

L14: Hypertension



objectives

1. To be able to recognize the definition of hypertension.
2. To be able to identify the Stages of Hypertension.
3. To find out the complication of Hypertension
4. To learn how to measure blood pressure.
5. To acquire knowledge on how to treat hypertension.

Hypertension (HTN)

- The 4th most common cause of death worldwide.
- Directly and indirectly responsible for >20% of all deaths.
- 29-30% (about 66 million, 1 out of every 3) incidence of hypertension adult of the United States.
- 15.2% and 40.6% of Saudis were hypertensive or borderline hypertensive.
- Onset stage 25-55 years mainly in 40-50 years.
- Occurs over 30% of persons older than 65 years.
- Only 72% are aware of their disease.
- 57.8% of hypertensive Saudis were undiagnosed.
- 55% of participants on medication for hypertension had their blood pressure uncontrolled.

Blood pressure

- measurement of BP is applied to adults on no antihypertensive medications and who are not acutely ill.
- If there is a disparity in category between the systolic and diastolic pressures, the higher value determines the severity of the hypertension.
- Measure blood pressure to arm the high reading.

Mechanism of Blood Pressure :

Blood Pressure (BP)

= Cardiac output (CO) X Systemic Vascular Resistance (SVR)
= Stroke volume X HR X SVR

Definition of HTN

Category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Blood pressure		
Optimal	<120 and	<80
Normal	120–129 and/or	<80–84
High normal ^a	130–139 and/or	85–89
Hypertension		
Grade 1 (mild)	140–159 and/or	90–99
Grade 2 (moderate)	160–179 and/or	100–109
Grade 3 (severe)	≥180	≥110
Isolated systolic hypertension		
Grade 1	140–149	<90
Grade 2	>160	<90

National Institute for Health and Clinical Excellence Hypertension Guidelines 2011 (UK)

	Clinical Blood Pressure	Ambulatory Blood Pressure day time Monitoring (ABPM)	Home Blood Pressure Monitoring (HBPM)
Stage 1	140/90 mmHg	135/85 mmHg	135/85 mmHg
Stage 2	160/100 mmHg	150/95 mmHg	150/95 mmHg
Stage 3 Severe hypertension	180/110 mmHg	-----	-----

How to measure blood pressure

1. Sphygmomanometer

blood pressure monitor is a device used to measure blood pressure, composed of an inflatable cuff to collapse and then release the artery under the cuff in a controlled manner, and a mercury or mechanical manometer to measure the pressure. It is always used in conjunction with a means to determine at what pressure blood flow is just starting, and at what pressure it is unimpeded. Manual sphygmomanometers are used in conjunction with a stethoscope.

2. Home Blood Pressure Monitoring

3. Ambulatory Pressure Monitoring

measures blood pressure at regular intervals. It is believed to be able to reduce the white coat hypertension effect in which a patient's blood pressure is elevated during the examination process due to nervousness and anxiety caused by being in a clinical setting.

How to measure blood pressure

1. Sphygmomanometer , steps

To allow the patients to sit for 3–5 minutes before beginning BP measurements

Back straight and arm supported at heart level

Take at least two BP measurements, spaced 1–2 min apart, and additional measurements if the first two are quite different.

Consider the average BP if deemed appropriate.

To use a standard bladder (12–13 cm wide and 35 cm long)

A larger bladder for larger arm (circumference >32 cm)

The bladder of the pressure cuff should encircle at least 80% of the upper arm

Place the cuff at the heart level, whatever the position of the patient.

Measure BP in both arms at first visit to detect possible differences. In this instance, take the arm with the higher value as the reference.

Measure BP in sitting and standing position in elderly subjects and diabetic patients

Use phase I and V (disappearance) Korotkoff sounds to identify systolic and diastolic BP, respectively.

Hypertensive Emergency

Hypertensive Emergency

- Systolic BP > 220 and/or diastolic **BP > 120** in addition to end-organ damage—immediate treatment is indicated.

Hypertensive urgencies

- Elevated BP levels alone without end-organ damage
- rarely require emergency therapy and can be managed with attempts to lower BP over a period of 24 hours.
- **There is no proven benefit from rapid reduction in BP in asymptomatic patients who have no evidence of acute end-organ and are little short-term risk**

causes

1. Noncompliance with antihypertensive therapy
2. Cushing's syndrome
3. Drugs such as cocaine, LSD, methamphetamines
4. Hyperaldosteronism
5. Eclampsia
6. Vasculitis
7. Alcohol withdrawal
8. Pheochromocytoma
9. Noncompliance with dialysis
10. Renal artery stenosis (atherosclerosis or fibromuscular dysplasia)
11. Polycystic kidney disease

'Malignant' or 'accelerated' phase hypertension.

