36 *Indian Hypertension Guidelines-2007*

EXECUTIVE SUMMARY
CORE COMMITTEE GROUP

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Objective: The primary aim of these guidelines is to offer balanced information to guide clinicians, rather than rigid rules that would constrain their judgment, on the management of individual patients who will differ in their personal, medical, social, economic, ethnic and clinical characteristics.

Methodology: The first Indian guidelines were formulated by a core committee who, in turn, were supported by a working group. The document was then circulated to 250 doctors whose inputs were incorporated in the final version. The updated guidelines have also been spearheaded by a core committee. There have been three meetings at which the evidence since 2001 and the US, European, British and WHO guidelines were reviewed. Relevant portions of the first Indian guidelines were revised. New data from the latest gold standard clinical trials was added as well as data from Indian studies where applicable. Once the document was drafted, it was circulated to a group of 25 reviewers. The final document has been endorsed by the ICP, CSI, HSI, ISN and IMA.

Definition

Hypertension in adults aged 18 years and older is defined as systolic blood pressure (SBP) of 140 mmHg or greater and/or diastolic blood pressure (DBP) of 90 mmHg or greater or any level of blood pressure in patients taking antihypertensive medication.

- Because BP is characterized by large spontaneous variations, the diagnosis of hypertension should be based on multiple BP measurements taken on several separate occasions. Definitions are given in Table 36.1 above for subjects not taking antihypertensive medication.
- Measurement of blood pressure outside the clinic may provide valuable information for the initial evaluation of patients with hypertension and for monitoring the response to treatment. In some patients, office (or clinic) is persistently elevated whereas daytime BP outside the clinic environment is normal. Home measurement can distinguish sustained hypertension from "white-coat hypertension".

Table 36.1: Classification of blood pressure for adults aged 18 and older*

Category	*Systolic (mmHg)*		*Diastolic (mmHg)*
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
Isolated systolic hypertension (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 mmHg. 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.

Table 36.2: Hypertension in Urban Indian population per casual screening blood pressure

Authors	*Place*	*Year*	*Age group years*	*Hypertension Criteria mmHg*	***Prevalence*** *Men* %	*Sample size*	*Women* %	*Sample size*
Mathur	Agra	1963	> 20	≥ 160/95	3.98	(1408)	6.64	(227)
Malhotra	Railways	1970	20-58	≥ 160/95	6.2[a]	(2638)	15.2[b]	(1594) -
Gupta SP	Rohtak	1978	> 20	≥ 160/95	6.00	(1151)	7.00	(872)
Dalal	Bombay	1980	> 18	Variable	15.63	(3148)	15.38	(2575)
Wasir	New Delhi	1984	20-60	≥ 160/95	3.80	(1767)	1.45	(688)
Ahmed	Mumbai	1988	> 21	DBP > 90	10.20	(698)	2.00	(102)
Hussain	Rajasthan	1988	20-> 60	≥ 140/90	6.15	(1561)	7.33	(1103)
Chaddha	New Delhi	1990	25-64	≥ 160/90	11.66	(637)	13.68	(7351)
Gupta R	Jaipur	1995	> 20	≥ 140/90	30.00	(1415)	34.00	(797)
Anand*	Mumbai	2000	28-65	≥ 140/90*	26.78	(1512)	27.65	(141)
Shanthirani	Chennai	2003	> 20	≥ 140/90	22.8	(557)	19.7	705
Gupta R	Jaipur	2002	≥ 20	≥ 140/90	36.36%	550	37.52%	573
Bharucha	Bombay	2003	≥ 20	≥ 140/90	36.4%		(2879)	
Zachariah	Kerala	2003	40-60	JNC VI-WHO	56.3%	163	52.3%	151
Gupta PC	Mumbai	2004	≥ 35	≥ 140/90	47.5%	(35423)	48.4%	(53230)
Gupta R	Jaipur	2004	≥ 20	≥ 140/90	51.3%	226	51.7%	232
Deepa	Chennai	2004	≥ 20	≥ 140/90, known hypertensives, or on antihyper-tensive treatment	22.1%		(1262)	

