

**MANAGEMENT OF PATIENTS
WITH ARTERIAL HYPERTENSION**

**MODERN PRACTICE OF INTERNAL MEDICINE
WITH EMERGENCY CONDITIONS**

Guidelines for students and interns

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
Харківський національний медичний університет

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**ВЕДЕННЯ ПАЦІЄНТІВ
З АРТЕРІАЛЬНОЮ ГІПЕРТЕНЗІЄЮ**

**СУЧАСНА ПРАКТИКА
ВНУТРІШНЬОЇ МЕДИЦИНИ З
НЕВІДКЛАДНИМИ СТАНАМИ**

*Методичні вказівки
для студентів та лікарів-інтернів*

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Ведення пацієнтів з артеріальною гіпертензією. Сучасна практика внутрішньої медицини з невідкладними станами : метод. вказ. для студентів та лікарів-інтернів / упоряд. О. Я. Бабак, А. С. Шалімова, Н. М. Железнякова та ін. – Харків : ХНМУ, 2021. – 24 с.

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Management of patients with arterial hypertension

1. Number of hours: classroom work – 5 hours, independent work of students – 3 hours.

2. Material and methodological support of the topic: tables, multimedia presentations, electrocardiograms, data of laboratory and instrumental research methods.

3. Rationale for the topic.

Arterial hypertension (AH) is one of the most common cardiovascular diseases in most European countries, with about 90% of its essential form - essential hypertension (EH). The number of adults with EH worldwide increased from 594 million in 1975 to 1.13 billion in 2015. One of the components of the development of hypertension is an increase in the activity of the sympathetic nervous system (SNS), which precedes the increase in blood pressure (BP) and confirmed in experimental and clinical studies. Increased SNS activity, especially in the kidneys, contributes to hypertension. Renal SNS increases sodium reabsorption and renin secretion and worsens natriuresis pressure. Greater activity of the SNS also contributes to metabolic disorders. In patients with metabolic syndrome, SNS is activated by hyperinsulinemia, hyperleptinemia, activation of the renin-angiotensin-aldosterone system (RAAS), baroreflex dysfunction, and obstructive sleep apnea.

An important element of the treatment of patients with hypertension is a healthy lifestyle, including salt restriction, alcohol moderation, healthy eating, regular exercise, weight control and smoking cessation. When prescribing drug therapy to patients with hypertension, preference is given to combining several drugs in one tablet. Step-by-step treatment focused on lifestyle adjustment and medication optimization is an effective treatment of hypertension, which helps prevent cardiovascular complications, increase life expectancy and improve the quality of life of patients.

4. The purpose of the lesson:

– general: to acquire knowledge about the management of patients with hypertension, to study diagnostic methods and means of providing care to such patients, to assess the prognosis for the patient.

– specific: provide the scope of examination of the patient at the level of practical training of the doctor

Specific goals: The student must know:	Initial level of knowledge – skills: The student must be able to:
<ul style="list-style-type: none"> • modern classification of essential and symptomatic hypertension; • differential diagnosis of essential and secondary hypertension; • risk stratification of cardiovascular complications and prognosis; • tactics of patient management depending on the risk group; • recommendations for the treatment of hypertension (lifestyle interventions and drug treatment); • first and second line antihypertensive drugs, contraindications and side effects; • modern principles of selection and combination of antihypertensive drugs; • standards of treatment of arterial hypertension; • primary and secondary prevention, prognosis in hypertension 	<ul style="list-style-type: none"> • analyze the data of the survey and objective examination of a patient with hypertension; • identify clinical symptoms characteristic of hypertension and secondary hypertension; • make a plan for the diagnosis of a patient with hypertension; • determine and interpret the data of laboratory tests of a patient with hypertension; • analyze the data of the instrumental study of a patient with hypertension; • formulate a diagnosis in case of hypertension or symptomatic hypertension in accordance with modern classifications; • prescribe treatment (including prescription forms for the main drugs of antihypertensive drugs).

