HYPERTENSION
7TH JOINT NATIONAL COMMITTEE ON HYPERTNSION

Need for JNC 7

(1) publication of many new hypertension observational studies and clinical trials
(2) need for a new, clear, and concise guideline that would be useful for clinicians
(3) need to simplify the classification of blood pressure
(4) clear recognition that the JNC reports were not being used to their maximum benefit

Classification of Hypertension

-Classification of BP for adults ages 18 and older.
-The classification is based on the average of two or more properly measured seated BP readings on each of two or more office visits.

BP Classification	SBP* mmHg	DBP* mmHg
Normal	<120	and <80
Prehypertension	120-139	or 80-89
Stage 1 Hypertension	140-159	or 90-99
Stage 2 Hypertension	>160	>100

Cardiovascular disease risk

-As the population ages, the prevalence of hypertension increases unless broad and effective preventive measures are implemented.
-Individuals who are normotensive at age 55 have a 90 percent lifetime risk for developing hypertension.
-The relationship between BP and risk of CVD events is continuous, consistent, and independent of other risk factors.

The higher the BP, the greater is the chance

- ✓ Heart attack
- ✓ Heart failure
- ✓ Stroke
- ✓ Kidney disease.

-For individuals 40–70 years of age, across the entire BP range from 115/75 to 185/115 mmHg each increment of 20 mmHg SBP or 10 mmHg in DBP doubles the risk of CVD.
-The classification "prehypertension,", recognizes this relationship and signals the need for increased education of health care professionals and the public to reduce BP levels and prevent the development of hypertension in the general population.

Hypertension prevention strategies are available to achieve this eg Lifestyle Modifications

Benefits of lowering the Blood pressure

-Antihypertensive therapy has been associated with reductions

- stroke incidence by 35–40%
- myocardial infarction 20–25%

Blood pressure control rates

-Goal blood pressure treatment in hypertension is BP below 140/90 mmHg or below 130/80 mmHg for patients with diabetes or chronic kidney disease.
-In the majority of patients, controlling systolic hypertension has been considerably more difficult than controlling diastolic hypertension.
-Systolic hypertension is a more important CVD risk factor than DBP except in patients younger than age 50 years. It also occurs much more commonly in older persons.
-Effective BP control can be achieved in most patients who are hypertensive, but the majority will require two or more antihypertensive drugs.
-Challenges in BP control

- Patient compliance to drug intake
- clinicians fail to prescribe lifestyle modifications
- Inappropriate antihypertensive drug doses
- Inappropriate antihypertensive drug combinations

Accurate blood pressure measurement in the office

-The auscultatory method of BP measurement with a properly calibrated and validated instrument should be used.
-Persons should be seated quietly for at least 5 minutes in a chair (rather than on an exam table), with feet on the floor, and arm supported at heart level.
-Measurement of BP in the standing position is indicated periodically, especially in those at risk for postural hypotension.
-An appropriate-sized cuff (cuff bladder encircling at least 80 percent of the arm) should be used to ensure accuracy.
-At least two measurements should be made. SBP is the point at which the first of two or more sounds is heard phase 1), and DBP is the point before the disappearance of sounds (phase 5).
-Clinicians should provide to patients, verbally and in writing, their specific BP numbers and BP goals.

PATIENT EVALUATION

History

1.To assess lifestyle and identify cardiovascular risk factors

Major risk factors

Modifiable

- ✓ Hypertension
- ✓ Cigarette smoking
- ✓ Hyperlipidaemia
- ✓ Diabetes mellitus

Non-modifiable factors

- ✓ Age (older than 55 for men, 65 for women)
- ✓ Family history of premature cardiovascular disease(men under age 55 or women under age 65)
- ✓ Male gender

Minor risk factors

- ✓ Obesity* (body mass index ≥30 kg/m$_2$)
- ✓ Physical inactivity
- ✓ Microalbuminuria or estimated GFR <60 mL/min
- ✓ Stress type A personality
- ✓ Low HDL
- ✓ Post menopausal estrogen deficiency