Ashavaid	Mumbai	2004		≥ 140/90 (medical record screening)	22.5%	(39,940)

[a]North Indians
[b]South Indians
*Diagnosis of hypertension based on the average of three readings on the 2nd occasion after the initial screening

EPIDEMIOLOGY (Tables 36.2 and 36.3)

Table 36.3: Hypertension in Rural Indian population as per casual screening blood pressure

Authors	*Place*	*Year*	*Age group years*	*Hypertension Criteria mmHg*	***Prevalence*** *Men*		*Women*	
					%	*Sample size*	*%*	*Sample size*
Gupta SP	Haryana	1977	20-69	≥ 160/95	3.50	(1154)	3.69	(891)
Wasir	Delhi	1983	> 20	≥ 160/95	3.20	(441)	7.50	(464)
Baldwa	Rajasthan	1984	21-60	≥ 141/91	6.93	(447)	8.81	(465)
Puri	Himalayas	1986	15-82	≥ 160/95	2.44	(1592)	2.38	(1511)
Hussain	Rajasthan	1988	20->60	≥ 140/90	5.72	(1328)	6.43	(1150)
Kumar	Rajasthan	1991	> 21	≥ 160/95	4.00	(3742)	3.60	(3098)
Joshi	Maharashtra	1993	> 16	≥ 160/95	4.85	(227)	3.17	(221)
Jajoo	Maharashtra	1993	> 20	≥ 160/95	2.89	(2247)	4.06	(1798)
Agarwal		1994	> 20	≥ 160/95	1.57	(3760)		
Malhotra	Haryana	1999	16-70	≥ 140/90	3.00	(2559)[#]	5.80	
Hazarika	Assam	2003[$]	≥ 60	JNC-VI	64.2	(50)	62.89	(388)
Hazarika	Assam	2004	≥ 30	JNC-VI	33.3		3180	
Thankappan	Kerala	2006	≥ 30	JNC VII	36	(2159)	37.2	(2796)

[#]Total sample size for men and women

[$]NOT SPECIFIED URBAN/RURAL

Cardiovascular diseases caused 2.3 million deaths in India in the year 1990; this is projected to double by the year 2020. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India. There is a strong correlation between changing lifestyle factors and increase in hypertension in India. The nature of genetic contribution and gene-environment interaction in accelerating the hypertension epidemic in India needs more studies. Pooling of epidemiological studies shows that hypertension is present in 25% urban and 10% rural subjects in India. At an underestimate, there are 31.5 million hypertensives in rural and 34 million in urban populations. A total of 70% of these would be Stage I hypertension (systolic BP 140-159 and/or diastolic BP 90-99 mmHg).

According to a recent review on "the global burden of hypertension", the estimated prevalence of hypertension (in people aged 20 years and older) in India in 2000 was 20.6% among males and 20.9% among females and is projected to increase to 22.9 and 23.6% respectively in 2025. The estimated total number of people with hypertension in India in 2000 was 60.4 million

males and 57.8 million females and projected to increase to 107.3 million and 106.2 million, respectively, in 2025.

There are multiple single center studies on prevalence of hypertension available from across the country. However, there is no multicentric national prevalence data. The various epidemiological studies published from India over last 5 decades are tabulated in the Table 36.2. A review of this data shows that prevalence of hypertension has progressively increased over last 5 decades, in urban as well as rural India.

Majority of these studies have shortcomings, in that, they have used differing examination techniques, differing diagnostic criteria and only screening blood pressure values for defining hypertension. The fact that hypertension is a major health problem in our country calls for large, nationwide, multi-centric, prospective and supervised epidemiological studies.

In India and its surrounding countries, awareness level for hypertension is $\leq$ ”45%. Only half of these are on treatment, and adequacy of control of blood pressure is very poor and in one such study, it has been observed in < 10% of the total hypertensive population. Thus, there is a need to increase awareness, detection and adequate control of blood pressure.

