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# 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

## ★ Resources Used in This lecture:

Step-up to medicine, Master the boards, Mayo clinic website, Davidson, **Doctor's slides.**

## Definition

Systolic BP greater than 140 or diastolic BP greater 90.

## Epidemiology

- The 4th most common cause of death worldwide
- Prevalence of of Saudi Arabia population with hypertension 15% and 40% are border line (will have it in future).
- Onset mainly in 40-50y

## 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 Caucasian.
- ❑ Obesity·Sedentary lifestyle, dyslipidemia
- ❑ Family history of essential HTN
- ❑ Increased sodium intake—or low potassium intake (Potassium causes vasodilation)
- ❑ Alcohol
- ❑ Polycythemia
- ❑ NSAID by salt and water retention through the kidney by inhibiting prostaglandin.



Smoking and caffeine drinking cause temporary HTN but are not risk factors.

## Etiology

- **Primary/Essential Hypertension:** Has no clear etiology and account for 95% of Hypertension.
- **Secondary Hypertension:** Has many identifiable cause and account for 5% of cases such :
  - ❑ **Renal disease** :renal artery stenosis , chronic renal failure , polycystic kidneys , glomerulonephritis.
  - ❑ **Medications:** oral contraceptives by direct increase of angiotensinogen from the liver., decongestants, estrogen, appetite suppressants, chronic steroids, tricyclic antidepressants (TCAs).

## Pathophysiology :



- Renal artery stenosis: hypoperfusion to the kidney → RAAS activation → increased PVR + salt and water retention → higher BP
- Chronic renal failure: compromised function of the kidney → less salt excretion → water follows salt !! so volume increases → hypertension
- Oral contraceptives caused HTN by direct increase of angiotensinogen from the liver

- ❑ **Endocrine disorder:** Hyperthyroidism , Hyperaldosteronism(Conn's disease), Cushing syndrome,Pheochromocytoma , Acromegaly (elevated of GH) ,
- ❑ **Coarctation of the aorta (Narrowing)**
- ❑ **Cocaine, other stimulants**
- ❑ **Obstructive sleep apnea(OSA)**

- **Common cause of secondary HTN: 1- Renal disease (RAS<sup>1</sup>) 2- aortic coarctation**
- Most common cause of secondary HTN in young women is OCP .
- HTN but the most common cause of secondary HTN in young women is Oral contraceptives

### Clinical Presentation:

- Most common Asymptomatic
- Headache
- Epistaxis
- Chest discomfort
- Symptom complications

### Stages

	Systolic BP	Diastolic BP
<b>Normal</b>	<b>&lt; 120</b>	<b>&lt; 80</b>
<b>Pre-HTN</b>	<b>120- 139</b>	<b>80-89</b>
<b>Stage 1 HTN</b>	<b>140-159</b>	<b>90-99</b>
<b>Stage 2 HTN</b>	<b>160- 179</b>	<b>100-119</b>
<b>Stage 3/ HTN Urgency</b>	<b>&gt; or = 180</b>	<b>&gt; or = 120</b>
<b>HTN emergency</b>	<b>End organ damage</b>	

Pathogenesis of HTN emergency<sup>2</sup> /malignant is characterized by:

- 1- Accelerated microvascular damage
- 2-Necrosis walls of small arterioles→ fibrinoid necrosis
- 3-Intravascular thrombosis

★ **Difference between urgency and emergency: urgency is asymptomatic and no rapid reduction of BP is considered while emergency the opposite.**

- HTN Urgency asymptomatic and should lowered within 24 hours
- HTN emergency (Hypertensive crisis) ; associated with confusion , blurry vision , dyspnea , chest pain due organ dysfunction .
- Normal persons should measure HTN every 2 years, while pre-hypertensives every year.
- White coat hypertension : BP will be doctor's clinic and normal in other settings

<sup>1</sup> Renal artery stenosis

<sup>2</sup> You have to stop the progression of the disease in damaging the organ it might lead to death.

## Diagnosis:

### ❑ Measure the BP By either ;

- **Sphygmomanometer** : from 3-6 visits.
- **Home Blood Pressure Monitoring** : patient record the results in about 2 weeks → then doctor takes average of the readings
- **Ambulatory Pressure Monitoring**: for anxious people a device fixed in the arm for 24 hours.