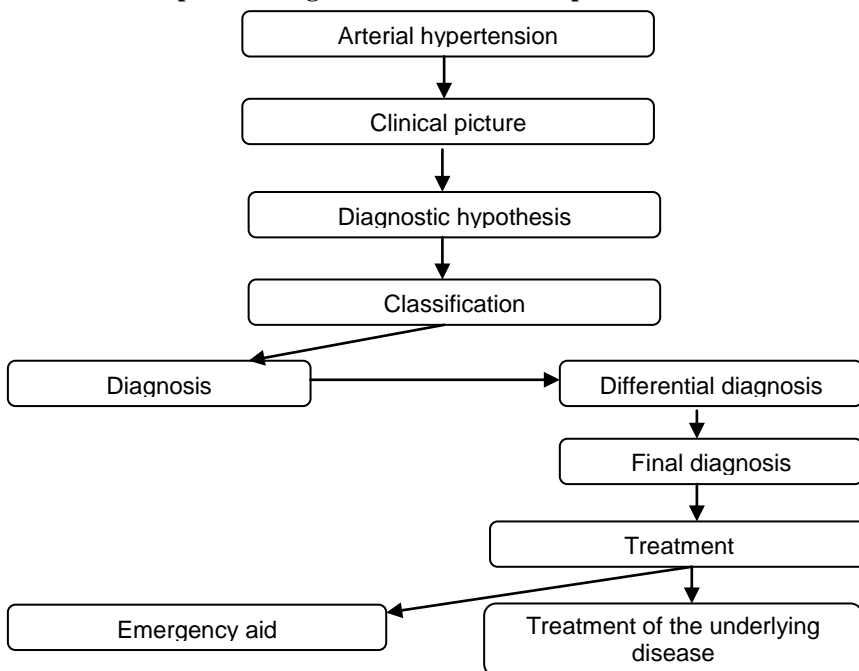
The list of practical skills that the student must master:

1. Examination of patients with hypertension.
2. Interpretation of laboratory parameters that confirm or exclude secondary hypertension.
3. Interpretation of instrumental research data that confirm or exclude secondary hypertension.
4. Interpretation of the results of additional diagnostic methods used to assess the target organs damage.
5. Interpretation of the results of additional diagnostic methods used to clarify the diagnosis and complications of hypertension.
6. Prescription for the main antihypertensive drugs.

Materials for self-training

Discipline	Know	Be able
Anatomy	Anatomical structure of the cardiovascular, nervous and endocrine systems	
Physiology	Physiology of blood circulation, nervous, endocrine systems	
Pathophysiology	Understand the pathogenetic mechanisms of arterial hypertension	
Propaedeutics of internal medicine	Have the skills and demonstrate the ability for physical examination of patients	Diagnose and interpret ECG data, X-ray examinations, blood pressure measurements
Pharmacology	Know the classification, pharmacokinetics and pharmacodynamics, indications and contraindications for the appointment of drugs affecting vascular tone	

5. Graph of the logical structure of the topic



6. Oriented map of students' work:

- a) criteria for diagnosis with their verification at the patient's bedside;
- b) selection of the most informed tests, laboratory and instrumental tests (if possible performed by students), which confirm the diagnosis;
- c) appointment of treatment; prescribing (knowledge of the mechanism of action of drugs);
- d) the choice of method of physiotherapeutic treatment;
- e) determining the prognosis and efficiency of the patient;
- g) definition of disability group;
- h) disease prevention.

Contents of the topic

According to most international guidelines, the recommended level for the diagnosis of hypertension is the level of systolic blood pressure (SBP) in the range of ≥ 140 mm Hg and/or diastolic blood pressure (DBP) ≥ 90 mm Hg.

Essential hypertension (hypertension, primary arterial hypertension) is an increase in blood pressure in the absence of an obvious cause.

Secondary hypertension (or symptomatic) is hypertension with an identified cause that can be treated with an intervention specific to that cause.

Hypertensive crisis is a sudden significant increase in BP (*grade 3*), which in many cases is accompanied by acute target organs damage (TOD), which is often life-threatening and requires immediate but careful intervention to reduce blood pressure.

According to the Guidelines of the European Society of Hypertension (ESH) and European Society of Cardiology (ESC) in 2018, there are several levels of BP (*table 1*).

Table 1

**Classification of hypertension according blood pressure levels
(ESH/ESC Guidelines, 2018)**

Categories	SBP, mm Hg	DBP, mm Hg
Optimal level	< 120	< 80
Normal level	< 130	< 85
High normal level	130–139	85–89
Arterial hypertension:		
AH grade 1	140–159 and/or 90–99	
AH grade 2	160–179 and/or 100–109	
AH grade 3	≥ 180 and/or ≥ 110	
Isolated systolic hypertension	≥ 140	< 90

According to the Guidelines of the International Society of Hypertension (ISH) in 2020, there are only 2 grades of the AH (*table 2*).

