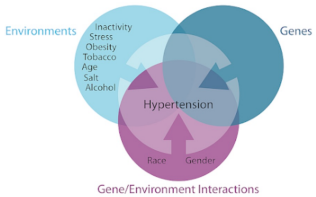
أسئلة الدكتور من السلايدات

Questions

docs.google.com

1/1* The patient history is negative for drugs known to elevate blood pressure. Which ONE of the following is least consistent with the diagnosis of primary hypertension in this patient ?



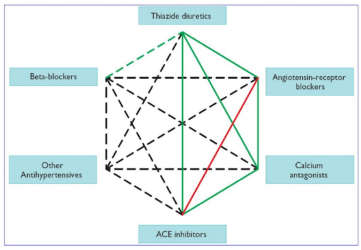
- Her age
- ✓ Her symptoms
- A positive family history of hypertension
- Her gender
- A positive history of high salt intake

التعليقات

The age, gender, high salt intake, and family history of hypertension all suggestive of

docs.google.com

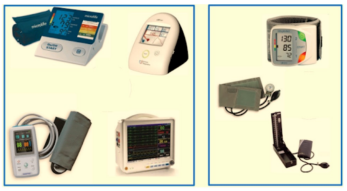
1/1* Which ONE of the following anti-hypertensive drugs is most likely started at the ED two weeks ago?



- A beta-blocker
- A thiazide diuretic
- ACE inhibitor
- ARB blocker
- ✓ dihydropyridine calcium-channel blocker

docs.google.com

1/1* Which one of the following is the recommended blood pressure monitor for home use by patients?



- The wrist auto digital BP monitor
- ✓ The upper arm auto digital BP monitor
- The upper arm Aneroid monitor
- The standard mercury sphygmomanometer
- New wearable blood pressure measuring smart watch

التعليقات

The upper arm auto digital is the recommended device

docs.google.com

1/1 * Which ONE of the following diagnosis is most consistent with her presentation

Causes of Secondary Hypertension

Secondary hypertension		
Renal	Endocrine	Cardiovascular
• Renovascular HTN • Renal parenchymal HTN	• Primary hyperaldosteronism • Cushing's syndrome • Pheochromocytoma • Hyperreninism • Hypothyroidism	• Obstructive sleep apnea • Coarctation of the aorta

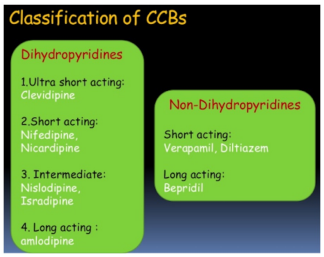
- ✓ Pheochromocytoma
- Hyperthyroidism
- Primary aldostironism
- Secondary aldostironism
- Acromegaly

التعليقات

Pheochromocytoma best explain her presentation, however, hyperthyroidism may also explain partially her symptoms

docs.google.com

1/1* Which ONE of the following is not expected side-effect of non-dihydropyridine calcium-channel blockers?



- ✓ Tachycardia
- Headache
- Hotness
- Constipation
- Bilateral pedal edema

* حلّوا باقي أسئلة فورم د.عزّت: https://forms.gle/KGXxrhHSCTrMdm9FA

Definition = Classification

- **Hypertension in adults**
  - 2017 ACC/AHA: persistent systolic blood pressure (SBP) ≥ **130 mm Hg** and/or diastolic blood pressure (DBP) ≥ **80 mm Hg** [1]
  - 2020 International Society of Hypertension (ISH) and 2014 JNC 8: persistent SBP ≥ **140 mm Hg** and/or DBP ≥ **90 mm Hg** [2][3]

Classification

Classification of hypertension in adults

	2017 ACC/AHA guideline [1]	2014 JNC 8 guideline [2][7]	2020 ISH guideline [3]
Normal blood pressure	• SBP < 120 mm Hg • **AND** DBP < 80 mm Hg		• SBP < 130 mm Hg • **AND** DBP < 85 mm Hg
Elevated blood pressure	• SBP 120–129 mm Hg • **AND** DBP < 80 mm Hg	• SBP 120–139 mm Hg • **OR** DBP 80–89 mm Hg	• SBP 130–139 mm Hg • **OR** DBP 85–89 mm Hg
Stage 1 hypertension	• SBP 130–139 mm Hg • **OR** DBP 80–89 mm Hg	• SBP 140–159 mm Hg • **OR** DBP 90–99 mm Hg	
Stage 2 hypertension	• SBP ≥ 140 mm Hg • **OR** DBP ≥ 90 mm Hg	• SBP ≥ 160 mm Hg • **OR** DBP ≥ 100 mm Hg	