- heart failure >50 %

(2) To reveal identifiable causes of high BP
- ✓ Chronic kidney disease
- ✓ Endocrine causes
  - -Primary aldosteronism
  - - Pheochromocytoma
  - -Thyroid or parathyroid disease
  - -Cushings syndrome
  - -Acromegaly
- ✓ Renovascular disease
- ✓ Coarctation of the aorta
- ✓ Drug-induced or related causes
  - -Chronic steroid therapy
- ✓ Sleep apnea

(3) To assess the presence or absence of target organ damage and CVD
- ✓ Heart
  - -Left ventricular hypertrophy
  - -Angina or prior myocardial infarction
  - -Prior coronary revascularization
  - -Heart failure
- ✓ Brain
  - -Stroke or transient ischemic attack
- ✓ Chronic kidney disease
- ✓ Peripheral arterial disease
- ✓ Retinopathy

Physical examination-Conventional CVS examination plus:

-Appropriate measurement of BP, with verification in the contralateral arm
-Examination of the optic fundi
-Calculation of body mass index(BMI) (measurement of waist circumference also may be useful)
-Auscultation for carotid, abdominal, and femoral bruits
-Palpation of the thyroid gland
-Thorough examination of the heart and lungs;
-Examination of the abdomen for enlarged kidneys, masses, and abnormal aortic pulsation
-Palpation of the lower extremities for edema and pulses; and neurological assessment.

Laboratory Tests and Other Diagnostic Procedures

Routine laboratory tests recommended before initiating therapy include:

Lab

1.**FHG**
HB level
2. **U/E/C**
Urea, electrolyte (Na+,K+, Ca+) and creatinine.
Estimation of creatinine clearance
(140-Age)* Body Weight
Serum creatinine
3.**Urinalysis**-Microalbinaemia
4.**Random blood sugar**/Fasting Blood sugar
5.**Fasting Lipid profile** after 9- to 12-hour fast, that includes high density lipoprotein cholesterol and low-density lipoprotein cholesterol, and triglycerides

Imaging

6. CXR
- ✓ Excessive Alcohol intake
- ✓ Homocysteine
- ✓ Lipoprotein a
- ✓ Chronic inflammation
- ✓ High fat diet

-Optional tests include measurement of urinary albumin excretion or albumin/creatinine ratio.
Other tests may be done to diagnose the etiology of secondary hypertension**.**

MANAGEMENT OF HYPERTENSION

Goals of Therapy

The ultimate public health goal of antihypertensive therapy is the reduction of cardiovascular and renal morbidity and mortality.
Since most persons with hypertension, especially those age >50 years, will reach the DBP goal once SBP is at goal, the primary focus should be on achieving the SBP goal.
Treating SBP and DBP to targets that are <140/90 mmHg is associated with a decrease in CVD complications.
In patients with hypertension and diabetes or renal disease the BP goal is <130/80 mmHg

NON -PHARMACOLOGICAL

Lifestyle Modifications

-Adoption of healthy lifestyles by all persons is critical for the prevention of high BP and is an indispensable part of the management of those with hypertension.
Major lifestyle modifications shown to lower BP include
1.**Weight reduction**
-In those individuals who are overweight or obese.
-Maintain normal body weight body mass index **18.5–24.9 kg/m2**
-Reduction by **5–20 mmHg/10 kg weight loss**
2. Physical activity
- Engage in regular aerobic physical activity such as brisk walking (at least 30 min per day, most days of the week
3**. Adopt DASH**
(Dietary Approaches to Stop HTN)
-Consume a diet rich in fruits, vegetables
-Low fat dairy products with a reduced content of saturated and total fat.
-Monounsaturated fats and omega 3 and 6 oils should have less CVS risks.
3. **Dietary sodium reduction**
-Reduce dietary sodium intake to no more than 100mmol per day (2.4 g sodium or 6 g sodium chloride).
4.).
5. **Moderation of alcohol Limit consumption**
- To no more than consumption 2 drinks (30 mL ethanol) per day in most men and to no more than 1 drink per day in women and lighter weight persons.
-Benefits of Lifestyle modifications
- ✓ Reduce BP
- ✓ Enhance antihypertensive drug efficacy
- ✓ Decrease cardiovascular risk.

