

Arterial Hypertension And Its Early Diagnosis

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Annotation. Arterial hypertension (AH) is one of the leading causes of death and disability worldwide. This disease leads to damage to the cardiovascular system, significantly increasing the risk of myocardial infarction, stroke, heart failure and chronic kidney disease. Studies conducted in recent years have shown that even blood pressure above 115/75 mmHg begins to increase the risk of cardiovascular complications. Therefore, early diagnosis of arterial hypertension, that is, its detection and control in the early stages of the disease, remains one of the urgent scientific and clinical issues.

International clinical guidelines have different diagnostic criteria. For example, according to the 2024 ESC/ESH guidelines, arterial hypertension is diagnosed when blood pressure is recorded in the office setting $\geq 140/90$ mmHg. At the same time, the ACC/AHA guidelines have adopted lower limits — $\geq 130/80$ mmHg. This increases the possibility of detecting the disease at an early stage in young patients. However, there is also a risk of overdiagnosis.

Scientific studies conducted in the younger population show that even relatively low levels of blood pressure elevation can be associated with early vascular aging (EVA) and target organ damage (TOI). Therefore, in the diagnosis of arterial hypertension, not only classic office measurements, but also additional methods such as ambulatory blood pressure monitoring (ABPM), home blood pressure monitoring (HBPM), and assessment of vascular stiffness (pulse wave velocity — PWV) are of great importance.

Early diagnosis is important not only for clinical practice, but also for the health system. Because late detection of hypertension reduces the effectiveness of treatment and increases the risk of long-term cardiovascular complications. Thus, early diagnosis of AG is one of the priorities of modern medicine today.

Keywords. Arterial hypertension, blood pressure, early diagnosis, ESC/ESH 2024, ACC/AHA 2017, ambulatory monitoring, home monitoring, premature vascular aging (EVA), target organ damage (TOI).

Arterial hypertension (AH) is one of the most serious health problems today. According to the World Health Organization (WHO), one third of adults worldwide have high blood pressure, and more than half of them are unaware of their condition. As a result, hypertension is often described as a “silent killer” for many cardiovascular diseases. Because the patient often feels healthy, but irreversible changes slowly occur in the body.

Arterial hypertension is a leading risk factor for the development of ischemic heart disease, stroke, heart failure and chronic kidney disease. According to statistics, millions of people die every year from complications caused by hypertension. This figure is especially high in low- and middle-income countries, where health system resources are limited, public awareness of the disease is low, and regular screening programs are insufficient.

In recent years, the international scientific community has been revising the diagnostic criteria for hypertension. For example, the European Society of Cardiology (ESC) guidelines published in 2024 indicate that arterial hypertension is diagnosed when the office blood pressure is $\geq 140/90$ mmHg. At the same time, the American College of Cardiology/American Heart Association (ACC/AHA) has set lower limits since 2017 — $\geq 130/80$ mmHg. This difference has caused considerable debate in clinical practice. On the one hand, lower limits allow for earlier detection of the disease in younger patients, on the other hand, the likelihood of overdiagnosis and unnecessary treatment increases.

Furthermore, it has been shown that office blood pressure alone is not sufficient for diagnosing hypertension. Ambulatory blood pressure monitoring (ABPM), home blood pressure monitoring (HBPM),

and vascular elasticity assessment methods (e.g., pulse wave velocity — PWV) are becoming increasingly important in identifying the early stages of the disease.

This article reviews the global epidemiology, pathophysiology, diagnostic criteria, early detection methods, and their clinical significance of arterial hypertension. It also highlights the benefits and challenges of early diagnosis of hypertension based on international guidelines.

Epidemiology and clinical significance. Arterial hypertension (AH) is one of the most common chronic diseases globally. According to the World Health Organization (WHO), approximately 1.28 billion adults worldwide have high blood pressure. More than half of them are undiagnosed or have not started treatment. This figure makes hypertension a serious health problem worldwide.

Epidemiological studies conducted in recent years show that the prevalence of hypertension in developed countries is stable or slowly decreasing. However, its prevalence is increasing sharply in low- and middle-income countries, including Africa and Asia. The main reasons for this include:

Low level of awareness. A large part of the population does not have sufficient knowledge about hypertension and its consequences.

Limited screening programs. Systems for regular blood pressure testing and monitoring have not been established in many countries.

Lack of medical resources. The number of qualified doctors and nurses, as well as modern diagnostic tools, is limited.

Lifestyle factors. Poor diet, inactivity, stress, and excess weight increase the risk of hypertension.