Etiology = Causes

Etiology

Primary hypertension [1][8]

- Multifactorial etiology including epigenetic, genetic, and environmental factors
- Directly related to total peripheral resistance and cardiac output
- **Risk factors for primary hypertension**
  - Nonmodifiable risk factors
    - Positive family history
    - Race and **ethnicity**
    - Advanced age
  - Modifiable risk factors
    - Overweight and **obesity** (greatest modifiable risk factor)
    - Uncontrolled **diabetes**
    - **Smoking**
    - Excessive alcohol intake
    - Diet high in **sodium** and low in potassium
    - **Physical inactivity**
    - Psychological stress

Secondary hypertension

See "Secondary hypertension."

Common causes of endocrine hypertension [1]

	Potential indication for further workup	Typical findings
Primary hyperaldosteronism (Conn syndrome)	• Resistant hypertension • Stroke at < 40 years of age • Family history of early-onset hypertension and/or primary hyperaldosteronism • Adrenal incidentaloma • Possible hypokalemia with consequent metabolic alkalosis [1]	• ↑ Plasma aldosterone concentration (≥ 10 ng/dL) • ↓ Plasma renin activity (< 1.0 ng/mL/hour) • ↑ Aldosterone-to-renin ratio on a morning blood sample [22]
Pheochromocytoma	• Resistant hypertension • Paroxysmal hypertension • Episodes of headaches, palpitations, and diaphoresis • Family history of endocrine tumors • Cutaneous features suggestive of NF type 1	• ↑ 24-hour urinary fractionated metanephrines • ↑ Plasma metanephrines
Hypercortisolism (Cushing syndrome)	• Weight gain • Osteoporosis • Facial plethora, skin thinning, striae • Muscle weakness • Hyperglycemia	• ↑ Serum cortisol following a low-dose dexamethasone suppression test
Hyperthyroidism	• Heat intolerance, diarrhea, tachycardia, and/or tremor	• ↓ TSH, ↑ free T4
Primary hyperparathyroidism	• Typically asymptomatic • ↑ Serum calcium	• ↑ PTH level • ↓ Serum phosphates

Congenital adrenal hyperplasia	• 11β-hydroxylase deficiency: virilization
	• 17α-hydroxylase deficiency
	  ◦ Incomplete masculinization (males)
	  ◦ Primary amenorrhea (females)
	• Hypokalemia
		• ↑ 17-hydroxyprogesterone

Acromegaly	• Clinical features of acromegaly, including:
	  ◦ Tumor mass effects like bitemporal hemianopia
	  ◦ Typical facial features
		• ↑ Serum IGF-1

Secondary hypertension

Hypertension due to an identifiable cause. Accounts for 5–15% of cases of hypertension. Important causes include renal disease, renal artery stenosis, pheochromocytoma, hyperthyroidism, hyperaldosteronism, hypercortisolism, obstructive sleep apnea, raised intracranial pressure, and certain drugs (e.g., sympathomimetics).

The Causes:

RECENT: **R**enal (e.g., renal artery stenosis, glomerulonephritis), **E**ndocrine (e.g., Cushing syndrome, hyperthyroidism, Conn syndrome), **C**oarctation of the aorta, **E**strogen (oral contraceptives), **N**eurological (raised intracranial pressure, psychostimulants use), and **T**reatment (e.g., glucocorticoids, NSAIDs) are the causes of secondary hypertension.

Renal hypertension

Any renal disease can potentially trigger hypertension.