Combinations of two (or more) lifestyle modifications and drug therapy achieve even better results.

7. ECG
7.Echocardiograph

Pharmacologic Treatment

-Most patients require combination of anti hypertensive drugs to achieve goal BP control.
-Commonly used groups of drugs include:

1) Angiotensin converting enzyme inhibitors (ACEI)
2) Angiotensin receptor blockers (ARBs)
3) Beta-blockers (BBs)
4) Calcium channel blockers (CCBs)
5) Diuretics

-Diuretics have been virtually unsurpassed in preventing the cardiovascular complications of hypertension.
-Diuretics enhance the antihypertensive efficacy of multidrug regimens, can be useful in achieving BP control, and are more affordable than other antihypertensive agents.
Despite these findings, diuretics remain underutilized.
-Thiazide-type diuretics should be used as initial therapy for most patients with hypertension, either alone or in combination with one of the other classes (ACEIs, ARBs, BBs, CCBs)

Thiazide diuretics

- Chlorothiazide
- hydrochlorothiazide
- chlorthalidone
- polythiazide
- indapamide
- metolazone

Loop diuretics

- bumetanide (Bumex†
- furosemide (Lasix†)
- torsemide (Demadex†)

Potassium-sparing diuretics

- amiloride (Midamor†)
- triamterene (Dyrenium)

Aldosterone receptor blockers

- eplerenone (Inspra)
- spironolactone (Aldactone†)

Beta-Blockers

- atenolol (Tenormin†)
- betaxolol (Kerlone†)
- bisoprolol (Zebeta†)
- metoprolol (Lopressor†)
- metoprolol extended release (Toprol XL)
- nadolol (Corgard†)
- propranolol (Inderal†)
- propranolol long-acting (Inderal LA†)
- timolol (Blocadren†)

BBs with intrinsic sympathomimetic activity

- acebutolol (Sectral†)
- penbutolol (Levatol)
- pindolol (generic)

Combined alpha- and BBs

- carvedilol (Coreg)
- labetalol (Normodyne, Trandate†)

Angiotensin converting enzyme inhibitors (ACEIs)

- benazepril (Lotensin†)
- captopril (Capoten†)
- enalapril (Vasotec†)
- fosinopril (Monopril)
- lisinopril (Prinivil, Zestril†)
- moexipril (Univasc)
- perindopril (Aceon)
- quinapril (Accupril)
- ramipril (Altace)
- trandolapril (Mavik)

Angiotensin II Receptor antagonists

- candesartan (Atacand)
- eprosartan (Teveten)
- irbesartan (Avapro)
- losartan (Cozaar)
- olmesartan (Benicar)
- telmisartan (Micardis)
- valsartan (Diovan)

Calcium channel Blockers
Non-Dihydropyridines

- diltiazem extended release (Cardizem LA)
- verapamil immediate release (Calan, Isoptin†)
- verapamil long acting (Calan SR, Isoptin SR†)
- verapamil—Coer, Covera HS, Verelan PM)

Calcium channel blocker
Dihydropyridines

- amlodipine (Norvasc)
- felodipine (Plendil)
- isradipine (Dynacirc CR)
- nicardipine sustained release (Cardene SR)
- nifedipine long-acting (Adalat)
- nisoldipine (Sular)

Alpha-1 blockers

- doxazosin (Cardura)
- prazosin (Minipress†)
- terazosin (Hytrin)