Table 2

**Classification of hypertension according blood pressure levels
(ISH Guidelines, 2020)**

Categories	SBP, mm Hg	DBP, mm Hg
Optimal level	< 120	< 80
Normal level	< 130	< 85
High normal level	130–139	85–89
Arterial hypertension:		
AH grade 1	140–159 and/or 90–99	
AH grade 2	≥ 160 and/or ≥ 100	
Isolated systolic hypertension	≥140	<90

The stage of the AH is determined by the classification of target organs damage (*tabl. 3*)

Table 3

Classification of hypertension by target organs damage

<i>Stage 1 (uncomplicated)</i>	There are no objective signs of organic lesions of the heart, brain, kidneys, retina, blood vessels
<i>Stage 2 (asymptomatic disease)</i>	<p>There are objective signs of hypertensive target organs damage without symptoms of dysfunction:</p> <ul style="list-style-type: none"> • Arterial stiffness: pulse pressure (in the elderly) > 60 mm Hg, carotid-femoral pulse wave > 10 m/s • ECG signs of left ventricular hypertrophy (Sokolov-Lyon index > 35 mm, or R in avL > 11 mm; Cornell product > 2440 mm.ms or Cornell voltage test > 28 mm in men or > 20 mm in women) • Echocardiographic signs of left ventricular hypertrophy • Microalbuminuria (30-300 mg / 24 h), or increased albumin-creatinine ratio (30-300 mg/g; 3.4–34 mg/mmol) • Moderate CKD with GFR > 30–59 ml/min/1.73 m² • Ankle-shoulder index < 0.9 • Acquired retinopathy • Signs of carotid artery damage – increase in intima-media thickness ≥ 0.9 mm or determination of existing atherosclerotic plaque
<i>Stage 3 (established disease)</i>	Objective signs of target organ damage with corresponding symptoms and dysfunction were determined
Heart	<p>Left ventricular myocardial infarction</p> <p>Chronic heart failure IIA-III stages</p>

Brain	Acute cerebrovascular accident Hypertensive encephalopathy (acute) Dementia of vascular origin
Retina	Hemorrhages and/or retinal exudates Swelling of the optic disc
Kidneys	Severe CKD with GFR <30 ml/min/1.73m ²
Vessels	Aortic dissection Occlusive disease of peripheral arteries

Risk stratification. Many cardiovascular risk assessment systems are now available, and most identify the risk within 10 years. Since 2003, the European guidelines for CVD prevention recommend the use of systematic coronary risk assessment SCORE (Systematic COronary Risk Evaluation), as it is based on the results of large-scale, representative studies of the European cohort. The SCORE system assesses the 10-year risk of the first fatal atherosclerotic phenomenon associated with age, sex, smoking, total cholesterol and SBP, TOD and the main risk factors listed in table. 4.

Table 4

Parameters for assessing the overall risk of complications

<p><u>Demographic characteristics and laboratory parameters</u></p> <ul style="list-style-type: none"> - Gender (men > women) - Age (men > 55 years, women > 65 years) - Smoking (current or past history) - Dyslipidemia (total cholesterol > 5.0 mmol/l or LDL cholesterol > 3.0 mmol/l, or HDL cholesterol < 1.0 mmol/l in men and < 1.2 mmol/l in women, or TG > 1.7 mmol/l) - The level of fasting blood glucose is 5.6 - 6.9 mmol/l - Impaired glucose tolerance - Signs of abdominal obesity (waist > 88 cm in women and > 102 cm in men) - Family history of premature CVD (men < 55 years and women < 65 years) <p><u>Additional risk factors</u></p> <ul style="list-style-type: none"> - Uric acid - Early menopause - Sedentary lifestyle - Psychosocial and socio-economic factors - Heart rate (values at rest > 80 beats/min) <p><u>Comorbid pathology</u></p> <ul style="list-style-type: none"> - Diabetes mellitus - Cerebrovascular pathology (acute cerebrovascular accident of ischemic or hemorrhagic nature) - Ischemic heart disease (myocardial infarction, angina, revascularization surgery, heart failure IIA-III, atrial fibrillation) - Renal pathology (renal failure - serum creatinine in men > 133 μmol/l, in women > 124 μmol/l; diabetic nephropathy), proteinuria ≥ 300 mg/day - Occlusive disease of peripheral arteries - Severe retinopathy (hemorrhage, exudates, optic disc edema)

Table 5

Risk stratification to assess prognosis in AH

Stratification factors	BP level, mm Hg				
	Normal SBP 120–129 DBP 80–84	High normal SBP 130–139 DBP 85–89	AH grade 1 SBP 140–159 DBP 90–99	AH grade 2 SBP 160–179 DBP 100–109	AH grade 3 SBP ≥ 180 DBP ≥ 110
There are no risk factors	Low risk		Low risk	Moderate risk	High Risk
1–2 risk factors	Low risk	Low risk	Moderate risk	High Risk	Very high risk
Multiple risk factors, without target organs damage, metabolic syndrome, diabetes	Moderate risk	High Risk	High Risk	High Risk	Very high risk
Cardiovascular pathology, CKD, diabetes mellitus with target organs damage	Very high risk	Very high risk	Very high risk	Very high risk	Very high risk