- **Renal artery stenosis** (e.g., due to atherosclerosis, fibromuscular dysplasia, polyarteritis nodosa, aortic arch syndrome)
  - Potential indications for further workup
    - Resistant hypertension need ≥ 3 Antihypertensives
    - Recurrent flash pulmonary edema
    - Abdominal bruit
    - ↑ Serum creatinine (by ≥ 50%) within 1 week of starting an ACEI or ARB [19]
    - Hypokalemia [20][21]
    - Asymmetric kidney size
  - Workup and findings: Duplex ultrasonography or MRA or CTA of the renal arteries
- **Renal parenchymal disease** (e.g., due to glomerulonephritis, polycystic kidney disease, systemic lupus erythematosus, renal tumors, atrophic kidney)
- **Chronic kidney disease** CKD

Other

- **Coarctation of the aorta** distal to the left subclavian artery
  - Potential indications for further workup: Blood pressure difference between the **upper** and **lower** limbs
  - Workup and findings
    - Doppler echocardiography
    - X-ray chest
    - CTA or MRA chest and abdomen
- **Obstructive sleep apnea**
  - Pathophysiology: ↑ catecholamines during apneic phases → secondary hypertension
  - Potential indications for further workup
    - Resistant hypertension
    - Obesity, snoring, and/or daytime sleepiness
    - Nondipping pattern on 24-hour blood pressure monitoring
  - Workup and findings: sleep studies often leads to resolution of hypertension.
  - Continuous positive airway pressure (CPAP)
- **Substance-related** Drug or Drug Abuse
  - Potential indications for further workup
    - Recreational drug use: amphetamines, cocaine, phencyclidine
    - Caffeine, nicotine, and/or alcohol use
    - Use of certain medications: sympathomimetic drugs (e.g., decongestants), corticosteroids, NSAIDs, oral contraceptives
  - Workup and findings
    - Urine drug screening
    - Response to withdrawal of suspected culprit

Management

- Management of secondary hypertension depends on the suspected cause.
- See "Approach to management of hypertension."

Clinical features = Symptoms

Clinical features

Silent Killer

1° 2°

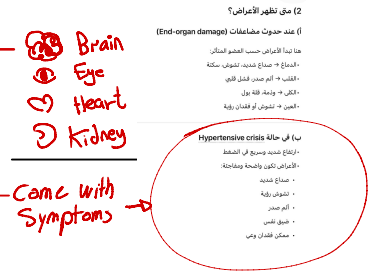
- Hypertension is usually asymptomatic until:
  - Complications of **end-organ damage** arise (see "Complications" below)
  - Or an acute increase in blood pressure occurs (see "Hypertensive crisis")
- Secondary hypertension usually manifests with symptoms of the underlying disease.
- Nonspecific symptoms of hypertension
  - Headaches, esp. early morning or waking headache
  - Dizziness, tinnitus, blurred vision
  - Flushed appearance
  - Epistaxis
  - Chest discomfort, palpitations
  - Strong, bounding pulse on palpation
  - Nervousness
  - Fatigue, sleep disturbances

Since hypertension is often asymptomatic, regular screening is necessary to prevent end-organ damage.

Brain
Eye
Heart
Kidney

Come with Symptoms

Non Specific Symptoms come with Secondary HTN



يجب المستشفى

بتفحّص عن الطبيب

Subtypes of HTN

① White Coat HTN → ② Masked HTN → ③ Isolated Systolic HTN

BP ↑ in Clinic
BP ↓ in other place
* Need lifestyle Modification

BP ↓ in Clinic
BP ↑ in other place
* Need lifestyle Modification
+
* Anti Hypertensive

↑ SBP and Normal DBP
≥140 <90
* Need lifestyle Modification
+
* Anti Hypertensive
- Thiazide Diuretics
- Dihydropyridine CCBs

Mind Map — Hypertension Variants (Exam Focus)

التعليمات البرمجية

```
Hypertension Variants
├── White Coat Hypertension
│   ├── Clinic: High BP
│   ├── Home: Normal BP
│   ├── Cause: Anxiety/Stress from Medical environment
│   ├── Dx:
│   │   ├── Office ≥130/89 ≤160/100
│   │   └── Home <130/80 (ABPM/HBPM): Normal
│   ├── Risk: Moderate (may progress)
│   └── Tx: Lifestyle + annual monitoring ✓
│
├── Masked Hypertension
│   ├── Clinic: Normal BP
│   ├── Home: High BP
│   ├── Risk: HIGH (like sustained HTN)
│   ├── Suspect:
│   │   └── Office 120–129 / 75–79
│   ├── Dx: ABPM/HBPM
│   └── Tx: Lifestyle + Medications ✓
│
└── Isolated Systolic HTN
    ├── SBP ≥140, DBP ≤90
    ├── Cause:
    │   ├── Aging (↓ elasticity) ← most common
    │   └── High CO (anemia, hyperthyroid, AR, AV fistula)
    ├── Features:
    │   ├── Asymptomatic
    │   └── Wide pulse pressure (bounding pulse)
    ├── Risk: Stroke, MI, renal disease
    └── Tx:
        ├── Lifestyle
        ├── Thiazide or CCB
        └── Goal SBP <140 ✓
```