Hypertension is of great clinical importance. It is one of the major risk factors for cardiovascular disease. Studies have shown that even a blood pressure reading above 115/75 mmHg increases the risk of heart attack and stroke. It has been found that every 20 mmHg increase in blood pressure doubles the risk of cardiovascular death.

The main clinical consequences of AG are:

1. **Brain strokes.** Hypertension is the most important risk factor for stroke.
2. **Ischemic heart disease.** High blood pressure accelerates the process of atherosclerosis in the coronary arteries.
3. **Heart failure.** Heart function is impaired as a result of left ventricular hypertrophy and diastolic dysfunction.
4. **Kidney diseases.** Hypertension is one of the main causes of chronic kidney disease.
5. **Retinopathy.** Vision is reduced as a result of damage to the blood vessels in the retina.

Therefore, arterial hypertension causes significant harm not only to health, but also to the economy. At the national level, the costs of treating hypertension and its complications account for a large share of the total budget of the healthcare system. This makes early diagnosis and preventive measures even more urgent.

Pathophysiology. Arterial hypertension (AH) is a complex pathophysiological process. In its development, hereditary factors, environmental influences, neurohumoral mechanisms, and morphological changes in blood vessels are closely interconnected. The main essence of the disease is an increase in resistance in the arterial system and a violation of hemodynamic balance associated with cardiac output.

1. Sympathetic nervous system activity

In the early stages of hypertension, the sympathetic nervous system is activated. This leads to an increase in heart rate, peripheral resistance, and arterial blood pressure. Prolonged sympathetic stimulation causes hypertrophy of the heart muscle, which can later lead to heart failure.

2. Renin-angiotensin-aldosterone system (RAAS)

RAAS is one of the central mechanisms of hypertension. Renin secretion increases in the kidneys, resulting in the formation of angiotensin II. Angiotensin II is a potent vasoconstrictor, constricting blood vessels and promoting sodium and water retention. In addition, it enhances fibrotic processes in the heart and blood vessel walls.

3. Endothelial dysfunction

Healthy endothelial cells produce nitric oxide (NO), which promotes vasodilation. In hypertension, endothelial cells become dysfunctional, resulting in reduced NO production and impaired vasodilation. At the same time, prooxidant and proinflammatory mediators are increased, which contribute to the development of atherosclerosis.

4. Arterial hardening

Recent studies have shown that even young people can experience a decrease in arterial wall elasticity, a condition known as early vascular aging (EVA). As vascular stiffness increases, the pressure during systole increases, while coronary blood flow decreases during diastole. This poses a significant risk to the heart and brain.

5. Renal mechanisms

The kidneys are one of the main organs in the regulation of blood pressure. Disturbances in sodium and water balance aggravate hypertension. Also, narrowing of the renal vessels, or nephrosclerosis, is closely associated with hypertension.

6. Genetic and epigenetic factors

Genetic predisposition plays an important role in the development of AG. Polymorphisms occurring in certain genes can increase RAAS activity or reduce endothelial function. In recent years, it has been revealed that epigenetic mechanisms - DNA methylation, microRNAs - affect blood pressure regulation.

7. Target organ injury (TOI)

Hypertension not only increases overall blood pressure, but also causes structural and functional changes in organs such as the heart, brain, kidneys, and eyes. For example:

In the heart - left ventricular hypertrophy, diastolic dysfunction.

In the vessels of the brain - lacunar infarctions, risk of dementia.

In the kidneys - microalbuminuria and chronic renal failure.

In the eye - hypertensive retinopathy.

Diagnostic criteria and differences. The main step in the diagnosis of arterial hypertension is the correct and regular measurement of blood pressure. However, in recent years, the diagnostic criteria in the guidelines adopted by various international organizations have significantly varied. This creates some confusion in practice, but at the same time offers approaches that help to make the diagnosis more accurate.

ESC/ESH 2024 guidelines

In 2024, the European Society of Cardiology (ESC) and the European Society of Hypertension (ESH) adopted updated guidelines. According to them:

Blood pressure in office settings: $\geq 140/90$ mmHg — hypertension is diagnosed.

Ambulatory 24-hour monitoring (ABPM): an average of $\geq 130/80$ mmHg corresponds to hypertension.

Home blood pressure monitoring (HBPM): $\geq 135/85$ mmHg was defined as the diagnostic criterion.

The advantage of this approach is that it avoids overdiagnosis and focuses on identifying high-risk patients.