EXAMINATION OF PATIENTS WITH ARTERIAL HYPERTENSION

The purpose of objective examination is to diagnose and degree of hypertension, identify potential secondary causes of hypertension, identify factors that could potentially contribute to the development of hypertension (lifestyle, concomitant medications or family history), identify concomitant cardiovascular risk factors (including lifestyle) and family history), detect comorbidities and establish the presence of data of TOD or existing CVD, cerebrovascular or renal diseases.

A thorough history of the disease should include, in particular:

- Time of first diagnosis of hypertension, including records of any previous medical examinations, hospitalizations, etc.
- Any current and past BP levels
- Current and past antihypertensive drugs
- Taking other medications
- Family history of hypertension, CVD, stroke or kidney disease
- Assessment of lifestyle, including exercise levels, weight changes, diet history, smoking history, alcohol use, drug use, sleep disorders, and the effect of any treatment on sexual function
- History of any concomitant cardiovascular risk factors
- Details and symptoms of past and present comorbidities.

Key aspects of the physical examination:

Stature:

- Weight and height are measured on a calibrated scale, calculated by BMI
- Waist and hip circumference

Signs of damage to target organs:

- Neurological examination and cognitive status
- Fundoscopic examination for hypertensive retinopathy
- Palpation and auscultation of the coronary and carotid arteries
- Palpation of peripheral arteries
- Comparison of blood pressure on both hands (at least once)

Secondary hypertension:

- Examination of the skin: areas of neurofibromatosis (pheochromocytoma)
- Palpation of the kidneys to detect an increase in polycystic kidney disease
- Auscultation of the coronary and renal arteries to detect noise indicating coarctation of the aorta, or renovascular hypertension
- Comparison of radial pulse with pulse of a femoral artery: detection of a delay at aortic coarctation
- Signs of Cushing's disease or acromegaly
- Signs of thyroid disease

Recommended tests:

- Hemoglobin and/or hematocrit
- Fasting blood glucose, glucose tolerance test and glycosylated hemoglobin
- Blood lipids
- Blood electrolytes
- Blood uric acid
- Blood creatinine and GFR
- Tests for liver function
- Urine analysis: microscopic examination; urinary protein, albumin: creatinine ratio
- ECG in 12 leads
- Outpatient blood pressure monitoring
- Fundoscopy
- Echocardiography
- Dopplerography of the carotid arteries
- Pulse wave speed
- Ultrasound of the abdominal cavity with Doppler
- Neurological examination of the CNS

TECHNIC OF BLOOD PRESSURE MEASUREMENT

Office blood pressure measurement

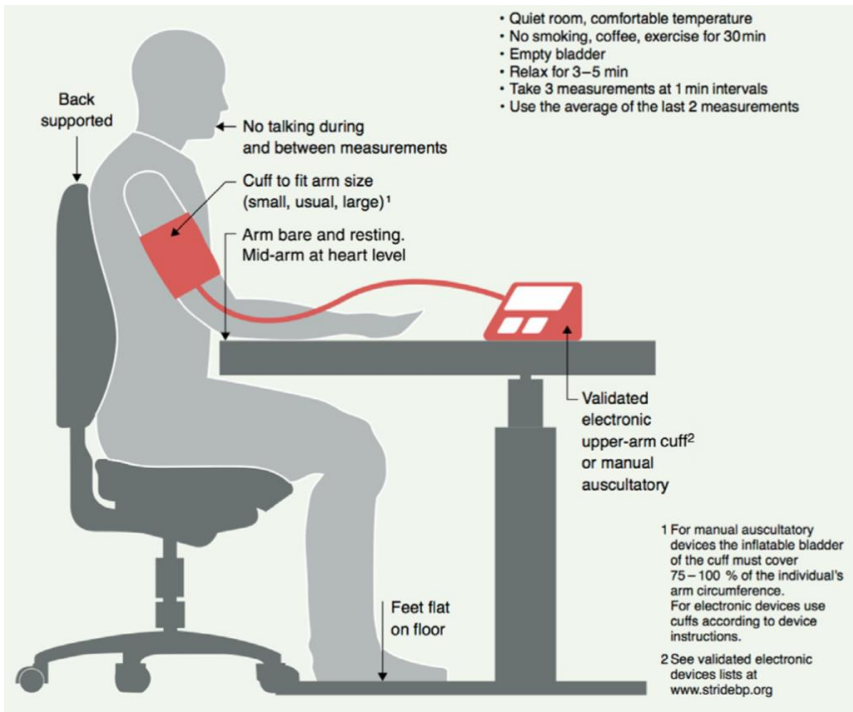


Fig.1. Technic of blood pressure measurement (ISH Guidelines, 2020)