Table 36.4: Blood pressure thresholds (mmHg) for definition of hypertension with different types of measurement

	SBP	*DBP*
Office or clinic	140	90
Home (self)	135	85
ABPM (24-hour average)	125	80

SBP: Systolic Blood Pressure; **DBP:** Diastolic Blood Pressure

EVALUATION

Measurement of Blood Pressure

- Blood pressure (BP) is characterized by large spontaneous variations. Therefore, the diagnosis of hypertension should be based on multiple BP measurements taken on several separate occasions.
- Standard mercury sphygmomanometer should be used. Use a standard cuff with a bladder that is 12 cm × 35 cm. Use a large bladder for fat arms and a small bladder for children. The bladder should encircle and cover two-thirds of the length of the arm. Proper maintenance and calibration of the sphygmomanometer should be ensured. Whenever aneroid sphygmomanometer is used, its accuracy should be checked against standard mercury sphygmomanometer at regular intervals.
- For measurement, inflate the bladder quickly to a pressure 20 mmHg higher than the point of disappearance of the radial pulse. Deflate the bladder slowly by 2 mmHg every second.
- The first appearance of the sound (Phase I Korotkoff) is the systolic BP. The disappearance of the sound (Phase V Korotkoff) is the diastolic BP. For children and in those with high output states, muffling of the sound (Phase IV Korotkoff) is taken as diastolic pressure.

PRECAUTIONS

- At the initial visit, an average of three readings, taken at intervals of 2-3 minutes, should be recorded.
- For confirmation of diagnosis of hypertension, record at least 3 sets of readings on different occasions, except in Stage III hypertension.
- Patients should be asked to refrain from smoking or drinking tea/coffee, exercise for at least 30 minutes before measuring the BP.

- Allow the patient to sit for at least five minutes in a quiet room before beginning blood pressure measurement.
- Measurement should be done preferably in a sitting or supine position. Patient's arm should be fully bared and supported at the level of the heart.
- Measure the blood pressure in both arms at the first visit and use higher of the two readings.
- In older persons aged 60 years and above, in diabetic subjects and patients on anti-hypertensive therapy, the BP should be measured in both, supine/sitting and in standing positions to detect postural hypotension.
- If atrial fibrillation is present, additional readings may be required to estimate the average SBP and DBP.
- Occasionally, thigh BP (popliteal) has to be measured with appropriately large cuff, especially in younger persons with hypertension. Normally thigh SBP is higher and DBP a little lower than the arm BP because of the reflected pulse wave. This is important for suspected coarctation and non-specific aortoarteritis.

Table 36.5: Factors influencing risk

Risk factors for cardiovascular disease	*Target organ damage (TOD)*	*Associated clinical conditions (ACC)*
• Age > 55 years • Male sex • Post-menopausal women • Smoking and tobacco use • Diabetes mellitus • Family history of premature CAD (Males < 55 years, Female < 65 years) • Increased Waist hip ratio, High LDL or total cholesterol, Low HDL cholesterol and High triglycerides • High sensitivity C-reactive protein (HS-CRP) and homocysteine levels might evolve as markers for high risk of vascular damage • Estimated GFR < 60 mL/min	• Left ventricular hypertrophy detected by ECG and/or echocardiogram • Microalbuminuria/proteinuria and/or elevation of serum creatinine (1.2-2.0 mg/dl) • Urinary ACR (albumin creatinine ratio) • Ultrasound or radiological evidence of atherosclerotic plaques in the carotids • Hypertensive retinopathy	• Cerebrovascular disease – Ischemic stroke – Cerebral hemorrhage – Transient ischemic attack • Heart disease – Myocardial infarction – Angina – Coronary revascularization – Congestive heart failure • Renal disease – Diabetic nephropathy – Renal failure (serum creatinine > 2.0 mg/dl) • Vascular disease – Peripheral arterial disease including non-specific aortoarteritis – Aortic dissection • Advanced hypertensive retinopathy – Hemorrhages or exudates
– Papilledema		