### ❑ History and physical examination:

- Abdominal Bruit auscultated in flank → secondary HTN caused by Renal artery stenosis.
- Upper limbs BP > lower limbs → secondary HTN caused coarctation of aorta (radiofemoral delay)
- Episodic HTN with flushing, palpitation, headache and sweating → Pheochromocytoma
- Weakness with Hypokalemia → Hyperaldosteronism (Conn's)
- Acne + abdominal striae → cushing's
- Congenital adrenal hyperplasia → hairy woman

### ❑ lab tests

- Urinalysis
- Fasting Glucose level
- Cholesterol screening
- ECG



- History , Physical examination and Lab tests -done to assess Risk factors, Organ damage and determine the HTN is essential or secondary.
- For asymptomatic HTN (stage 1 and 2) test should be repeated **only** if **stage 3** or there it's symptomatic (e.g blurred vision, dyspnea, confusion) from first reading we confirm HTN → start Tx.
- **Pseudo HTN due to: 1- Inappropriate size of calf 2-White coat phenomena ( BP will be doctor's clinic and normal in other settings )**

## Treatment

### Choice of therapy depends on:

- 1-Risk factors (mainly age and ethnicity)
- 2- Cause
- 3- Respond to initial therapy
- 4- Comorbid condition.

Goal of management is to reduce the incidence of adverse cardiovascular events, stroke and heart failure.

### When to treat & what target ?

- Low risk patients >160/100 target <140/90
- Diabetic ,high risk patients and elderly treat when its > 130/80 target < 130-120/80.
- Moderate to high risk treat > 140/90.

## 1. Life style modification

- Weight loss (low BMI)
- Dietary management as salt restriction + less fat and red meat and more vegetables & fruits and potassium.
- Exercise
- Tobacco cessation + Avoid alcohol consumption
- Stop unnecessary medications.

## 2. Drug Therapy → divided into two states:

### A. People without any conditions:

- People less than 60y (either black or white ) → thiazide , Calcium Channel blockers(CCB) , ACEi or ARB .
- Black people above 60 y → thiazide or (CCB)
- Non black people Above than 60y → CCB or ACEi or ARB



- Prehypertensive don't need any medications only lifestyle modification.
- Follow up HTN Patients after 2-4 weeks, & Serum potassium and creatinine monitored 1-2/yr.
- The decision when to start pharmacological treatment based on cardiovascular risks not only high BP
- Beta Blocker is not commonly used as an initial monotherapy unless there is cardiovascular condition.
- If single drug can't control HTN use either :
  1. Maximize the dose or use second drug .
  2. If still not controlled maximize the dose of both drugs.
- ★ Thiazide use in Black people because they are salt sensitive HTN more common in them.

### B. People with specific condition:

<b>DM</b>	ACEi or ARB ( Inhibit the RAAS ) and major side effect is Hyperkalemia
<b>Hyperthyroidism</b>	BB ( decrease both CO and Renin release ) and has many side effects including bradycardia and bronchospasm.
<b>Benign Prostatic Hypertrophy</b>	Alpha Blockers (decrease the arteriolar resistance )
<b>Osteoporosis</b>	Thiazide (increase the Calcium reabsorption )
<b>CHF or CAD</b>	BB , ACEi or ARB
<b>Pregnant woman</b>	BB (use first) or CCB or hydralazine or alpha methyl dopa
<b>Migrain</b>	BB, CCB

❑ **Patient with Hypertensive crisis (HTN emergency/malignancy) :**

- 1- IV labetalol give him labetalol or nitroprusside
- 2-I.V glycerol trinitrate
- 3-hydralazine
- 4- I.V sodium nitroprusside

**Note: Don't lower the BP to normal because my provoke stroke .**

❑ Other modalities to treat resistant HTN

- Hypertension renal denervation → interrupt the renal sympathetic nervous system → stop RAAS system.
- Implantable device to activated baroreceptor → to reduce BP

❑ **Refractory HTN causes:**

- 1- Non-adherence to therapy
- 2- Inadequate Tx
- 3- Failure to recognise underlying cause



❑ **Consider second cause of HTN in young and old patients (<30 or >60 years old)**

❑ **Contraindications in pregnant woman:**

- ACE, ARBs
- Avoid Diuretics (might cause low birth weight)