Auscultatory or oscillometric semi-automatic or automatic sphygmomanometers are recommended for measuring BP during a visit to the doctor. These devices must be tested in accordance with standardized conditions and protocols. Blood pressure should first be measured on both upper arms, using the appropriate cuff size for the arm circumference. The constant and significant difference in SBP between the hands (> 15 mm Hg) is associated with an increased cardiovascular risk, most likely due to atheromatous vascular damage. Where there is a difference in BP between the hands, established during the simultaneous measurement, the hand with the highest BP levels should be used for all subsequent measurements.

In the elderly, people with diabetes, or people with other possible causes of orthostatic hypotension, BP should also be measured 1 min and 3 min after standing. *Orthostatic hypotension* is defined as a decrease in SBP > 20 mm Hg or in DBP > 10 mm Hg within 3 minutes of standing and is associated with an increased risk of mortality and cardiovascular events. Heart rate should also be

recorded when measuring BP, as resting heart rate is an independent predictor of pathological or fatal cardiovascular events, although heart rate is not included in cardiovascular risk assessment algorithms.

General recommendations for the BP measurement procedure:

- The patient should be in a comfortable sitting position in a quiet environment for 5 minutes.
- Three BP measurements should be recorded with an interval of 1–2 minutes, additional measurements - only if the first two indicators differ > 10 mm Hg. BP is defined as the average of the last two indications.
- Additional measurements can be performed in patients with unstable BP levels caused by arrhythmias, for example, in patients with atrial fibrillation (AF), as most automated devices have not been tested for BP measurement in patients with AF.
- For most patients, use a standard cuff (12–13 cm × 35 cm), but you should also have larger and smaller cuffs.
- The cuff should be at the level of the heart, with the back and arm supported to avoid muscle contraction and the associated increase in BP.
- Measure BP in both arms during the first visit to identify possible differences between the shoulders. Use a hand with a higher value later.
- Measure BP after 1 minute and 3 min after leaving a sitting position in all patients at the first measurement to exclude orthostatic hypotension. Measurement of blood pressure in the supine and standing position should also be considered in subsequent visits to the elderly, people with diabetes and people with other conditions in which orthostatic hypotension can often occur.
- Record heart rate and use pulse palpation to rule out arrhythmia.

TREATMENT OF PATIENTS WITH ARTERIAL HYPERTENSION

There are two strategies for reducing BP: lifestyle modification and drug treatment.

Instrumental therapies are currently being studied, but have not yet been confirmed as effective treatment options.

Lifestyle modifications can certainly lower BP and, in some cases, overall cardiovascular risk, but most patients with hypertension also require medical intervention.

Antihypertensive therapy is based on the results obtained in the largest number of randomized trials in clinical medicine. A meta-analysis of data from studies of several hundred thousand patients showed that a decrease in SBP by 10 mm Hg and/or DBP by 5 mm Hg is associated with a decrease in cardiovascular accidents by 20 %, mortality from all causes by 10–15 %, stroke by 35 %, coronary events by 20 % and heart failure by 40%. This relative risk reduction is long-term, independent of baseline BP and cardiovascular risk, age, gender, and ethnicity.

Target BP levels in patients with hypertension:

- The initial goal of treatment - to reduce BP < 140/90 mm Hg.
- For patients < 65 years-old receiving antihypertensive drugs, it is recommended to reach a SBP range of 120–129 mm Hg.
- In elderly patients (\geq 65 years-old) receiving antihypertensive drugs, it is recommended to reach a SBP range of 130–139 mm Hg.
- The above BP is recommended for patients at any level of cardiovascular risk and in patients with and without established CVD.
- For all patients with hypertension, the target value of DBP is recommended <80 mm Hg, regardless of the level of risk and the presence of comorbidities.
- Careful monitoring of side effects (ESH Guidelines, 2018).

According to the ISH Guidelines, 2020, target BP reduction must be at least 20/10 mm Hg (ideally to < 140/90 mm Hg). Optimal target BP reduction: < 65 years – < 130/80 mm Hg if tolerated (but > 120/70 mm Hg); \geq 65 years – < 140/90 mm Hg if tolerated, but consider an individualized BP target in the context of frailty, independence and likely tolerability of treatment.

