



Hypertension (HTN)

Objectives:

- To be able to recognize the definition of hypertension
- To be able to identify the Stages of Hypertension (ACC/AHA - European Society of Cardiology /European Society of Hypertension (ESC/ESH).
- To find out the complication of Hypertension
- To learn how to measure blood pressure
- To acquire knowledge on how to treat hypertension

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Resources: 436 slides, 435 team, Davidson, kumar & Recall questions step up to medicine.

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Introduction and Epidemiology of HTN

❖ Overview:

Elevated arterial blood pressure is a major cause of premature vascular disease leading to cerebrovascular events, ischaemic heart disease and peripheral vascular disease. Blood pressure is a characteristic of each individual, like height and weight, with marked interindividual variation. The levels of blood pressure observed depend on the characteristics of the population studied – in particular, the age and ethnic background. Hypertension is very common in the developed world. Depending on the diagnostic criteria, hypertension is present in 20–30% of the adult population. Hypertension rates are much higher in black Africans (40–45% of adults).

Case : A 47 years old man came to the clinic with headache for 3 weeks. The nurse measure his blood pressure and was found to be 150/ 95 mmHg . (After you study the lecture well, answer the next questions)

1. Does he have hypertension?
2. What is the stage of hypertension?
3. What investigation should you perform ?
4. What could be your management in his case ?
5. Is there any possible prevention to his disease and its complication ?

❖ Epidemiology and Prevalence of Hypertension:

- The fourth most common cause of death worldwide.
- The overall prevalence of hypertension in adults is around 30 - 45%
- The global prevalence of hypertension was estimated to be 1.13 billion in 2015.
- Onset ranges between 25 to 55 years, mainly in 40 to 50.
- Prevalence of >60% in people aged >60 years.

Why? blood vessels become more stiff with age + sedentary life + ↑body weight.

- More common with advancing age.
- Only 72% are aware of their disease.
- The overall prevalence of hypertension in Saudi was 25.5%.

Because we are young population and the old population are less, so our percentage is less than international .

- 15.2% and 40.6% of Saudis were hypertensive or borderline hypertensive.
- 55% of participants on medication for hypertension had their blood pressure uncontrolled.

Because they aren't compliance to the medication due to its side effects.

- Directly and indirectly responsible for >20% of all deaths.

○ Risk of hypertension:

A)As populations age B) sedentary lifestyles C) increase their body weight

Pathophysiology of Hypertension

Blood Pressure (BP) Equation:

$BP = (\text{cardiac output}) \times (\text{systemic vascular resistance}) \rightarrow (\text{CO depends on stroke volume} \times \text{heart rate}) \times (\text{systemic vascular resistance})$
 The ability of BV to dilate)

- Anything \uparrow SV will \uparrow BP e.g. someone with polycythemia “ \uparrow RBCs will \uparrow the volume” also who eat salts there will be water retention and \uparrow in volume.

- Tachycardia \rightarrow increase HR \rightarrow high BP.

- Vascular resistance: it is the flexibility of blood vessels to be dilated. When the heart contract it pushes the blood into blood vessels with high pressure and normally it should be dilated, but when it become thick due to atherosclerosis it won't be able to dilate so the systolic pressure rise and this is the systolic pressure. زي لمن يكون عندك لي صغير وتحط فيه مويه حيصير الضغط عالي بينما لو وسعته يصير الضغط قليل

While the diastolic BP, during relaxation the blood may go back to the heart so the blood vessels contract to prevent this, and some people have diastolic contractility more than usual e.g sympathomimetic stress they contract more, and this is diastolic pressure.

Systolic BP during heart contraction Diastolic BP during heart relaxation

What control the vascular resistance?

1. Elasticity of the blood vessel.

2. Neurological (sympathetic+parasympathetic): by baroreceptors (feel the BP if it \uparrow or \downarrow) found in aortic & paraaortic.

When baroreceptor feel the BP \downarrow it will stimulate sympathomimetic \rightarrow stimulate B-adrenergic receptor which cause tachycardia \rightarrow increase contractility and BP.

Sympathomimetic also stimulate a-adrenergic receptors in blood vessel \rightarrow vasoconstriction of blood vessel.

Sympathomimetic aslo send signals to adrenal gland stimulate it to release adrenalin and noradrenalin \rightarrow more vasoconstriction.