Table 36.6: Risk Stratification

Blood pressure (mmHg)				
Other risk factors and disease history		*Stage 1*	*Stage 2*	*Stage 3 (severe hypertension)*
		SBP 140-159 or DBP 90-99	SBP 160-179 or DBP 100-109	SBP $\geq$ 180 or DBP $\geq$ 110
I	No other risk factors	Low risk	Medium risk	High risk
II	1-2 risk factors[a]	Medium risk	Medium risk	Very high risk
III	3 or more risk factors or TOD[b] or diabetes	High risk	High risk	Very high risk
IV	ACC[c]	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
[a]See Table 36.5
[b]TOD: Target organ damage – see Table 36.5
[c]ACC: Associated clinical conditions, including clinical cardiovascular disease or renal disease—see Table 36.5.

Home BP Measurement

Home measurement has the advantage that it distinguishes sustained hypertension from "white-coat hypertension", a condition noted in patients whose blood pressure is elevated in the physician's clinic but normal at other times.

Ambulatory Blood Pressure Monitoring

Ambulatory blood pressure monitoring (ABPM) has been found to be clinically useful in the following settings: to identify non-dippers and white-coat hypertension, evaluate drug resistant hypertension, episodic hypertension, evaluate antihypertensive drugs and in individuals with hypotensive episodes while on antihypertensive medication.

Early morning surge in BP for 3 or more hours during transition from sleep to wakefulness can be an independent risk factor and needs to be managed effectively.

Table 36.4: Blood pressure thresholds (mmHg) for definition of hypertension with different types of measurement

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Home (self)	135	85
ABPM (24-hour average)	125	80

SBP: Systolic Blood Pressure; **DBP:** Diastolic Blood Pressure

EVALUATION

In addition to detailed medical history and comprehensive physical examination, the following investigations should be done:

- Routine
  - Urine examination for protein and glucose and microscopic examination for RBCs and other sediments.
- Hemoglobin, fasting blood glucose, serum creatinine, potassium and total cholesterol.
  - 12-lead electrocardiogram.
- Additional investigations in special circumstances can include:
  - Fasting lipid profile and uric acid.
- Echocardiogram.
- Other specific tests to rule out secondary causes of hypertension where there is a high index of suspicion.
- At the present state, tests for HS-CRP, serum homocysteine levels and microalbuminuria are not recommended for clinical use.
- The cost of investigations in the context of the needs of an individual patient and resources available is an important consideration. In patients with essential hypertension where there is a resource crunch, one may be required to initiate therapy without carrying out any laboratory investigations.

Factors Influencing Risk

Decisions about management of patients with hypertension should not be made on their BP alone, but also on the presence of other risk factors, target organ damage, associated clinical conditions, as well as on other aspects of the patients personal, medical and social situations as shown in (Table 36.5) and also stratifying the risk as shown in (Table 36.6).

MANAGEMENT OF HYPERTENSION

Goals of Therapy

- The primary goal of therapy of hypertension should be effective control of BP to prevent, reverse or delay the progression of complications and thus reduce the overall risk of an individual without adversely affecting the quality of life.
- Antihypertensive therapy should achieve and maintain SBP below 140 mmHg and DBP below 90 mmHg and lower, if tolerated, while controlling other modifiable risk factors.
- Gradual reduction of BP to the optimal level over a period of 2-6 months is a prudent therapeutic goal except in stage 3 hypertension.