Lifestyle Modifications

Salt reduction

There is strong evidence for a relationship between high salt intake and increased blood pressure. Avoid or limit consumption of high salt foods such as soy sauce, fast foods and processed food including breads and cereals high in salt.

Healthy diet

Eating a diet that is rich in whole grains, fruits, vegetables, polyunsaturated fats and dairy products and reducing food high in sugar, saturated fat and trans fats, such as the DASH diet. Increase intake of vegetables high in nitrates known to reduce BP, such as leafy vegetables and beetroot.

Healthy drinks

Moderate consumption of coffee, green and black tea.

Moderation of alcohol consumption

Positive linear association exists between alcohol consumption, BP, the prevalence of hypertension, and CVD risk. The recommended daily limit for alcohol consumption is 2 standard drinks for men and 1.5 for women (10 g alcohol/standard drink).

Weight reduction

Body weight control is indicated to avoid obesity. Particularly abdominal obesity should be managed.

Smoking cessation

Smoking is a major risk factor for CVD, COPD and cancer. Smoking cessation and referral to smoking cessation programs are advised.

Regular physical activity

Studies suggest that regular aerobic and resistance exercise may be beneficial for both the prevention and treatment of hypertension. Moderate

intensity aerobic exercise (walking, jogging, cycling, yoga, or swimming) for 30 minutes on 5–7 days per week or high intensity interval training (involves alternating short bursts of intense activity with subsequent recovery periods of lighter activity). Performance of resistance/strength exercises on 2–3 days per week.

Reduce stress and induce mindfulness

Chronic stress has been associated to high BP later in life.⁵⁹ Stress should be reduced and mindfulness or meditation introduced into the daily routine.

Complementary, alternative or traditional medicines

Large proportions of hypertensive patients use complementary, alternative or traditional medicines (in regions such as Africa and China) yet large-scale and appropriate clinical trials are required to evaluate the efficacy and safety of these medicines. Thus, use of such treatment is not yet supported.

Reduce exposure to air pollution and cold temperature

Evidence from studies support a negative effect of air pollution on BP in the long-term.

Pharmacological Treatment

The main classes of drugs that are used to treat hypertension include: ACE inhibitors, sartans, calcium channels blockers (CCB) and diuretics (mainly thiazide and thiazide-like diuretics). Beta-blockers as part of complex therapy are prescribed only to patients with ischemic heart disease, heart failure, atrial fibrillation, as well as to young women who are planning a pregnancy. The mineralocorticoid receptor antagonist spironolactone is prescribed for patients with resistant hypertension (as the fourth drug for triple antihypertensive therapy).

Algorithm of the pharmacological treatment of hypertension:

In the treatment of patients with arterial hypertension use the following treatment algorithm (ESH, 2018):

1. Initiate treatment in most patients with a combination product that includes two active substances to increase the speed, effectiveness and predictability of blood pressure control.

2. The preferred fixed combinations of two drugs (a RAAS blocker with a CCB or a diuretic). A beta-blocker in combination with a diuretic or any other major class of drugs is an alternative when there are specific indications for a beta-blocker, such as angina, myocardial infarction, heart failure, or heart rate control.

3. Use monotherapy for low-risk patients with stage 1 hypertension whose SBP is less than 150 mm Hg.

4. If the blood pressure is not controlled by a combination of the two drugs, use a fixed combination of three drugs, including a RAAS blocker, CCB, and a diuretic.

5. Add spironolactone to treat resistant hypertension if there are no contraindications.

6. Use other classes of antihypertensive drugs in rare cases where BP is not controlled by the above drugs.

The difference between the treatment algorithms in the ISH Guidelines 2020 is that it is primarily proposed to use low-dose double fixed combinations, followed by the transition to full-dose double combinations

Secondary Hypertension

Approximately 5–10 % of hypertensive patients have secondary hypertension (in which specific causes can be identified).

Consider screening for secondary hypertension in patients with:

- early onset hypertension with resistant hypertension
- individuals with sudden deterioration in BP control
- hypertensive urgency and emergency
- those presenting with high probability of secondary hypertension

based on strong clinical clues.

In patients with resistant hypertension, investigations for secondary hypertension should generally be preceded by exclusion of pseudoresistant hypertension and drug/substance-induced hypertension.

The most common types of secondary hypertension:

- Renal parenchymal disease
- Primary aldosteronism
- Renal artery stenosis
- Pheochromocytoma
- Cushing's syndrome and disease
- Coarctation of the aorta
- Obstructive sleep apnea
- Thyroid disease.