3. Hormonal (endocrine): RAAS by kidney. Adrenaline & noradrenaline (catecholamine system) by Adrenal gland.

4. Endothelium of BV: release two hormon: 1. endothelin-1(vasoconstriction) 2. Nitric oxide (vasodilation).

Pathogenesis of Hypertension :

Figure 1: Systems involved in the development and maintenance of hypertension

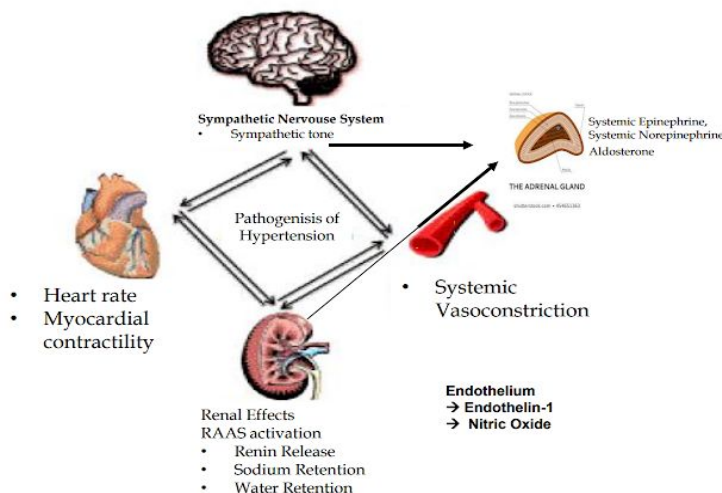


Figure 1: Systems involved in the development and maintenance of hypertension

- An overactive Renin angiotensin system leads to vasoconstriction and retention of sodium and water \rightarrow increase in blood volume \rightarrow hypertension.

(Angiotensin II is the strongest vasoconstrictor in the world)

- An overactive sympathetic nervous system \rightarrow Tachycardia, increase contractility, vasoconstriction of blood vessel and more vasoconstriction by stimulation of adrenal gland to release adrenalin and noradrenalin.

- The Brain, Heart, Blood vessels and Kidney are organs control BP and they also destroyed by hypertension.

- By knowing all these mechanisms, we treat hypertension.



Types of Hypertension

1) Essential Hypertension:

In 90%-95% of cases, but no cause can be found (primary hypertension). More common in black people. It results from environmental and genetic factors (more than 50 genes).

◆ Risk factors:

Modifiable :

- Obesity Usually they have salt and water retention and increased Sympathomimetic, Metabolic Syndrome, DM, Vitamin D deficiency. Excessive salt intake, low potassium intake. Like unhealthy food contain ↑ Na and ↓ K
- Excessive alcohol intake and Lack of exercise,
- Polycythemia. ↑ RBCs will ↑ the volume so increase BP
- Non-steroid anti-inflammatory drugs. It cause salt and water retention so ↑ BP.

Non Modifiable:

- Aging By stiffness of BV, Race, Genetic, Family history of essential HTN.

Smoking & Caffeine increases BP acutely but is not a risk factor for the development of chronic essential HTN.

2) Secondary hypertension: (If the primary cause treated the hypertension will disappear)

- Account for 5 to 10 %
- The Possible etiologies are :
 - **Primary renal disease (The most common cause of 2ndry HTN)** . (CKD) by two mechanism: injury in kidney lead to high RAAS stimulation and when there is ↓ in filtration no Na excreted so high Na water retention = high BP
 - **Oral contraceptives.** Estrogen compounds causes salt and water retention, they also increase Angiotensinogen from liver.
 - **Sleep apnea syndrome.** Any scenario of obese with hypertension and snoring at night we should rule out SAS
The mechanism is that they have snoring; suddenly they get desaturation → relax muscles in the neck usually it happened in obese people and this muscles lead to obstruction of respiratory system → they wake up from night. This can happen for many times in night. If not treated properly they can get: Car accident (daytime sleeping) or Arrhythmias.
 - **Primary hyperaldosteronism (conn's syndrome).**
 - **Renovascular disease.** Narrow renal artery > no flow to kidney > RAAS stimulation
 - **Cushing syndrome.** When you see the manifestation of the syndrome, rule out hypertension due to the syndrom.
 - **Pheochromocytoma.** Suprarenal gland release adrenaline and noradrenaline suddenly as bolus الضغط فجأة يرتفع وفجأة طبيعي
 - **Other endocrine disorders.** Hyperparathyroid → high calcium → vasoconstriction / Hyperthyroid
 - **Coarctation of the aorta.** Narrowing in aorta, Happen In young pt. Lead to radio radial or radio femoral delay.