- This **rare condition** may complicate hypertension of any aetiology and is characterised by **accelerated microvas- cular damage with necrosis in the walls of small arteries and arterioles** (fibrinoid necrosis) and by intravascular thrombosis. The diagnosis is based on evidence of high BP and rapidly progressive end organ damage, such as retinopathy (grade 3 or 4), **papilledema ,retinal hemorrhages**, renal dysfunction (especially proteinuria) and/or hypertensive encephalopathy. Left ventricular failure may occur and, if this is untreated, death occurs within months.
- **Associated with a diastolic pressure above 120 mmHg**



Caffeine and smoking increase the BP acutely but **are not risk factors** for the development of chronic essential HTN.

Hypertension types

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Essential

there is **no identifiable cause**) applies to more than 95% of cases of HTN.

Secondary

has **many identifiable causes**

Risk factors

- Age: Both systolic and diastolic BP increase with age.
- Gender: more common in men.
- Race: It is twice as common in African-American patients as in Caucasian patients.
- Obesity, sedentary lifestyle.
- Family history.
- Increased sodium intake.
- Polycythemia.
- Alcohol.

causes

1. **Renal disease/renovascular disease:**
 - a) Renal artery stenosis (most common cause of secondary HTN).
 - b) chronic renal failure.
 - c) polycystic kidneys.
2. **Endocrine causes:**
 - a. Thyroid or Parathyroid disease.
 - b. Hyper-thyroidism.
 - c. Hyper-aldosteronism.
 - d. Cushing's syndrome.
 - e. Pheochromocytoma.
 - f. Acromegaly.
3. **Medications:**
 - a. **Oral contraceptives.**(Birth control pills are the most common secondary cause of HTN in young women)
 - b. Decongestants.
 - c. Estrogen.
 - d. Appetite suppressants.
 - e. Chronic steroids.
 - f. Tricyclic antidepressants (TCAs).
 - g. Non-steroidal anti-inflammatory drugs (NSAIDs).
4. **Sleep apnea.**
5. **Coarctation of the aorta. (congenital narrowing of a short section of aorta).**
6. **Cocaine, other stimulants**

NOTES:

- Hyperinsulinemia, ↑ Triglycerides, sleep apnea.
- Salts intake → ↑ salts → ↑ Na → ↑ vasoconstriction → ↑ Blood pressure.
- The potassium decrease blood pressure, so people who don't eat enough fruits and vegetables they will have increased blood pressure.
- Polycythemia → ↑ Blood viscosity → ↑ Blood pressure.
- NSAIDs → ↑ Salts & water retention.
- There are special gene for black people APOL1.

Complications

- Major complication of HTN are:






1. Cardiac complications.

- Coronary Artery Disease: HTN is a major risk factor for CAD
- CHF with left ventricular hypertrophy.