→ Arterial Stiffness
→ Aortic Regurgitation

Diagnosis

① screening in Clinic → 2s: 2 arms, 2 reading, 2 visits

② Confirmation → ABPM / HBPM

③ Evaluation if It is 2° Hypertenion ?! → Px, Hx, lab

Screening for hypertension [8]

- **Indications**
  - **Annual screening** [1]
    - **Individuals > 40 years of age**
    - Adults of any age with risk factors for primary hypertension
  - Screening every 3–5 years: individuals 18–39 years of age with previously normal blood pressure (< 130/85 mm Hg) and no risk factors
- **Method**: in-office blood pressure measurement
  - If elevated, measurements should be repeated on both arms.
  - Elevated average blood pressure on **at least two readings** obtained on **at least two separate visits** supports a diagnosis of hypertension. [1]

! ~ 20% of individuals with high blood pressure are unaware they have hypertension. [23]

Diagnostic confirmation [1][8][24]

Out-of-office measurement is recommended in all individuals for confirmation of hypertension before initiating treatment.

- **Ambulatory blood pressure measurement (ABPM)**: preferred method
  - A device measures blood pressure at fixed intervals (e.g., every 15–30 minutes) over 12–24 hours.
  - Takes measurements while the individual is carrying out normal activities during the day and at nighttime
- **Home blood pressure monitoring (HBPM)**: Blood pressure is measured by the individual at periodic intervals.

! Patients should be taught to measure their own blood pressure to allow for long-term monitoring and assessment of treatment.

Evaluation of patients with newly diagnosed hypertension [1][19][3]

The initial exam should focus on evaluation for signs indicating secondary hypertension and target organ damage, and the assessment of ASCVD risk. [25]

- **Physical examination and patient history**
- **Routine studies**
  - Fasting blood glucose — Risk
  - Serum sodium, potassium, and calcium levels
  - Renal function tests: serum creatinine and eGFR — R
  - CBC
  - TSH — E
  - Lipid profile (HDL, LDL, and triglycerides levels) — Risk
  - Urinalysis and urinary albumin-to-creatinine ratio — R
  - Electrocardiogram (ECG)
- **Additional studies**
  - Hemoglobin A1c — Risk
  - Liver chemistries [3]
  - Serum uric acid
  - Echocardiogram

! The initial evaluation should include an assessment for orthostatic hypotension (by measuring blood pressure while sitting and standing), especially in older adults. All adults ≤ 30 years of age with elevated brachial blood pressure should also have their blood pressure measured in their thigh to rule out coarctation of the aorta. [1]

Treatment

① Non-Pharmacological = Life Style Modification

② Pharmacological

③ Patient's Comorbidities effect your choice of Antihypertensive drug.

Management

Recommendations regarding indications for treatment and target blood pressure differ between clinical practice guidelines. The following recommendations are consistent with those in the **2017 ACC/AHA guidelines** unless specified otherwise. [1][2][26][27][3]

Approach [1]

- Lifestyle changes for managing hypertension: for all patients with SBP > 120 mm Hg or DBP > 80 mm Hg
- Identify indications for antihypertensive treatment.
- Select first-line antihypertensive medication based on individual patient characteristics (see also "Antihypertensive treatment by comorbidities")
- Titrate treatment to reach target blood pressure. [2][1][3]
  - Most adults: blood pressure < 130/80 mm Hg
  - Individualize targets based on age and comorbidities.
- Follow-up regularly: reassess indications for pharmacological treatment and tailor therapy to individual needs.