Stages of Hypertension

- Stages

European Society of Nephrology Classification of Blood Pressure Levels		
Category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Optimal blood pressure	<120	<80
Normal blood pressure	<130	<85
High-normal blood pressure*	130-139	85-89
Grade 1 hypertension (mild)	140-159	90-99
Grade 2 hypertension (moderate)	160-179	100-109
Grade 3 hypertension (severe)	≥ 180	≥ 110
Isolated systolic hypertension	>140	<90

*within 6 months to 2 years they will develop hypertension. Also the risk of CVD is high in this group. Treatment at this stage is not effective because it won't decrease the risk of CVD or any other disease.

The next table from American Heart Association and American College of Cardiology

BP Category	SBP		DBP
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120–129 mm Hg	and	<80 mm Hg
Hypertension			
Stage 1	130–139 mm Hg	or	80–89 mm Hg
Stage 2	≥ 140 mm Hg	or	≥ 90 mm Hg

*Individuals with SBP and DBP in 2 categories should be designated to the higher BP category.
BP indicates blood pressure (based on an average of ≥ 2 careful readings obtained on ≥ 2 occasions, as detailed in DBP, diastolic blood pressure; and SBP systolic blood pressure.





Hypertensive Emergency:

If pt left with untreated HTN he will present with stroke or sudden MI or Arrhythmia and sudden death.

Severe hypertension that develops rapidly (Diastolic blood pressure above 120 mmHg), that results in **end organ damage** (MI, Stroke, AKI, CHF). Admitted to ICU and treat with IV administration.

Hypertensive Urgency: hypertension without end organ damage.

- Severe hypertension (diastolic blood pressure above 120 mmHg) in asymptomatic patients.
- 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. No need to admit the pt just treat orally.

Malignant (accelerated) hypertension¹: Need for ICU and treat with IV

- Marked **hypertension with encephalopathy** and retinal hemorrhages, exudates, and/or papilledema
- Associated with a diastolic pressure above 120 mmHg

Masked hypertension (border line):

المريض يجي عند الدكتور يكون ضغطه كويس بس أول ما يطلع من العيادة مثلا وهو يسوق أو في الشغل أو في البيت يصير الضغط عالي

- Office blood pressure (Hospital readings) (BP) level is <140/90 mm Hg but ambulatory or home BP readings are in the hypertensive range. So you will do an ambulatory blood pressure monitoring.
- In adults with untreated office BPs that are consistently between 120 mm Hg and 129 mm Hg for SBP or between 75 mm Hg and 79 mm Hg for DBP, **screening for masked hypertension with home BPM (or ABPM) is reasonable.**
- The prevalence about 1 in 7 or 8 persons.

White Coat Hypertension (Pseudo-HTN): يجي المريض العيادة وبسبب الخوف والتوتر والانتظار يصير الضغط عالي بس إذا رجع البيت يصير طبيعي

- A phenomenon in which patients exhibit a blood pressure level above the normal range, **in a clinical setting**, though they do not exhibit it in other settings
- Approximately 20 to 25% of patients with mild or moderate office hypertension
- More common in elderly
- The diagnosis of mild hypertension should not be made until the blood pressure has been measured on at least three to six visits. قول للمريض يجيك زيارة أخرى وقيس مرة ثانية، ومن 3 زيارات عالأقل تحدد إذا كان عالي أو لا

¹ This rare condition may complicate hypertension of any aetiology and is characterised by accelerated microvascular 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), renal dysfunction (especially proteinuria) and/or hypertensive encephalopathy (see above). Left ventricular failure may occur and, if this is untreated, death occurs within months (Davidson).

Instrument of Blood Pressure Measurement

- Instrument Used to Measure Blood Pressure:

Device			To Dx HTN		Notes
			Systolic	Diastolic	
Office BP	Non-automated device [non-AOBP]	Mercury Type	≥140	≥90	Not used anymore
		Aneroid Type			
		Half automated device			Still accepted
	Automated Device	Digital Type	This is what use in hospital. Measure the pressure by ultrasonic and it is very accurate. Finger and/or wrist BP measuring devices are not recommended.		
Ambulatory BP		Daytime	≥135	≥85	For 24 hours during daytime as well as in nighttime. Then it will calculate the mean. زي المسجل الصغير يشبهه المريض تحت ملبسه ويتركب على يده اليسرى، ويسجل الضغط كل نص ساعة ويعطي average BP during 24h
		Nighttime	≥120	≥70	
		Mean (24 h)	≥ 130	≥80	
Home BP Monitoring (HBPM)		Arm	≥135	≥85	Among the home devices the arm device is the best. Recommended for people who has high BP, small devices and easy to use, the pt measure the pressure 2 time in the morning and 2 time in the night documented and bring it hospital to make sure it is controlled.
		Wrist			
		Finger			
AOBP (Automated office blood pressure) ²			≥135	≥85	Recommended method. (is the preferred method of performing in-office BP measurement) الممرضة تركيب الجهاز وتروح وتترك المريض جالس لحاله، والجهاز يقيس 3 قراءات خلال مدة من الوقت. الفائدة إن الضغط يُقاس بدون التوتر إلى يجي للمرضى في وجود الدكاترة أو الممرضين.