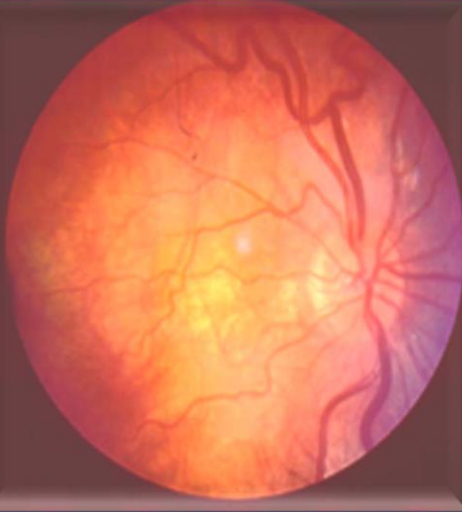

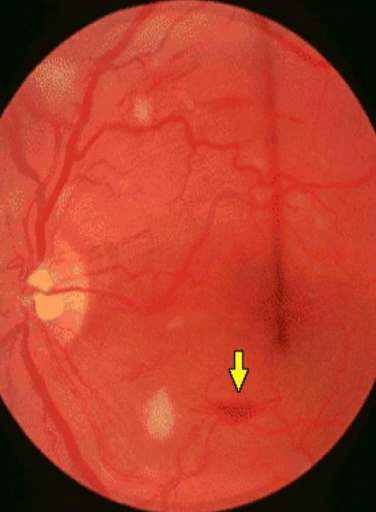
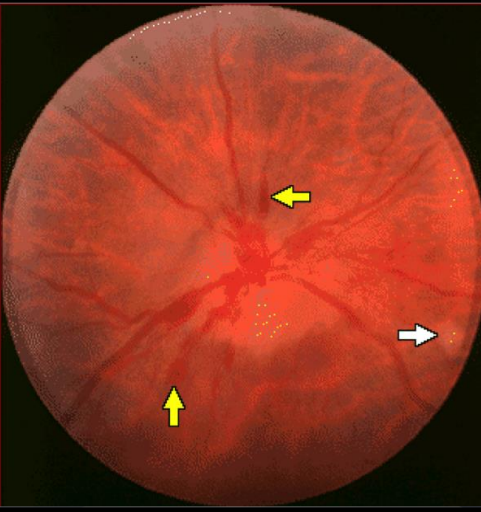
2. Stroke.

3. Renal failure.

4. Retinopathy.

Organ	Problem	
	Atherosclerosis Aneurysms Aortic dissections	
	Haematuria Uraemia Proteinemia	Chronic kidney disease
	Pulmonary oedema Myocardial infarction Left ventricular hypertrophy	Cardiac failure
	Haemorrhage / infarction Seizures Vascular dementia	Stroke / TIA
	Haemorrhages Exudates A-V nipping Papilloedema	Blindness

Hypertensive Retinopathy

<u>Grade 1</u>	<u>Grade 2</u>	<u>Grade 3</u>	<u>Grade 4</u>
<p>Generalized arteriolar constriction seen as “silver wiring” and “Vascular tortuosities”.</p>	<p>Arteriovenous nicking in association with hypertension Grade 2</p>	<p>Flame-shaped hemorrhage in association with severe hypertension Grade 3</p>	<p>Papilledema from malignant hypertension. There is blurring of the borders of the optic disk with hemorrhages (yellow arrows) and exudates (white arrow)</p>
			

Hypertensive retinopathy


(Summary)

Grade	Description
I	Minimal narrowing of retinal arteries
II	Narrowing of retinal arteries in <u>conjunction</u> with regions of focal narrowing and arterio-venous nipping.
III	Abnormalities seen in Grade 1 and II, as well as retinal hemorrhages, hard exudation and cotton wool spots.
IV	Abnormalities encountered in Grades I through III, as well as swelling of the optic nerve head and macular star.

White Coat Hypertension

- Approximately 20 to 25% of patients with mild office hypertension.
- More common in elderly.
- Infrequent in patients with office **diastolic pressures ≥ 105 mmHg.**

Diagnosis

 **Clinical Presentations:**
Asymptomatic
Headache
Epistaxis
Chest discomfort
Symptom of complications

1. BP measurement:

- Unless the patient has severe HTN or evidence of end-organ damage, **never diagnose hypertension on the basis of one BP reading**. Establish the diagnosis on the basis of **at least two readings over a span of 4 or more weeks**.
- Observe the following to obtain an accurate BP reading:
 - The arm should be at heart level, and the patient should be seated comfortably.
 - Have the patient sit quietly for at least 5 minutes before measuring BP.
 - Make sure the patient has not ingested caffeine or smoked cigarettes in the past 30 minutes (both elevate BP temporarily).
 - Use a cuff of adequate size.

 **Physical Examination**

Confirm the diagnosis of hypertension
Detect causes of secondary hypertension
Assess CV risk
Organ damage
Concomitant clinical conditions.



- The diagnosis of mild hypertension should not be made until the blood pressure has been measured on at least three to six visits
- Average of 10 to 15 mmHg decrease between visits 1 and three

Diagnosis

2. Order the following laboratory tests:

(to evaluate target organ damage and assess overall cardiovascular risk)

- a. Urinalysis for blood, protein and glucose.
 - b. Chemistry panel: serum K1, BUN, Cr
 - c. Fasting glucose (if patient is diabetic, check for microalbuminuria)
 - d. Lipid panel.
 - e. ECG (LVH, CAD)
 - f. Thyroid function tests.
- If the history and physical or laboratory tests suggest a secondary cause of hypertension, order appropriate tests

Management

Lifestyle Changes

- ✓ Reduce salt intake
- ✓ Weight loss lowers BP significantly
- ✓ Avoid excessive alcohol consumption
- ✓ Exercise regularly
- ✓ Increase consumption of vegetables, fruits and low-fat dairy products
- ✓ Stop smoking