❑ **Contraindications in Asthma and depression → BB**

❑ **Contraindications in Cough → ACEi**

## Complications

### 1- Cardiovascular system

- CAD (MI)
- CHF, LVH peripheral vascular disease (PVD).
- Aortic aneurysm & aortic dissection<sup>3</sup>.
- **Atrial fibrillation**



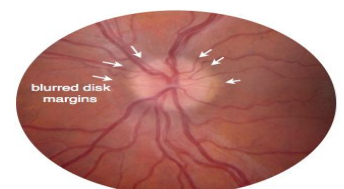
### Pathophysiology

- CAD and PAD : HTN accelerate the atherosclerosis process
- CHF : HTN increases the afterload → LVH → LVD → decrease the function of Heart

### 2- Eyes (retinal changes) using fundoscopy

❑ **Early changes:**

- Generalized arteriolar constriction see as **silver writing and vascular tortuosities**.
  - Arteriovenous nicking → discontinuity in the retinal vein secondary to thickened arterial walls. **(left image)**
  - Cotton wool spots (infarction of the nerve fiber layer in the retina) can cause visual disturbances and scotomata. **(Right image)**
- ❑ More serious disease ( **and here we scared of brain stroke!**)



**Papilledema**

<sup>3</sup> Tear in the layers of aorta cause blood flow in between → rupture + bleeding

- Flame- shaped hemorrhages and exudates (small white dense deposits of lipid.)
- Papilledema.


### 3- CNS

- Increased incidence of intracerebral hemorrhage.
- Increased incidence stroke subtypes ( (ischemic stroke, and lacunar stroke) and transient ischemic attacks [TIAs<sup>4</sup>] .
- Hypertensive encephalopathy when BP is severely elevated (uncommon)

### 4- Kidney

- Nephrosclerosis
- Renal failure. (most common cause of dialysis)

**Pathophysiology :**



- Nephrosclerosis : HTN → Arteriosclerosis of afferent and efferent arterioles
- Renal failure : HTN → Decreased GFR and dysfunction of tubules

## Summary

Thiazides	CCB	BB	ACE	ARBs	Alpha-blockers
-Osteoporosis -African american patients	-pregnant woman	-hyperthyroidism -CHF,CAD, A-fib -Pregnant woman Migrain	-DM	-Cough	-BPH

<sup>4</sup> Transient disturb in speech or vision, paresthesia or disorientation.

## MCQ's

**1- A 70-year-old female has been relatively healthy (but allergic to penicillin), treated only for hypertension, on a thiazide diuretic. She comes to the hospital due to the sudden onset of a severe, tearing chest pain, which radiates through to the back, associated with dyspnea and diaphoresis. Blood pressure is 165/80. Lung auscultation reveals bilateral basilar rales. A faint murmur of aortic insufficiency is heard. The BNP level is elevated at 550 pg/mL. ECG shows nonspecific ST-T changes. A chest x-ray suggests a widened mediastinum. Which of the following choices represents the most prudent emergent management?**

- A. IV furosemide plus IV loading dose of digoxin
- B. Emergent percutaneous coronary intervention with consideration of angio-plasty and/or stenting
- C. Blood cultures followed by rapid initiation of vancomycin plus gentamicin, then echocardiography
- D. IV beta-blocker therapy plus echocardiography; consideration of nitroprusside
- E. IV heparin followed by chest CT scan; consideration of thrombolytic therapy

This case description is classic for aortic dissection, other than the fact that it is more common in men than women.

**2- A 55-year-old African American female 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 exam, 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 slowly but surely
- D. Nifedipine sublingually to lower blood pressure rapidly
- E. Further history about recent home antihypertensives before deciding current therapy

This patient manifests malignant hypertension with diastolic blood pressure greater than 130 and acute (or ongoing) target organ damage.

**3-A 50-year-old construction worker continues to have an elevated blood pressure of 160/95 even after a third agent is added to his antihypertensive regimen. Physical exam is normal, electrolytes are normal, and the patient is taking no over-the-counter medications. Which of the following is the next helpful step for this patient?**

- A. Check pill count
- B. Evaluate for Cushing syndrome
- C. Check chest x-ray for coarctation of the aorta
- D. Obtain a renal angiogram
- E. Obtain an adrenal CT scan

The most common cause of refractory hypertension is nonadherence to the medication regimen.

Answers: D,B,A