ACC/AHA 2017 Guidelines

The 2017 guidelines from the American College of Cardiology (ACC) and the American Heart Association (AHA) set lower limits:

Blood pressure in office settings: $\geq 130/80$ mmHg is considered a diagnosis of hypertension.

These lower criteria apply to both ABPM and HBPM.

This approach allows for early detection of hypertension in young patients, but also increases the likelihood of unnecessary diagnosis and excessive pharmacotherapy.

Differences and their clinical significance

The main difference between the ESC/ESH and ACC/AHA is in the diagnostic thresholds. While the European criteria are more traditional, the American guidelines place more emphasis on preventive goals. For example:

According to ESC criteria, a blood pressure of 135/85 mmHg is considered normal in a 35-year-old patient.

According to the ACC/AHA criteria, this patient can be diagnosed with hypertension.

This raises questions for the physician in the clinical decision-making process: which approach should be chosen, should the patient be treated immediately or should it be limited to lifestyle changes?

White coat and masked hypertension

Another important issue in the diagnostic process is "white coat hypertension" and "masked hypertension."

In white coat hypertension, blood pressure is high in the office but normal at home or with ABPM.

In masked hypertension, blood pressure is normal in the office but high on home or ambulatory monitoring.

Therefore, it is recommended to use a broader diagnostic approach, not limited to office measurements.

Early diagnostic methods. Arterial hypertension often occurs for years without clinical symptoms. Therefore, its early detection is one of the most important tasks for the healthcare system. Early diagnosis allows you to prevent irreversible damage to important organs such as the heart, brain, kidneys and eyes. Currently, in addition to classic office measurements, a number of modern methods are widely used in the diagnosis of hypertension.

1. Blood pressure measurement in an office setting

It is the main method in clinical practice. However, this method has some limitations:

Falsely high readings may be recorded due to white coat hypertension.

Some patients, on the contrary, have masked hypertension, that is, the readings are normal in the office but high at home.

Therefore, although office measurement is the first step in diagnosis, it is necessary to supplement it with additional methods.

2. Ambulatory blood pressure monitoring (ABPM)

The patient's blood pressure is recorded using a special device for 24 hours. Advantages of ABPM:

Shows blood pressure dynamics throughout the day and night.

Allows detection of white coat and masked hypertension.

Blood pressure better predicts cardiovascular risk by detecting circadian rhythms (daily changes).

Studies show that assessing the risk of cardiovascular complications based on ABPM results is more reliable than a simple office measurement.

3. Home blood pressure monitoring (HBPM)

The patient independently records his blood pressure using an electronic tonometer. This method:

It increases the patient's sense of responsibility for their own health.

Convenient for evaluating treatment effectiveness.

Regular monitoring allows you to detect changes in blood pressure at an early stage.

4. Assessment of arterial stiffness and vascular elasticity

Arterial hypertension is often accompanied by early vascular aging (EVA). The pulse wave velocity (PWV) method is used to assess vascular stiffness. High PWV values indicate an early increase in cardiovascular risk even in young patients.

5. Laboratory and instrumental indicators

Microalbuminuria— a sign of early kidney damage.

ECG and ECHO— allows for early detection of left ventricular hypertrophy.

Retinography— provides information about changes in the blood vessels of the eye.

6. Digital technologies and telemedicine

In recent years, regular monitoring using electronic health systems, mobile applications, and "smart" tonometers has been widely implemented. This not only allows for early diagnosis, but also increases the effectiveness of communication between the patient and the doctor.

The clinical importance of early diagnosis. Early detection of arterial hypertension is an important turning point in clinical practice. Because high blood pressure often goes on for years without clinical symptoms, and the patient considers himself healthy. However, it is during this period that irreversible changes begin in important organs such as the heart, brain, kidneys and eyes. Early diagnosis makes it possible to stop or slow down this process.

1. Reduce cardiovascular complications

Studies show that early detection and treatment of hypertension can reduce the risk of heart attack, stroke, and heart failure by 20–40%. For example, early detection and treatment in a patient with blood pressure $\geq 140/90$ mmHg can reduce the risk of stroke by 35–40%.

2. Prevention of Target Organ Injury (TOI)

Heart: slows the development of left ventricular hypertrophy.

Brain: reduces the risk of lacunar infarction and vascular dementia.

Kidneys: Treatment at the microalbuminuria stage prevents chronic kidney failure.

Eye: Early detection of hypertensive retinopathy can help preserve vision.