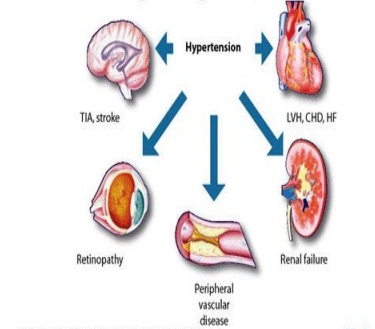
² AOBP is taken for 5 times, regular automated office measuring is done only once

Complication of Hypertension

★ Without treatment, high BP can lead to:

- (the mechanism is BV layers become thick > fat deposition > narrow > thrombosis and ischemia).
- **Stroke** , Ischemia, Alzheimer’s Disease (↓cognitive function), **retinal hemorrhage**
- **CAD**, arrhythmia (**atrial fibrillation**), sudden death.
- **Congestive heart failure**, **left ventricular hypertrophy**
- Aortic dissection.
- **Renal disease**. continuous hypertension > vasoconstriction > nephrosclerosis. Common causes of renal disease in Saudi are DM and HYPERTENSION. 35% of pt on dialysis due to hypertension.
- Peripheral vascular disease.
- Hypertensive Emergency And Increase Emergency Morbidity

Complications of Hypertension: Target-Organ Damage



★ These diseases account for significant disability, loss of productivity, and decreased quality of life.

★ Hypertensive retinopathy can be graded as the following: ”الدكتور قال حتاخدوها بعدين فلا تشغلوا بالكم فيها”

Grade	Description	Picture
I	<ul style="list-style-type: none"> - Minimal narrowing of retinal arteries. - Generalized arteriolar constriction-seen as `silver wiring³`, Copper wiring⁴ and Vascular tortuosities. 	
II	<ul style="list-style-type: none"> - Narrowing of retinal arteries in conjunction with regions of focal narrowing and arteriovenous nipping⁵. - (yellow arrow) Arteriovenous nicking 	
III	<ul style="list-style-type: none"> - Abnormalities seen in Grade 1 and II, as well as retinal hemorrhages, hard exudates and cotton wool spots منفوشة. - (yellow arrow) Flame-shaped hemorrhage 	
IV	<ul style="list-style-type: none"> - Papilledema from malignant hypertension - Abnormalities encountered in Grades I through III, as well as swelling of the optic nerve head and macular star⁶. - There is blurring of the borders of the optic disk with hemorrhages (yellow arrows) and exudates (white arrow) 	

Normally in eye: the vein is more red and larger than the artery which is transparent.

³ Retinal arterioles look white if they have become occluded

⁴ Retinal arterioles appear orange or yellow instead of red

⁵ AV, or arteriovenous nicking (also known as arteriovenous nipping in the UK) is the phenomenon where, on examination of the eye, a small artery (arteriole) is seen crossing a small vein (venule), which results in the compression of the vein with bulging on either side of the crossing.

⁶ The lipid-rich component of the exudate is further able to penetrate into the outer plexiform layer, creating what is clinically seen as a macular star pattern.



The Clinical Features and The Diagnosis of HTN

1. Clinical Presentation of Hypertension:

- Asymptomatic
- Headache wake up in the morning with occipital headache
- Epistaxis
- Chest discomfort.
- Symptoms of complications. (stroke and its symptoms, Retinopathy related symptoms and Heart related symptoms)

2. Physical Examination:

- Confirm the diagnosis of of hypertension.
- Look for secondary causes (may be treatable). Is it primary or secondary e.g. if there is renal artery bruit > secondary
- Assess damage to target organ (heart, kidneys, Eyes, CNS). Eye changes / 4th heart sound
- Assess overall cardiovascular risk.
- Concomitant clinical conditions .