① Nonpharmacological measures

Lifestyle changes for managing hypertension [1][19][5]

Intervention (in order of effectiveness)		Target	Approximate SBP reduction in hypertensive patients
Weight loss(most effective measure)		• Ideal body weight	• 1 mm Hg per kg reduction in body weight in overweight individuals
Diet	DASH diet	• Diet rich in fruits, vegetables, and whole grains [28] • Low in saturated and trans fats	• 11 mm Hg
	Decrease dietary sodium	• Daily sodium intake < 1500 mg [5][25][28]	• 5–6 mm Hg
	Increase dietary potassium	• Daily potassium intake 3.5–5 g (preferably by increasing fruit and vegetable intake) [29]	• 4–5 mm Hg
	Decrease alcohol intake	• ♂: ≤ 2 standard drinks daily; ♀: ≤ 1 standard drink daily • Provide counseling on alcohol use disorder, if necessary.	• 4 mm Hg
Exercise	Aerobic [30]	• 90–150 minutes per week [5][28]	• 5–8 mm Hg
	Dynamic resistance (e.g., weight training)	• 90–150 minutes per week	• 4 mm Hg
	Isometric resistance (e.g., hand grip exercise)	• Three sessions per week	• 5 mm Hg

Wow

! Smoking cessation should be advised in all patients to reduce ASCVD risk. [1]

! Consider possible psychosocial factors or social determinants of health that may be contributing to the patient's high blood pressure (e.g., stress, anxiety, lack of access to fresh food) and make appropriate referrals where necessary. [5]

! Increased potassium intake should not be recommended for patients with advanced CKD. [29]

→ These lead to ↓ BP
↓ ASCVD Risk

عم فوزين في حجز

Initial medication [2][1][19]

Choice of initial medication should be based on the following:

- Patient's initial blood pressure [3][33][1]
  - SBP 130–139 mm Hg or DBP 80–89 mm Hg (stage 1 hypertension): Consider initial monotherapy.
  - SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg (stage 2 hypertension) AND an average blood pressure > 20/10 mm Hg above target
    - Initiate combination therapy.
    - Commonly used combinations are an ACEI or ARB PLUS either a dihydropyridine CCB OR a thiazide-type diuretic.
- Additional factors to consider
  - Major comorbidities (see "Antihypertensive treatment by comorbidities")
  - Major contraindications
  - Adverse effects that may be unacceptable to patients
  - Patient race: For Black patients (including individuals with diabetes) without CHF or CKD, initial antihypertensive therapy should **include** a thiazide-type diuretic or CCB. [34][12]

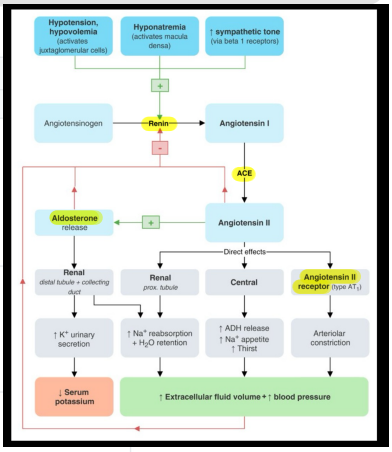
Monotherapy

Combination therapy

① 1st Line

First-line options

Quick Review



First-line antihypertensive medications [1][35][25][19]

Drug class	Examples	Indications
ACEIs	• Lisinopril • Enalapril • Captopril	• Nephroprotective, therefore preferred in patients with: ◦ **Diabetes mellitus** and albuminuria ◦ **Renal disease** [36]
ARBs	• Losartan • Valsartan	
Thiazide diuretics	• Chlorthalidone • Hydrochlorothiazide	• Preferred: ◦ As one of the initial antihypertensive medications in Black patients [2] ◦ In patients with isolated systolic hypertension [18][17]
Dihydropyridine CCBs [19]	• Amlodipine (preferred) • Nifedipine	
Nondihydropyridine CCBs	• Diltiazem • Verapamil	• Less commonly used

First-line medications for primary hypertension are thiazide diuretics, ACEIs, ARBs, and dihydropyridine CCBs.