Central alpha-2 agonists

- clonidine (Catapres†)
- methyldopa (Aldomet†)
- reserpine (generic)
- guanfacine (Tenex†)

Direct vasodilators

- Hydralazine (Apresoline†)
- Minoxidil (Loniten†)

SPECIAL CONSIDERATIONS

Ischemic Heart Disease

-Ischemic heart disease (IHD) is the most common form of target organ damage associated with hypertension.
-In patients with hypertension and stable angina pectoris, the first drug of choice is usually a BB; alternatively, long-acting CCBs can be used.
-In patients with acute coronary syndromes (unstable angina or myocardial infarction), hypertension should be treated initially with BBs and ACEIs, with addition of other drugs as needed for BP control.
-In patients with postmyocardial infarction, ACEIs, BBs, and aldosterone antagonists have proven to be most beneficial.
-Intensive lipid management and aspirin therapy are also indicated.

Heart Failure

-Heart failure (HF), in the form of systolic or diastolic ventricular dysfunction, results primarily from systolic hypertension and IHD.
-Fastidious BP and cholesterol control are the primary preventive measures for those at high risk for HF.
In asymptomatic individuals with demonstrable ventricular dysfunction, ACEIs and BBs are recommended.
-For those with symptomatic ventricular dysfunction or end-stage heart disease, ACEIs, BBs, ARBs and aldosterone blockers are recommended along with loop diuretics.

Diabetic Hypertension

-Combinations of two or more drugs are usually needed to achieve the target goal of <130/80 mmHg.
-Thiazide diuretics, BBs, ACEIs, ARBs, and CCBs are beneficial in reducing CVD and stroke incidence in patients with diabetes.
ACEI- or ARB-based treatments favorably affect the progression of diabetic nephropathy and reduce albuminuria and ARBs have been shown to reduce progression to macroalbuminuria.

Chronic Kidney Disease

In people with chronic kidney disease (CKD), as defined by either
(1) reduced excretory function with an estimated GFR below 60 ml/min per 1.73 m2 (corresponding approximately to a creatinine of >1.5 mg/dL in men or >1.3 mg/dL in women)
(2) the presence of albuminuria (>300 mg/day or 200 mg albumin/g creatinine), therapeutic goals are to slow deterioration of renal function and prevent CVD.
Hypertension appears in the majority of these patients, and they should receive aggressive BP management, often with three or more drugs to reach target BP values of <130/80 mmHg.
ACEIs and ARBs have demonstrated favorable effects on the progression of diabetic and non diabetic renal disease.
A limited rise in serum creatinine of as much as 35 percent above baseline with ACEIs or ARBs is acceptable and is not a reason to withhold treatment unless

-With advanced renal disease (estimated GFR <30 ml/min 1.73 m2, corresponding to a serum creatinine of 2.5–3 mg/dL), increasing doses of loop diuretics are usually needed in combination with other drug classes.

Cerebrovascular Disease

The risks and benefits of acute lowering of BP during an acute stroke are still unclear; control of BP at intermediate levels (approximately 160/100 mmHg) is appropriate until the condition has stabilized or improved.
-Recurrent stroke rates are lowered by the combination of an ACEI and thiazide-type diuretic

Obesity and the metabolic syndrome

Obesity (BMI >30 kg/m2) is an increasingly prevalent risk factor for the development of hypertension and CVD.
Metabolic syndrome as the presence of three or more of the following conditions:

1) Abdominal obesity (waist circumference >40 inches in men or >35 inches in women)
2) Glucose intolerance (fasting glucose >110 mg/dL)
3) BP >130/85 mmHg
4) High triglycerides (>150 mg/dL) or low HDL (<40 mg/dL in men or <50 mg/dL in women).

Intensive lifestyle modification should be pursued in all individuals with the metabolic syndrome, and appropriate drug therapy should be instituted for each of its components as indicated.