Threshold of Therapy and Level of Control

- Recent evidence suggests that the level of SBP control correlates better with reduction of mortality than the level of DBP control. Impressive evidence has accumulated to warrant greater attention to the importance of SBP as a major risk factor for CVDs.
- The earlier concern that lowering DBP too much may increase the risk of coronary events by lowering diastolic perfusion pressure in coronary circulation (J-curve hypothesis) has not been supported by recent studies.
- Gradual reduction of BP is a prudent therapeutic approach except in stage 3 hypertension.
- In Hypertension Optimal Treatment (HOT) study (target diastolic pressure less than 90, 85 or 80 mmHg) there was no increase in cardiovascular risk in patients randomized to the lowest target group (DBP < 80 mmHg).
- Among diabetic patients participating in the HOT study, there was a significantly lower risk of CAD in patients with the lowest target DBP group.
- The results of United Kingdom Prospective Diabetes Study (UKPDS) demonstrated that a tight control of BP (average achieved: 144/82 mmHg) in diabetic patients conferred a substantial reduction in the risk of CAD compared to a less tight control of BP (average achieved: 154/87 mmHg).
- The PROGRESS trial showed that, in patients with a history of stroke or TIA, stroke risk was reduced not only in participants classified as hypertensive, but also among those classified as non-hypertensive, among whom the mean blood pressure at entry was 136/79 mmHg.
- In view of the above studies, it would seem desirable to achieve optimal or normal BP in young and middle aged. In diabetic subjects (below 130/80 mmHg), or patients with stroke (below 130/85 mmHg) and at least high normal BP in elderly patients (below 140/90 mmHg). Antihypertensive therapy should achieve and maintain SBP below 140 mmHg and DBP below 90 mmHg and lower if tolerated, while controlling other modifiable risk factors.

How to Proceed?

- In low risk patients, institute lifestyle modifications and observe BP for a period of 3 months, before deciding whether to initiate drug therapy.
- In medium risk patients, institute lifestyle modifications and monitor BP on a monthly basis. If after a period of 2-3 months, BP remains above 140/90, then initiate drug therapy.
- In high and very high-risk groups, initiate immediate drug treatment for hypertension and other risk factors.

Non-Pharmacologic Therapy

Lifestyle measures should be instituted in all patients including those who require immediate drug treatment (Table 36.7).

Pharmacologic Treatment

- Achieve gradual reduction of blood pressure. Use low doses of antihypertensive drugs to initiate therapy.
- Five classes of drugs can be recommended as first line treatment for stage 1-2 hypertension. These include: 1) diuretics, 2) beta-blockers, 3) calcium channel blockers, 4) ACE inhibitors, 5) angiotensin II receptor blockers.
- With regard to lowering of blood pressure, all these five classes are equally effective.
- The Blood Pressure Lowering Treatment Trialists' Collaboration concluded that treatment with any commonly used regimen reduces the risk of total major cardiovascular events, and larger reductions in blood pressure produce larger reductions in risk.
- Low dose diuretics may be preferred as initial therapy unless there are compelling or specific indications for other classes.
- Choice of an antihypertensive agent is influenced by age, concomitant risk factors, presence of target organ damage, other co-existing diseases, socioeconomic considerations, availability of the drug and past experience of the physician.
- Combining low doses of two drugs having synergistic effect is likely to produce lesser side effects. In 60-70% of patients, goal blood pressure will be achieved with two or more agents only.
- Use of fixed dose formulations may be considered to improve compliance.
- If a diuretic is not chosen as the first drug, it is usually indicated as a second step agent because its addition enhances the effects of other agents except dihydropyridine calcium channel blockers.
- Use of long acting drugs that provide 24-hour efficacy with once daily administration ensures smooth and sustained control of blood pressure; which in turn is expected to provide greater protection against the risk of major cardiovascular events and target organ damage. Once daily administration also improves patient compliance.
- Although antihypertensive therapy is generally lifelong, an effort to decrease the dosage and number of antihypertensive drugs should be considered after effective control of hypertension (step-down therapy).
- Due to a greater seasonal variation of temperatures in India, marginal alterations in dosages of drugs may be needed from time to time.
- If addition of a second agent controls blood pressure satisfactorily, an attempt to withdraw the first agent may be considered.