Screening:

we don't depend on the symptoms so we have to screen the pt. Symptoms are complications and we don't want to wait till they appear

- Every two years for people with systolic and diastolic pressure below 120 mmHg and 80 mmHg.
- And people above 40 age.

- ❖ If patient presented to the clinic with mild to moderate elevation of blood pressure, we can't diagnose this patient with hyper directly. Mild to moderate elevation need 3 visits at least and each visit 2 readings of BP.
- ❖ While if patient presented to the clinic with severe elevation of his BP, mostly he is hypertensive.



Diagnosis of HTN :

1) BP measurement : Unless the patient has severe HTN or evidence of end-organ damage, **never diagnose HTN 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 :

1. Apply to adults on no antihypertensive medications and who are not acutely ill. Pt come to ER with pneumonia and high BP I can't tell he is hypertensive.
2. The Back should be straight and the arm should be at heart level (whatever the position of the patient), and the patient should be seated comfortably. When pt come for first time we should measure BP in standing and sitting position for postural hypertension.
3. Have the patient sit quietly for at least 5 minutes before measuring BP.
4. Make sure the patient has not ingested caffeine or smoked cigarettes in the past 30 minutes.
5. **Use a cuff of adequate size** (the cuff must fit the pt so no False reading). The standard bladder is 12 to 13 cm wide and 35 cm long. For large arm you use large bladder which its circumference is more than 32 cm (**a cuff that is too small can falsely elevate BP readings**). The bladder within the cuff should encircle at least 80% of the upper arm.
6. Use phase **One Korotkoff sounds**⁷ to identify systolic BP. And phase **Five (disappearance)** Korotkoff sounds to identify diastolic BP.
7. 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.
8. 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. Normally there is difference of less than 5 between both arms
9. If there is a disparity in category between the systolic and diastolic pressures, the higher value determines the severity of the hypertension. If only diastolic or only systolic or both are high we consider it hypertension.

2) Order the following laboratory tests to evaluate target organ damage and assess overall cardiovascular risk:

1. Urinalysis for hematuria and proteinuria (if patient is diabetic, check for microalbuminuria). If it primary or secondary hypertension
2. **Serum sodium** (if ↓ it mean hypoaldosteronism), **serum potassium**, **BUN(blood urea nitrogen)**, **creatinine**, or the corresponding estimated GFR, calcium (if ↑ it means hyperparathyroidism) and uric acid.
3. Fasting glucose and hematocrit. Lipid profile, after 9- to 12-hour fast, that includes high density and low-density lipoprotein cholesterol, and triglycerides
4. Electrocardiogram. To make sure no effect on HR
5. Optional tests: Measurement of urinary albumin excretion or albumin/creatinine ratio.

3) If the history and physical examination or laboratory test suggest a secondary cause of HTN, order appropriate test.

4) Before starting treatment for hypertension, it is useful to evaluate the patient more thoroughly :

1. Risk factors by using Framingham Risk Score⁸
2. Asymptomatic organ damage⁹

⁷ Korotkoff sounds are blood flow sounds that healthcare providers observe while taking blood pressure with a sphygmomanometer over the brachial artery in the antecubital fossa. These sounds appear and disappear as the blood pressure cuff is inflated and deflated.

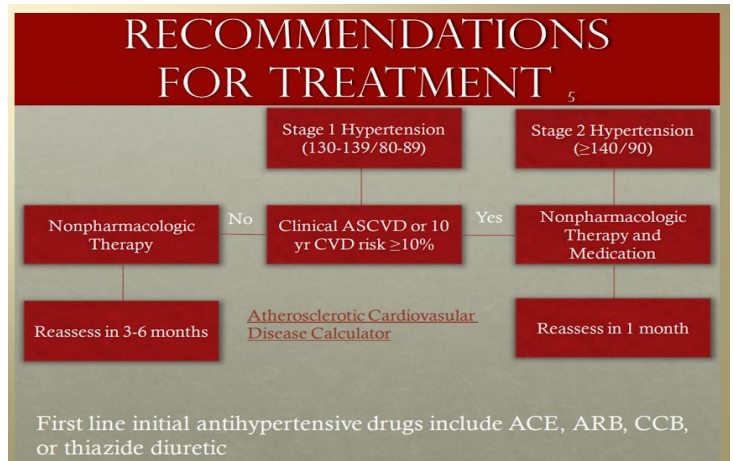
⁸ include age, male gender, smoking, dyslipidemia, glucose intolerance, obesity and family history of premature CVD.