Do not prescribe an ACEI and ARB together or in combination with a direct renin inhibitor. This increases the risk of hyperkalemia and renal dysfunction and does not provide additional benefit. [1][19]

"One RAAS Blocker is enough"

ACEI: Angiotensin Converting Enzyme Inhibitors

ARB: Angiotensin Receptor Blocker

② Second Line

Second-line options

Second-line antihypertensive medications [1][25]

Drug class		Examples	Indications
Beta blockers		• Combined alpha- and beta-adrenergic receptor antagonists ◦ Carvedilol ◦ Labetalol • Noncardioselective ◦ Nadolol ◦ Propranolol • Cardioselective ◦ Atenolol ◦ Bisoprolol ◦ Metoprolol succinate	• Recommended for first-line use only in patients with the following comorbidities: ◦ **Ischemic heart disease** ◦ **Heart failure** [1] ◦ Atrial fibrillation ◦ Thoracic aortic disease (e.g., aortic dissection, thoracic aortic aneurysm) ◦ Thyrotoxicosis ◦ Migraine ◦ Essential tremor
Loop diuretics		• Furosemide • Torsemide	• Preferred choice of diuretic in patients with symptomatic heart failure and CKD (if GFR < 30 mL/min)
Potassium-sparing diuretics	**Aldosterone antagonists**	• Steroidal ◦ Spironolactone ◦ Eplerenone • Nonsteroidal: finerenone	• Preferred in hypertension due to primary hyperaldosteronism • Frequently used as add-on therapy in resistant hypertension
	Epithelial sodium channel blockers	• Amiloride • Triamterene	• Consider as add-on therapy for patients with hypokalemia who are receiving thiazides.
Direct renin inhibitors		• Aliskiren	• Rarely used
Alpha-1 blockers		• Prazosin • Doxazosin	• Used in hypertension caused by pheochromocytoma • May be used as an adjunct in patients with benign prostatic hypertrophy
Alpha-2 agonists		• Clonidine • Methyldopa	• Rarely used
Direct arteriolar vasodilators		• Hydralazine • Minoxidil	• **Hydralazine** is a treatment option in **pregnant patients**.

Patients with CKD or baseline potassium > 5.5 mEq/L and those who take potassium supplements or potassium-sparing drugs are at higher risk of hyperkalemia as an adverse effect from pharmacological treatment for hypertension. [1][25][28]

③ Based on Comorbidities

Antihypertensive treatment by comorbidities [1]

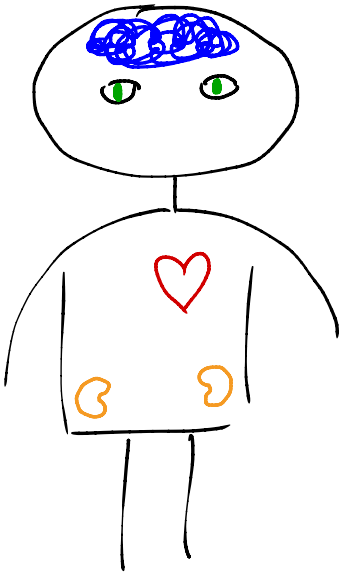
Comorbidity	Treatment recommendations
CKD [28]	• **Initial therapy** [1][28] ◦ ACEIs or ARBs • **Treatment goal**: SBP < 120 mm Hg (if tolerated) [28][1]
Diabetes	• **Initial therapy** ◦ For patients with microalbuminuria or overt proteinuria: ACEIs or ARBs (protective against diabetic nephropathy) [1][28][39][40] ◦ For patients without albuminuria: any first-line agent (ACEIs, ARBs, CCBs, OR thiazide diuretics) • **Treatment goal**: blood pressure < 130/80 mm Hg
CHF	• **Initial therapy** ◦ HFrEF: guideline-directed medical therapy ▪ Beta blockers (carvedilol, or metoprolol succinate, or bisoprolol) ▪ Recommended for use in compensated CHF ▪ Must be used cautiously in decompensated CHF ▪ Contraindicated in cardiogenic shock ▪ Diuretics, including aldosterone antagonists ▪ ACEIs OR ARBs ▪ Angiotensin receptor-neprilysin inhibitor ◦ HFpEF ▪ Current volume overload: diuretics ▪ No current volume overload: ACEIs or ARBs PLUS beta blockers ▪ Avoid nitrates. • **Treatment goals** [1] ◦ < 130/80 mm Hg
Asthma [41]	• **Initial therapy** ◦ ARBs, CCB, OR thiazide diuretics (no preference) ◦ Cautions ▪ Avoid beta blockers unless for a particular indication. ▪ Use cardioselective beta blockers when necessary (noncardioselective beta blockers can cause bronchoconstriction). ▪ ARBs may be preferred over ACEIs (increased risk of cough)
Osteoporosis	• **Initial therapy**: thiazide diuretics (↓ renal calcium excretion → ↓ bone loss)
Gout	• **Initial therapy** ◦ ARBs (e.g., losartan, have an uricosuric effect), ACEIs, and CCBs ◦ Thiazide diuretics should be avoided (↑ uric acid levels).
Migraine	• **Initial therapy**: beta blockers OR CCBs