Basic screening for secondary hypertension: thorough assessment of history, physical examination, basic blood biochemistry (including serum sodium, potassium, eGFR, TSH), and dipstick urine analysis.

Risk control of concomitant cardiovascular diseases

Patients with hypertension, and especially patients with type 2 diabetes or metabolic syndrome, often have atherogenic dyslipidemia, characterized by elevated levels of triglycerides and low-density lipoprotein cholesterol (LDL cholesterol).

In the presence of CVD and a very high level of cardiovascular risk, statins should be prescribed to achieve LDL cholesterol levels < 1.8 mmol/l or reduce > 50 % if the initial level of LDL cholesterol is 1.8 to 3.5 mmol/l. In patients with high cardiovascular risk, it is recommended to achieve LDL cholesterol goals < 2.6 mmol/l or a decrease > 50% if the baseline LDL level is 2.6 to 5.2 mmol/l. Significant effects of statin therapy have also been shown in patients with previous stroke with LDL cholesterol targets < 2.6 mmol/l. Whether they also benefit from LDL cholesterol levels < 1.8 mmol/l remains a question for future research.

Aspirin is not recommended for primary prevention in patients with hypertension without CVD. For secondary prevention, the benefits of antiplatelet therapy in patients with hypertension may outweigh the risk of side effects. Ticlopidine, clopidogrel, and new antiplatelet agents, such as prasugrel and ticagrelor, have not been adequately evaluated in patients with high BP.

7. Tasks for independent work:

1. Definition of hypertension.
2. Main causes of hypertension.
3. Classification of arterial hypertension.
4. Mechanisms of essential hypertension.
5. Causes and mechanisms of endocrine hypertension.
6. Causes and mechanisms of renoparenchymal hypertension.
7. Causes and mechanisms of vasorenal hypertension.
8. Causes and mechanisms of hemodynamic hypertension.
9. Clinical symptoms of hypertension.
10. Clinical symptoms of target organ damage in hypertension.
11. Clinical symptoms of complications in hypertension.
12. Diagnosis of diseases that lead to hypertension.
13. Stratification of the risk of complications in hypertension.
14. Differential diagnosis of arterial hypertension.
15. Treatment of arterial hypertension.
16. Basic antihypertensive drugs.
17. Prevention of hypertension.

8. Situational tasks to determine the final level of knowledge

1. A 41-year-old woman comes to the physician's office complaining of fatigue, muscle weakness, cramping, headaches, polydipsia, and polyuria. She has been treated for hypertension for 6 years, and her doctors have told her that she has renal problems. Beta-blockers, calcium channel blockers, and diuretics have been used to control her hypertension. There is a family history of renal disease and hypertension. Her blood pressure is 240/140 mm Hg and her pulse is 85/min. The remainder of her examination is normal. A routine chemical panel shows hypokalemia, hypernatremia, and metabolic alkalosis. Pathologic examination of this patient would most likely reveal which of the following findings?

- A. Adrenal adenoma
- B. Adrenal carcinoma
- C. Bilateral nodular hyperplasia
- D. Multiple adrenal adenomas
- E. Unilateral nodular adrenal hyperplasia

2. A 34-year-old man undergoing a routine physical examination is found to have a blood pressure of 165/105 mm Hg. The measurement is repeated 40 minutes later, and is 162/103 mm Hg. The physician asks the patient to return the next week and the week following, and each time repeats the evaluation yielding the

following results: 170/102, 168/107, 175/108, 167/102 mm Hg. This patient's blood pressure should be classified as which of the following?

- A. *Optimal*
- B. *Normal*
- C. *High-normal*
- D. *Stage 1 (mild) hypertension*
- E. *Stage 2 (moderate) hypertension*
- F. *Stage 3 (severe) hypertension*

3. A 35-year-old man has hypertension, which has been difficult to control with medication. Periodically, he experiences periods when he develops intense symptoms including racing heart, lightheadedness, flushing, diaphoresis, clammy skin, headache, and a sense of impending doom. He has gone to the emergency department of a local hospital several times during these episodes, but by the time he is seen several hours later, the symptoms have long passed, and nothing can be found on physical examination or serum chemistry studies. The patient's physician orders a 24-hour urine to be collected, which is found to contain significantly elevated levels of vanillylmandelic acid. This compound is a degradation product of which of the following?