⁹ mainly involves left ventricular hypertrophy, evidence of vascular damage and microalbuminuria; CKD; CVD, DM

Management of Hypertension

❖ Treatment of hypertension depend on the type of hypertension, comorbidity, the cause and the age of pt

Lifestyle Intervention	Pharmacological Therapy
- High normal (SBP >130–139 mmHg, DBP 85–89 mmHg) -In high risk patients	If blood pressure is more than 140/90 mmHG
Diet : high consumption of vegetables and fruits ¹⁰ , low-fat diet, Vit D replacement	Thiazide diuretics
Regular physical exercise : 30 min of moderate-intensity aerobic exercise 5-7 days/week	B-Blocker
Reduction of alcohol intake	ACE inhibitors
Reduction of dietary sodium intake: (5-6g/day) and use of low sodium salt	Angiotensin II receptor blockers (ARBs)
Smoking cessation	Calcium channel blockers
Weight reduction : BMI 25 kg/m	Vasodilators



Pts with elevated BP (120-129/ <80) should have optimal lifestyle bc if they didn't, within 0.5 - 2 years they will develop hypertension. If Pt with BP (130-139/80-89), we have to calculate CVD risk factors. If he doesn't have risk factors we advise him to undergo lifestyle changes and reassess him in 3-6 months. If he has risk factors we start medication and advise him to undergo lifestyle changes and reassess him in 1 month. If Pt with BP (more than 140/90), immediately start medication and advise him to undergo lifestyle changes and reassess him in 1 month.

¹⁰ As 7 to 8 servings per day of grain or grain products, 4 to 5 vegetable and 4 to 5 fruit



◆ Anti-hypertensive Medication:

Drugs	Indication	Side effects	Contraindication	Notes
Thiazide diuretics	- A good option in patients with osteoporosis - Secondary stroke prevention	- Hypokalemia - Hyperglycemia - Hyperuricemia	- Gout - Pregnancy	A good initial choice for African-American patients
B-blockers	1- A good option in patients with CHF,CAD or atrial fibrillation	-Bradycardia -bronchospasm -insomnia -fatigue	1-Asthma 2-COPD	1-Decrease HR and cardiac output and decrease renin release 2-B-Blocker safe in pregnancy
ACE inhibitors	1-preferred in all diabetic patients 2-A good option for patients with CHF,CAD, kidney failure	-Hyperkalemia -Cough -Acute renal failure	1-pregnancy 2-renovascular disease	—
Angiotensin II receptors blocker (ARBs)	ARBs have the same beneficial effects on the kidney in diabetic patients as ACE inhibitors.	Hyperkalemia	Pregnancy	1- If the patient has cough we can alternate ACEI to ARBs 2-ACE inhibitors and ARBs should not be used in combination
Calcium channel blockers	—	- Edema - Bradycardia - Tachycardia - Constipation	—	—
alpha -Blocker	1- If the patient has benign prostatic hyperplasia (BPH)	-1st dose hypotension -headache -dizziness	Urinary incontinence	Not consider first - second-line agents
Vasodilators (hydralazine and minoxidil)	Combination with B-blocker and diuretics to patients with refractory HTN	-Tachycardia -Edema		Not commonly used

High Risk Group

Start Lifestyle changes + medication in patient with BP of (130 – 139)/(85 – 89) mmHg.

- **Congestive heart failure** : Thiazide, ACE-1, Aldosterone antagonist , BB
- **Post Myocardial Infarction** : BB, ACEi
- **Diabetes Mellitus proteinuria** : ACEi, ARB,NO / **Non-proteinuria** : Thiazide, CCB,ARB, ACEi
- **Chronic kidney disease** : ACEi, ARBs, Thiazide
- **Stroke** : CCB +ACEi **Pregnancy**: Aldomet ,labetalol, Ca channel blocker

Summary of Antihypertensive drugs :

Step 1 (BP > 130/80) : If pt age under 55 years, use Single medication either A or B. but if pt age over 55, or african, use either C or D.

Step 2 (BP > 140/80):
One pill dual combination “A(B) + C “ OR “A(B) + D”. This combination will increase the compliance + less side effect.