Left ventricular hypertrophy

Left ventricular hypertrophy (LVH) is an independent risk factor that increases the risk of subsequent CVD.
Regression of LVH occurs with aggressive BP management, including weight loss, sodium restriction, and treatment with all classes of antihypertensive agents except the direct vasodilators hydralazine, and minoxidil.

Peripheral arterial disease

Peripheral arterial disease (PAD) is equivalent in risk to IHD. Any class of antihypertensive drugs can be used in most PAD patients. Other risk factors should be managed aggressively, and aspirin should be used.

Postural hypotension

A decrease in standing SBP >10 mmHg, when associated with dizziness or fainting, is more frequent in older patients with systolic hypertension, diabetes, and those taking diuretics, venodilators (e.g., nitrates, alpha-blockers, and sildenafil like drugs), and some psychotropic drugs.
BP in these individuals should also be monitored in the upright position. Caution should be used to avoid volume depletion and excessively rapid dose titration of antihypertensive drugs.

hyperkalemia develops.

Hypertension in women

Oral contraceptives may increase BP, and the risk of hypertension increases with duration of use.

Women taking oral contraceptives should have their BP checked regularly. Development of hypertension is a reason to consider other forms of contraception. In contrast, menopausal hormone therapy does not raise BP.

Women with hypertension who become pregnant should be followed carefully because of increased risks to mother and fetus.

-Methyldopa, BBs, and vasodilators are preferred medications for the safety of the fetus.

-ACEI and ARBs should not be used during pregnancy because of the potential for fetal defects and should be avoided in women who are likely to become pregnant.

-Preeclampsia, which occurs after the 20th week of pregnancy, is characterized by new-onset or worsening hypertension, albuminuria, and hyperuricemia ,sometimes with coagulation abnormalities.

-In some patients, preeclampsia may develop into a hypertensive urgency or emergency and may require hospitalization, intensive monitoring, early fetal delivery, and parenteral antihypertensive and anticonvulsant therapy

Potential favorable effects of anti-hypertensives

-Thiazide-type diuretics are useful in slowing demineralization in osteoporosis.

-BBs can be useful in the treatment of atrial tachyarrhythmias/ fibrillation, migraine, thyrotoxicosis (short term), essential tremor, or perioperative hypertension.

-CCBs may be useful in Raynaud's syndrome and certain arrhythmias,

- Alpha-blockers may be useful in prostatism.

Potential unfavorable effects

-Thiazide diuretics should be used cautiously in patients who have gout or who have a history of significant hyponatremia.

-BBs should generally be avoided in individuals who have asthma, reactive airways disease, or second or third degree heart block.

- ACEIs and ARBs should not be given to women likely to become pregnant and are contraindicated in those who are.

-ACEIs should not be used in individuals with a history of angioedema.

-Aldosterone antagonists and potassium-sparing diuretics can cause hyperkalemia and should generally be avoided in patients who have serum potassium values more than 5.0 mEq/L while not taking medications.

Resistant Hypertension

Resistant hypertension is the failure to reach goal BP in patients who are adhering to full doses of an appropriate three-drug regimen that includes a diuretic.

Causes

1.Improper BP Measurement

2. Identifiable Causes of Hypertension.

3.Volume Overload and Pseudo tolerance

- Excess sodium intake
- Volume retention from kidney disease
- Inadequate diuretic therapy

4.Drug-Induced or Other Causes

- Non adherence
- Inadequate doses
- Inappropriate combinations
- Nonsteroidal anti-inflammatory drugs; cyclooxygenase 2 inhibitors
- Cocaine, amphetamines, other illicit drugs
- Sympathomimetics (decongestants, anorectics)
- Oral contraceptives
- Adrenal steroids
- Cyclosporine and tacrolimus
- Erythropoietin
- Licorice (including some chewing tobacco)
- Selected over-the-counter dietary supplements and medicines (e.g., ephedra, ma haung, bitter orange)

5.Associated Conditions

- Obesity
- Excess alcohol intake