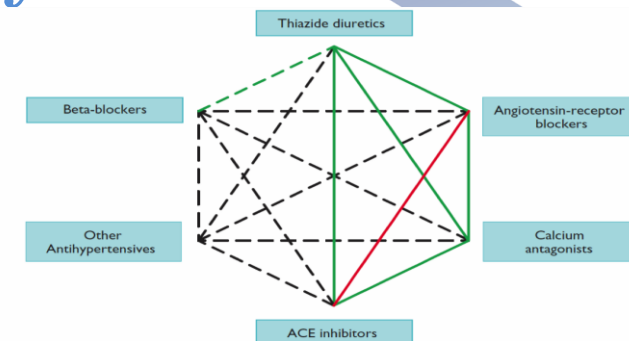
Pharmacological Treatment

- ✓ Thiazide diuretics.
- ✓ B-blockers. (Not commonly used initially, because of adverse effect on cardio-vascular outcome)
- ✓ ACE inhibitors.
- ✓ Angiotensin II receptor blockers (ARBs)
- ✓ Calcium channel blockers.
- ✓ a-blockers.
- ✓ Vasodilators.


Combination Therapy

- ✓ **ACE inhibitors and diuretics.**
- ✓ **Calcium antagonists and ACE inhibitors (more effective).**
- ✓ **Angiotensin II receptor antagonists and diuretics.**
- ✓ **ARBs + ACE inhibitors.**
- ✓ **ARBs + B-blocker.**

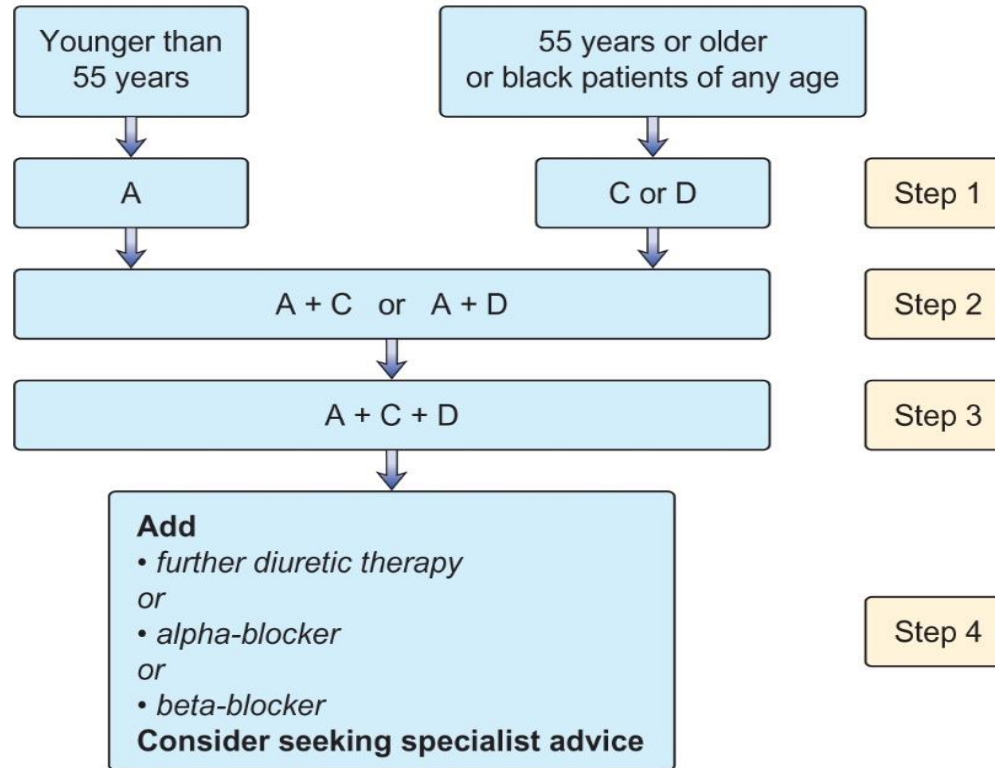
NOT Recommended



Drug	Indication	Side effect	Contraindication
Thiazide diuretics	>55, black patient, secondary stroke prevention, isolated systolic hypertension	Hypokalemia+hyperglycemia	Gout
ACE inhibitors	<55, HF, L.Ventricular dysfunction	Hyper-kalemia + cough	Pregnancy + Renovascular disease
Angiotensin II receptor blockers (ARBs)	<55, HF, L.Ventricular dysfunction	Hyper-kalemia	Pregnancy
B-blockers	MI & Angina	Bradycardia bronchospasm, sleep disturbances (insomnia).	Asthma+COPD
Ca-channel blockers	>55, black patient	Edema + Bradycardia	-
α-blockers	Benign prostatic hypertrophy	1st dose Hypotension	Urinary incontinence