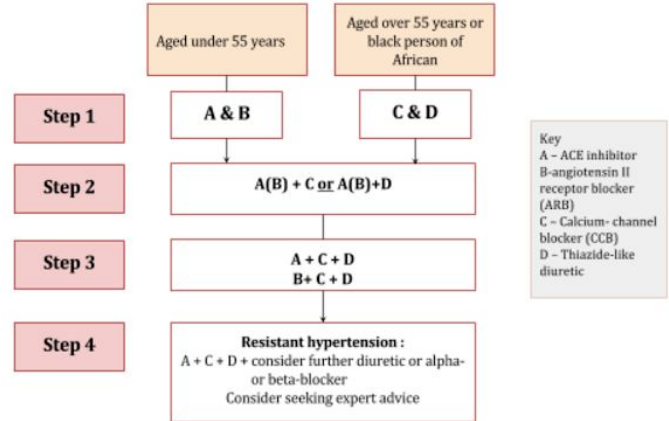
Step 3 (BP > 160):
One pill triple combination A+C+D OR B +C+D

Drugs you can't combine:

- 1- ACEi and ARBs
- 2- Beta blockers and NONdihydropyridine calcium channels blockers.

★ In old aged patients, the drop in blood pressure should be slowly to avoid any dizziness or confusion.

★ Our aim in hypertensive patient with DM and Hyperlipidemia is to keep the BP below 130/80



Benefits of Lowering BP:

- Stroke incidence will reduce 35 to 40%
- Myocardial infarction will reduce 20 to 25%
- Heart failure will reduce 50%
- Renal failure will reduce 35 to 50%
- 2 mmHg decrease in mean systolic BP will lead to:
 - 7% reduction in risk of ischemic heart disease mortality
 - 10% reduction in risk of stroke mortality.

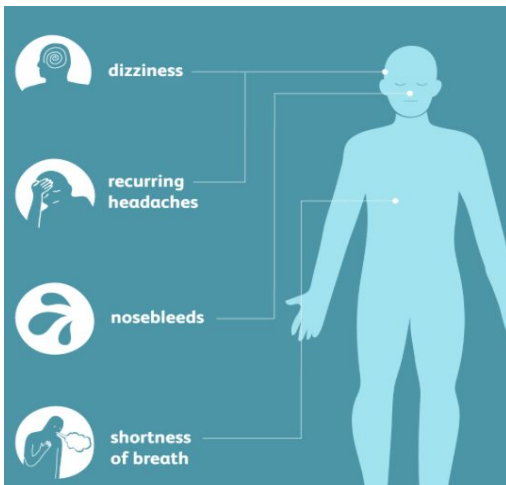
Recommendation for Follow-Up After Initial BP Elevation
For adults with a very high average BP (e.g., SBP > 180 mm Hg or DBP > 110 mm Hg), evaluation followed by prompt antihypertensive drug treatment is recommended.
For adults with a normal BP, repeat evaluation every year is reasonable

Summary

Hypertension is the fourth most common cause of death worldwide.
Blood pressure equation: cardiac output x systemic vascular resistance → (SV x HR) x systemic vascular resistance.
Pathogenesis of HTN : - An overactive Renin angiotensin system. - An overactive sympathetic nervous system

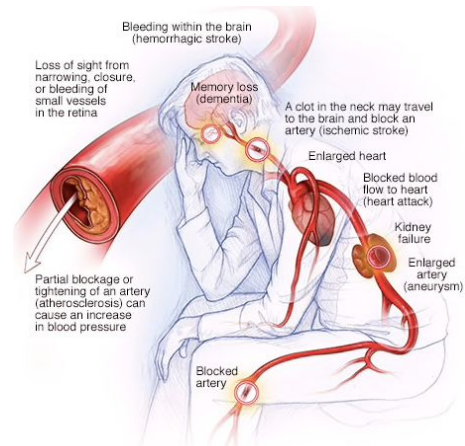
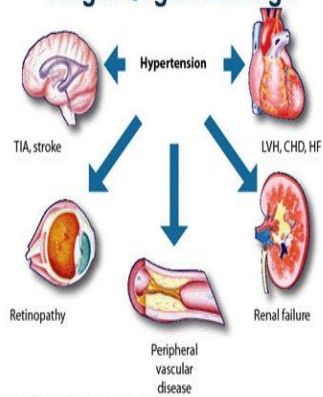
<h3 style="margin: 0;">Types of hypertension:</h3>	<ul style="list-style-type: none"> - Essential Hypertension: In 90%-95% of cases, but no cause can be found (primary hypertension) <p>Risk factors: Obesity, metabolic syndrome, DM , Excessive salt intake, low potassium intake, Excessive alcohol intake. Polycythemia , Lack of exercise , Family history of essential HTN, Vitamin D deficiency, aging.</p> <ul style="list-style-type: none"> - Secondary hypertension: Account for 5 to 10 % . <p>The Possible etiologies are : Primary renal disease, Oral contraceptive , Sleep apnea syndrome, Primary hyperaldosteronism , Renovascular disease, Cushing syndrome , Pheochromocytoma, Other endocrine disorder , Coarctation of the aorta.</p>
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Symptoms



