhibitors or ARBs are the drugs of choice in chronic heart failure. They also prevent remodeling of the ventricles along with control of blood pressure.

Flow chart 1: Maintenance therapy and reassessment



- Beta-blockers are used in hypertensives with ischemic heart disease. Cardio selective beta-blockers like metoprolol and bisoprolol are preferred. They are contraindicated in acute heart failure.
- In cases with fluid overload diuretics may be used.

Hypertension in Kidney Disease

- Patients with chronic kidney disease have elevated blood pressure and it is difficult to control.
- Sodium and water retention in end stage renal disease causes elevation of blood pressure.
- Any decrease in blood pressure is beneficial⁷ and a blood pressure below 125/75 mm Hg is generally targeted.
- Dietary restriction of sodium forms an integral part of management.
- ACE inhibitors and ARBs are generally initiated in initial stages of kidney disease with proteinuria but normal creatinine levels. Therapy with ACE inhibitors and ARBs is associated with a rise in serum creatinine and potassium levels. Although there is no single cut off creatinine level for stopping ACE inhibitors, rise of serum creatinine by more than 30% on initiation of treatment should prompt to stop the therapy or decrease the dose.⁸ Serum creatinine and potassium must be monitored at day 3, 7 and after 3 weeks.⁸ Thereafter it should be monitored once in 2-3 months.
- Thiazides, calcium channel blockers, α -blockers, clonidine have all been used in the treatment of hypertension in chronic kidney disease and most of the patients would end up in combination of two or more drugs to achieve the target blood pressure.

Hypertension in Pregnancy

- Systemic vasodilation generally decreases both systolic and diastolic blood pressure by 10 mm Hg during pregnancy. Diastolic blood pressure of 90 mm Hg or more needs urgent attention and treatment in pregnancy.
- Hypertension developing after 20 weeks of gestation in pregnant lady is termed pregnancy-induced hypertension.
- Hypertension that is present before 20 weeks or after 6 weeks postpartum is chronic hypertension in pregnant women. If the blood pressure goes above 30 mm Hg systolic or 15 mm Hg diastolic above baseline then a diagnosis of pre-eclampsia can be made. Development of proteinuria or edema is also considered as pre-eclampsia.
- ACE inhibitors, ARBs and diuretics are contraindicated in pregnancy. Calcium channel blockers, beta-blockers, α - and

β -blocker (labetalol), α -methyldopa are considered safe during pregnancy.

- In severe pre-eclampsia and eclampsia, intravenous magnesium sulfate is also used.

Hypertension in Diabetes Mellitus

- Diabetes is the most common comorbid condition in hypertension and its incidence is increasing.
- The blood pressure target in diabetic individuals is less than 130/85 mm Hg, which was found to have a better cardiovascular outcome.
- Lifestyle modification form important aspect in the treatment of either disease and should be stressed upon.
- Use of ACE inhibitors and ARBs is preferred over other drugs in diabetic hypertensive as it also decreases proteinuria.
- Combination of diuretics with β -blockers was shown to increase the incidence of new onset diabetes mellitus.
- Use of β -blocker alone is also a relative contraindication because of incidence of hypoglycemic unawareness.

Hypertension in Elderly

- A false elevation of blood pressure is seen in elderly patients due to vessel wall thickening.
- Pseudohypertension if suspected may be clinically confirmed by Osler's maneuver; if doubts still present intra-arterial blood pressure monitoring is confirmatory.⁹
- Isolated systolic hypertension is more common in elderly patients.⁴
- Elderly patients are more prone to develop postural hypotension.
- Thiazide is recommended as initial therapy of hypertension in elderly. Recently higher incidence of thiazide-induced hyponatremia has been reported in elderly.
- Calcium channel blockers are safe in elderly and are drugs of choice in isolated systolic hypertension.
- Rapid control of blood pressure is associated with increased incidence of postural hypotension; hence, blood pressure should be slowly controlled by gradually adjusting dose of antihypertensive medications.¹⁰
- α -blockers are preferred in the management of hypertension in elderly patients with benign prostatic hyperplasia.

Hypertensive Emergencies

- Presence of high blood pressure (more than 180/110 mm Hg) associated with target organ damage constitutes hypertensive emergencies.
- Malignant hypertension (presence of papilledema), hypertensive encephalopathy, acute left ventricular failure, intracerebral or subarachnoid hemorrhage, acute myocardial infarction and aortic dissection constitute hypertensive emergencies.
- There is a need to treat these conditions rapidly and control the blood pressure.
- Intravenous nitroprusside is used in malignant hypertension and aortic dissection. Intensive monitoring and titration of the dose is required in such situation.
- Intravenous nitroglycerine is used in acute left ventricular failure.
- Newer drugs like esmolol, IV enalaprilat and IV diuretics are used in other conditions.

Hypertensive Urgencies

- High blood pressure without evidence of target organ damage constitutes hypertensive urgencies.
- Rapid initiation of treatment with controlled reduction of blood pressure should be done in such situations.

- Clonidine and calcium channel blockers are used in such situations.

Resistant Hypertension

- It is defined as inability to achieve a target blood pressure in a patient receiving full doses of three antihypertensive medications, and one of which should be a diuretic for at least 3 weeks (thiazide diuretic requires 3 weeks for full antihypertensive effect).
- Secondary causes of hypertension should be ruled out in patients with resistant hypertension. Endocrine disorders, renal artery stenosis, steroid abuse, excessive dietary salt intake, drugs like tacrolimus, cyclosporine, sympathomimetics and oral contraceptives should be looked for in cases with resistant hypertension.

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