 Note: If the patient has cough we can alternate ACEI to ARBs

Management



Abbreviations:

- A = ACE inhibitor
(angiotensin-II receptor antagonist if ACE intolerant)
- C = calcium-channel blocker
- D = thiazide-type diuretic

Black patients are those of African or Caribbean descent and not mixed-race, Asian or Chinese patients

Drug Therapy

- A low dose of initial drug should be used, slowly titrating upward.
- Optimal formulation should provide **24-hour efficacy with once-daily dose.**
- Combination therapies may provide additional efficacy with fewer adverse effects.

Follow up & Monitoring:

- Patients should return for follow-up after **2- 4 weeks** and adjustment of medications until the BP goal is reached
- More frequent visits for stage 2 HTN or with complicating co-morbid conditions.
- **Serum potassium and creatinine** monitored 1–2 times per year.

High Risk Group Therapy:

- Start in pre-hypertension (130 – 139)/(85 – 89) mmHg Lifestyle change
- Drug therapy (If BP is 140/90 mmHg)
- CHF – Thiazide, ACE-1, Aldosterone, BB
- Post Myocardial Infarction – BB, ACEi
- Diabetes Mellitus – ACEi, ARB, Thiazide, CCB
- Chronic kidney disease – ACEi, ABB, Thiazide
- Stroke – CCB +ACEi

MCQs

1. A 72-year-old man with a history of poorly controlled hypertension develops a viral upper respiratory infection. On his second day of symptoms he experiences palpitations and presents to the emergency room. His blood pressure is 118/78. The following rhythm strip is obtained. **What is the best next step in the management of this patient?**



- A. Administration of intravenous metoprolol
- B. Administration of intravenous adenosine
- C. Administration of intravenous amiodarone
- D. Emergent electrical cardioversion
- E. Initiation of chest compressions and preparation for semielective intubation

MCQs

2. A 55-year-old African American woman presents to the ER with lethargy and blood pressure of 250/150. Her family members indicate that she was complaining of severe headache and visual disturbance earlier in the day. They report a past history of asthma but no known kidney disease. On physical examination, retinal hemorrhages are present. **Which of the following is the best approach?**

- A. Intravenous labetalol therapy
- B. Continuous-infusion nitroprusside
- C. Clonidine by mouth to lower blood pressure
- D. Nifedipine sublingually to lower blood pressure
- E. Intravenous loop diuretic

3. A 53 male known to be hypertensive and he is taking 10 mg of ramipril for several months. Despite this, his BP is suboptimal. There is no compliance issue. **Which one would be the best add-on therapy?**

- A. ARBs
- B. Thiazide diuretic
- C. Beta-Blocker
- D. Ca-channel-blocker

MCQs

4. A 30-year-old construction worker continues to have elevated blood pressure of 180/100 despite of four antihypertensive medications. He was found to be hypertensive at age 17 during a routine physical examination. He has a BMI of 23; the rest of the physical examination is unremarkable. He is taking no over-the-counter medications.

Routine blood chemistry are

Sodium: 145 mEq/L

Chloride: 110 mEq/L

Potassium: 3.0 mEq/L

HCO₃: 30 mEq/L

Glucose: 90 mg/dL

Which of the following is the best next step?

- A. Add a fifth antihypertensive medication and monitor blood pressure closely.
- B. Urinary VMA, metanephrines, and catecholamines.
- C. Bilateral renal artery Doppler ultrasound.
- D. Polysomnography.
- E. Plasma aldosterone concentration to plasma renin activity ratio.

MCQs

5. All the following endocrine causes for 2ndary HTN EXCEPT:

- A. Pheochromocytoma
- B. Addison's disease
- C. Conn's disease
- D. Congenital adrenal hyperplasia

6. A 77 women found to have elevated PB with typical reading of 162/84 mmgH. **Which one would be most appropriate?**

- A. ACEI
- B. ARBs
- C. Thiazide diuretic
- D. Beta-Blocker

Answers : 1-A 2-B 3-D 4-E 5-B 6-C



Medicine433



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*Medicine is a science of uncertainty
and an art of probability*



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