Complications

Complications of Hypertension: Target-Organ Damage



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Diagnosis	Management
<p>1) BP measurement.</p> <p>2) laboratory tests: - Urinalysis, Serum sodium , serum potassium , creatinine, or the corresponding estimated GFR, calcium, uric acid , Fasting glucose , hematocrit, lipid profile .</p> <p>3) If the history and physical examination or laboratory test suggest a secondary cause of HTN, order appropriate test.</p> <p>4) Before starting treatment for hypertension, it is useful to evaluate the patient more thoroughly : - Risk factors by using Framingham Risk Score, Asymptomatic organ damage.</p>	<p>1. Nonpharmacological (Lifestyle modification): In patient with High normal (SBP >130–139 mmHg, DBP 85–89 mmHg) - Healthy Diet, Weight reduction, smoking cessation, reduction of dietary salt and physical exercise.</p> <p>2. Pharmacological Intervention: If blood pressure is more than 140/90 mmHG. → Thiazide diuretics → B-Blocker → ACE inhibitors → Angiotensin II receptor blockers (ARBs) → Calcium channel blockers → Vasodilators</p>

Examine Yourself !!

1. Which of the following is important and serious complication of uncontrolled hypertension ?
 - A. DVT.
 - B. Atrial fibrillation.
 - C. Pulmonary Embolism.
 - D. Migraine.

2. Which one is considered as secondary hypertension ?
 - A. Cardiomyopathy
 - B. Behcet disease
 - C. Heavy smoking
 - D. Conn's syndrome

3. A 65 male known to be hypertensive, his blood pressure is 138/85, . Which one of the following would be the best atherapy for him ?
 - A. ARBs
 - B. Thiazide diuretic
 - C. Beta-Blocker
 - D. ACEis.

4. A 48-year-old woman was diagnosed with essential hypertension and was commenced on treatment three months ago. She presented to you with a dry cough which has not been getting better despite taking anti-hypertensive and antibiotics. You assess the patient's medication history. Which of the following antihypertensive medications is responsible for the patient's symptoms ?
 - A. Lisinopril
 - B. Atenolol
 - C. Furosemide
 - D. Amlodipine



- 5. A 34 year old man comes to your clinic with history of headache and dizziness for 2 months. His examination is unremarkable apart from repeated BP measurements of 200/100 mmHg. What is the most appropriate next step?**
- A. Recheck his BP again in 1 month.
 - B. starts low salt diet only.
 - C. starts antihypertensive medications.
 - D. order CT scan of his head.
- 6. A 55 years old male presented to outpatient clinic with history of fatigue found to have BP of 155/90 , no previous history of hypertension, no diabetes mellitus, with normal laboratory test.-What is the best next step for the patient?**
- A. Start Anti hypertension with beta blockers.
 - B. Repeat the blood pressure measurements after several days.
 - C. Give out patients a follow up after 3 months.
 - D. Reassure the patient.
- 7. A 32 years old pregnant woman know to have hypertension, which of the following medication would be most appropriate?**
- A. ACEI
 - B. Aldomet
 - C. Labetalol
 - D. Both b and c.
- 8. A 25-year-old male came complaining from headache. BP in several visits 150\105 mmhg. Which one of the following is the next most appropriate diagnostic step?**
- A. Ambulatory BP monitor
 - B. Ultrasound of the kidney
 - C. BUN and Creatinine and electrolytes
 - D. Liver function test
- 9. Which one of the following are effective combination to treat hypertension in African-American?**
- A. Lisinopril +isosorbide dinitrate.
 - B. Hydralazine +isosorbide dinitrate.
 - C. ACEis and ARBs.
 - D. None.
- 10 . 45 male presented with on/off headache for 3 weeks his reading of Blood pressure is 158/ 95 . His Weight 110 and his Height is 170. Fundus and cardiovascular examination are normal. What is best diagnostic test for his hypertension?**
- A. repeated measures with 1-2 weeks
 - B. serum Na, k, urea, Creatinine
 - C. urinalysis
 - D. US for kidney

Answers : 1.B / 2. D / 3.B / 4.A / 5.C / 6. B / 7. D / 8. C / 9. B / 10. A