The last Topic: Complications

may you discover HTN from complications so you have to do regular screen

Complications

- Arterial hypertension is the most common risk factor for cardiovascular disease
- It leads to changes in the vascular endothelium, particularly of the small vessels, and can therefore affect any organ system.
- See also "Hypertensive crisis."



1 Cardiovascular system (hypertensive vascular disease) [53][54]

- Left ventricular hypertrophy, **hypertrophic cardiomyopathy**, dilated cardiomyopathy
- **Congestive heart failure**
- Coronary artery disease and **myocardial infarction**
- Atrial fibrillation
- Aortic aneurysm
- **Aortic dissection**
- Carotid artery stenosis
- Peripheral artery disease
- Atherosclerosis

2 Brain [53][54][55]

- **Stroke**, TIA ✓
- Subcortical leukoencephalopathy
- Cognitive changes such as memory loss

3 Kidneys [56][54]

- **Hypertensive nephrosclerosis**: a renal vascular injury secondary to long-standing arterial hypertension
  - Pathophysiology: chronic hypertension → hypertrophy of medial and intimal layers → narrowing of afferent arterioles → ↓ glomerular blood flow → glomerular and tubular ischemia → arteriolonephrosclerosis and fibrosis (focal segmental glomerulosclerosis) → end-stage renal disease
  - Clinical findings FSGS
    - Initially microalbuminuria and microhematuria
    - ↑ BUN, Cr, and uric acid levels
    - Nephrosclerosis with proteinuria (usually < 1 g/day) and progressive renal failure occur with disease progression.
  - Diagnostics: renal biopsy shows vascular, glomerular, and tubulointerstitial changes [57]
    - Arterial and arteriolar medial hypertrophy, intimal thickening, and **hyalinosis**
    - Global glomerulosclerosis (more common) or focal segmental glomerulosclerosis
    - Tubulointerstitial fibrosis
  - Treatment: ACE-inhibitors (first-line), ARBs
- Chronic kidney disease CKD

3 Eyes [53][54]

- **Hypertensive retinopathy**
  - Arteriosclerotic and hypertension-related changes of the retinal vessels
  - Initial reactive vasoconstriction (vasospasm), followed by sclerosis with breakdown of blood-retinal barrier and subsequent hemorrhage and exudation
  - Fundoscopic examination ★ We have to do this test
    - Cotton wool spots
    - Retinal hemorrhages (i.e., flame-shaped hemorrhages)
    - Microaneurysms
    - Macular star (results from exudation into the macula)
    - Hard exudates
    - **Arteriovenous nicking**: a tapering of a retinal venule at the point where a retinal arteriole crosses the retinal venule
      - Hourglass shape on fundoscopic examination
      - Associated with advanced hypertensive retinopathy.
    - **Elschnig spots**: multiple, round, brown-black spots with a bright ring that are scattered throughout the retina
    - Marked swelling and prominence of the optic disk with indistinct borders due to papilledema and optic atrophy (end-stage disease)
  - The presence of papilledema in a hypertensive patient may indicate a hypertensive crisis and warrants urgent lowering of blood pressure (see "Hypertensive crisis").

Details

Classification system according to Keith-Wagener-Barker [53]

Grade	Findings	Symptoms
Grade I	Vessel diameter variation: arteriolar constriction and tortuosity	Usually asymptomatic
Grade II	Gunn sign and marked constriction of vessels and sclerosis of arterioles	
Grade III	Cotton wool exudates, hard exudates, retinal hemorrhage, retinal edema, macular star formation	Decreased and/or blurred vision, headaches
Grade IV	Papilledema, optic atrophy	

ⓘ Local treatment of retinopathy is not possible, therefore, systemic reduction of blood pressure is critical.