Table 36.8 presents guidelines for selecting the most appropriate dose of antihypertensive drugs.

An algorithm for combining antihypertensive drugs is given in Figure 36.1. An algorithm for maintenance and follow up of drug therapy is given in Figure 36.2. The undesirable combinations are given in Table 36.9. The main complications of hypertension are shown in Table 36.10.

Table 36.7: Lifestyle interventions for blood pressure reduction

Intervention	*Recommendation*	*Expected Systolic blood pressure reduction (range)*
Weight reduction	Maintain ideal body mass index Below 23 kg/m^2	5-20 mmHg per 10 kg weight loss
DASH eating plan	Consume diet rich in fruit, vegetables, low-fat dairy products with reduced content of saturated and total fat	8-14 mmHg

Dietary sodium restriction	Reduce dietary sodium intake to < 100 mmol/day (< 2.4 g sodium or < 6 g sodium chloride)	2-8 mmHg
Physical activity	Engage in regular aerobic physical activity, for example, brisk walking for at least 30 min most days	4-9 mmHg
Alcohol moderation	Men ≤ 60 ml per day, twice a week Women ≤ 30 ml per day, twice a week. Abstinence is preferred	2-4 mmHg
Tobacco	Total abstinence	—

DASH = Dietary Approaches to Stop Hypertension

Table 36.8: Guidelines for selecting drug treatment of hypertension

Class of drugs	*Definite indications*	*Possible indications*	*Definite contraindications*	*Relative contraindications*
Diuretics	– Heart failure – Elderly patients – Systolic hypertension	– Diabetes	– Gout	– Dyslipidemia
Beta-blockers	– Angina – Post-myocardial infarction – Tachyarrhythmia – Heart failure	– Pregnancy – Diabetes – Heart block[a]	– Asthma and chronic obstructive pulmonary disease – Heart block[a]	– Dyslipidemia – Physically active – Peripheral vascular disease
CCBs	– Angina – Elderly – Systolic hypertension – Diabetes	– Peripheral vascular disease – CVA	– Heart block[b]	– Congestive heart failure[c]
ACE inhibitors	– Heart failure – Left ventricular dysfunction – Post-myocardial infarction – Significant proteinuria – Diabetes	CVA	– Pregnancy and lactation – Bilateral renal artery stenosis – Hyperkalemia	– Moderate renal failure (Creatinine levels > 3 mg/dl)
Angiotensin II Receptor Blockers (ARBs)	– ACE inhibitor cough	– Heart failure – CVA failure	– Pregnancy and lactation – Bilateral renal artery stenosis – Hyperkalemia	– Moderate renal failure (Creatinine levels > 3 mg/dl)
Alpha-blockers	– Prostatic hypertrophy	– Glucose intolerance – Dyslipidemia	—	– Orthostatic hypotension

[a]Grade 2 or 3 atrioventricular block
[b]Grade 2 or 3 atrioventricular block with verapamil or diltiazem
[c]Verapamil or diltiazem

Fig. 36.1: Algorithm for recommended drug combination

*Combination therapy involving B and D may induce more new onset diabetes compared with other combination therapies.

Table 36.9: Undesirable combinations

- Low dose diuretics and calcium channel blockers
- Beta-blocker and ACE inhibitor
- Beta-blocker and verapamil/diltiazem
- Two drugs from the same class

Table 36.10: Complications of hypertension

COMPLICATIONS
Hypertensive heart diseases
• Left ventricular hypertrophy, increased risk
• Of coronary artery disease, arrhythmias, congestive cardiac failure and sudden death.
Kidney
• Microalbuminuria, overt proteinuria progressing to end stage renal disease
Cerebrovascular disease
• All types of athrothrombotic stroke and intracerebral
• Hemorrhage
Retina
• Grade I, II, III and IV retinopathy
Large vessel disease
Peripheral arterial occlusion causing:
1. Aortic aneurysms
2. Aortic dissection.