- A. *Acetylcholine*
- B. *Cholesterol*
- C. *Epinephrine*
- D. *Serotonin*
- E. *Testosterone*

4. Patients with hypertension would be most likely to have which of the following findings on renal biopsy?

- A. *Crescent formation*
- B. *Hyaline arteriosclerosis*
- C. *Kimmelstiel-Wilson nodules*
- D. *Papillary necrosis*
- E. *Subepithelial electron-dense humps*

5. All of the following statements are true about the management of hypertensive emergencies EXCEPT:

- A. *Mean arterial pressure (MAP) should be reduced by 20% to 25% over the first 2 to 3 hours in a patient with hypertensive encephalopathy.*
- B. *Myocardial ischemia in a patient with a blood pressure (BP) of 174/110 mm Hg is considered a hypertensive emergency.*
- C. *An asymptomatic patient with a BP of 170/116 mm Hg requires immediate pressure reduction prior to discharge.*
- D. *The presence of proteinuria, hematuria, and casts in the urine of a patient with severe hypertension suggests a hypertensive emergency.*
- E. *Papilledema distinguishes malignant hypertension from accelerated hypertension*

6. All of the following pairs of antihypertensive agents and side-effects/complications are correctly matched EXCEPT:

- A. *Nitroglycerin: methemoglobinemia*
- B. *Nicardipine: local phlebitis*
- C. *Fenoldopam: fluid retention*
- D. *Phentolamine: tachycardia, flushing, headache*
- E. *Trimethaphan: paresis of bowel and bladder*

7. A 18-year-old man presents to the emergency department following complaints of lower extrem extremity weakness. BP recordings reveal systolic and diastolic pressures that are lower in the legs than in the arms. A chest radiograph demonstrates rib notching and a figure-three silhouette of the aorta. The most likely cause of these findings is:

- A. *Aortic dissection*
- B. *Incorrect cuff size when measuring lower extremity pressures*
- C. *Renal stenosis*
- D. *Coarctation of the aorta*
- E. *Tetralogy of Fallot*

8. A 48-year-old man presents with a 2-day history of worsening morning occipital headaches and blurring of vision in his right eye. He has a BP of 220/130 mm Hg and a heart rate of 78 bpm. On funduscopic examination, the physiologic cup of the optic disc in the right eye is obscured. Flamed-shaped hemorrhages are noted. The remainder of the physical examination is normal. Laboratory findings include hematuria (2+) and a serum creatinine level of 2.1 mg/dL. Optimal management of this patient would be:

- A. *Gradual reduction of diastolic BP to 100 mm Hg over 2 days*
- B. *Reduction of diastolic BP to 90 mm Hg over 2 to 3 hours*
- C. *Reduction of MAP to 120 mm Hg over 2 to 3 hours*
- D. *Reduction of MAP to 120 mm Hg over 6 to 12 hours*
- E. *Measurement of intracranial pressure prior to lowering the BP*

9. A 19-year-old woman presents to her doctor's office for an annual physical examination. She has been previously healthy and is currently doing well without complaints. She is a non-smoker and has no significant past medical history or family history. Her temperature is 36.9 °C (98.5 °F), blood pressure is 160/90 mm Hg (confirmed in all extremities), pulse is 84/min, and respirations are 16/min. Her pulses are symmetric and equal, her cardiac and pulmonary examinations are unremarkable, and there is an abdominal bruit with a systolic and diastolic component. Serum chemistry reveals: Sodium – 145 mEq/L, potassium – 3.1 mEq/L, chloride – 102 mEq/L, bicarbonate – 28 mEq/L, blood urea nitrogen – 14 mg/dL, creatinine - 1.0 mg/dL, glucose – 80 mg/dL. Which of the following is the most likely cause of her elevated blood pressure?

- A. *Coarctation of the aorta*
- B. *Cushing syndrome*
- C. *Pheochromocytoma*

D. Renovascular hypertension

E. Thyrotoxicosis

10. A 70-year-old man feels trembling of all body, pulsation in the head, periodic syncope. The left border of heart is on the left front axillary line, diastolic noise in the Botkin-Erb's point. BP is 150/20 mm Hg. What disease is most likely in the patient?

A Thyrotoxic heart

B Hypertrophic cardiomyopathy

C Insufficiency of aortic valves

D Arterial hypertension

E Mitral orifice stenosis

Correct answers for tests

1	2	3	4	5	6	7	8	9	10
A	E	C	B	C	C	D	C	D	C

9. References:

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Навчальне видання

**ВЕДЕННЯ ХВОРОГО
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СУЧАСНА ПРАКТИКА
ВНУТРІШНЬОЇ МЕДИЦИНИ
З НЕВІДКЛАДНИМИ СТАНАМИ**

Методичні вказівки для студентів та лікарів-інтернів

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