3. Risks of delayed diagnosis

According to scientific sources, a one-year delay in diagnosing arterial hypertension increases the risk of cardiovascular complications by 29%. And patients who remain undiagnosed for five years may have a double risk of heart attack and stroke.

4. Effective implementation of preventive measures

Patients diagnosed early are more likely to make lifestyle changes. For example, diet, increased physical activity, and avoidance of unhealthy habits can reduce blood pressure by 5–10 mmHg. This may delay the need to start pharmacotherapy or reduce the dose of medications.

5. Economic benefits for the healthcare system

Early diagnosis and treatment will reduce healthcare costs in the long run, as treating complications caused by hypertension (stroke, heart attack, kidney failure requiring dialysis) is very expensive.

Prevention and management. Along with early detection of arterial hypertension (AH), its effective management and preventive measures are also very important. With modern approaches, hypertension can be controlled not only with the help of drugs, but also through comprehensive preventive measures.

1. Lifestyle changes

Improving lifestyle health is the primary measure for preventing and controlling arterial hypertension.

Control over eating. Reducing salt intake (less than 5 g per day), eating more vegetables, fruits, whole grains, and fish can reduce blood pressure by 4–6 mmHg.

Getting rid of excess weight. Losing 5–10% of your weight can lower your blood pressure by 5–10 mmHg.

Physical activity. At least 150 minutes of moderate-intensity exercise (e.g., brisk walking, cycling) per week is recommended.

Quitting alcohol and tobacco. These habits play an important role in maintaining stable blood pressure control and reducing complications.

Stress management. Meditation, yoga, and psychotherapeutic techniques reduce sudden changes in blood pressure.

2. Pharmacotherapy

If lifestyle changes are not enough or the patient has a high cardiovascular risk, drug therapy is used. According to the ESC/ESH 2024 guidelines, the following drug groups are considered the main ones:

Diuretics(thiazide, thiazide-like diuretics) — lower blood pressure by removing sodium and water.

RAAS blockers(ACE inhibitors, ARBs) — reduce vasoconstriction and protect the heart and kidneys.

Calcium channel blockers (CCBs)— dilates blood vessels and reduces peripheral resistance.

Beta-blockers— reduces heart rate and relieves the workload on the heart.

In many cases, one drug alone is not enough, so combination therapy is recommended.

3. Individual approach

The treatment of hypertension should take into account the patient's age, comorbidities, gender, and social factors:

Young patientsLower diagnostic thresholds ($\geq 130/80$ mmHg) are being discussed.

ElderlyIt is important to avoid drug overload, but blood pressure should be under stable control.

Pregnant womenOnly safe medications (e.g. methyldopa, labetalol) are used.

Kidney diseasesRAAS blockers are preferred in patients with

4. Telemedicine and digital technologies

In recent years, mobile applications, “smart” tonometers, and electronic health systems have been widely used in hypertension management. They provide regular patient monitoring and send timely information to the doctor.

5. Team approach

In the prevention and control of hypertension, it is important to involve not only the physician, but also nurses, pharmacists, dietitians, and psychologists. This team approach increases patient adherence to treatment and improves outcomes.

Conclusion

Arterial hypertension is one of the most pressing problems of modern medicine and is a major risk factor for cardiovascular disease, stroke, chronic kidney disease, and many other serious complications. The dangerous aspect of the disease is that it often does not cause any clinical symptoms for years and proceeds as a “silent killer.”

Early diagnosis is one of the main tools in the fight against hypertension. Studies show that regular blood pressure monitoring, ambulatory monitoring, home blood pressure measurement, and assessment of vascular elasticity (pulse wave velocity) can detect the disease in its early stages. This can prevent irreversible changes in vital organs such as the heart, brain, kidneys, and eyes.

There are differences in diagnostic criteria among international guidelines. While the ESC/ESH 2024 guidelines use a criterion of $\geq 140/90$ mmHg, the ACC/AHA 2017 approach adopts lower limits — $\geq 130/80$ mmHg. While the European approach avoids overdiagnosis, the American approach allows for early detection of the disease. Therefore, doctors should pay attention not only to the indications, but also to the individual characteristics of the patient when making a diagnosis.

Also, the most important measures in the prevention of hypertension are lifestyle changes - reducing salt intake, getting rid of excess weight, increasing physical activity, and giving up harmful habits. If this is not enough, medications (diuretics, RAAS blockers, calcium channel blockers, etc.) are used.

In conclusion, the most effective strategy for combating arterial hypertension is early diagnosis, individualized treatment, and widespread implementation of preventive measures. Early diagnosis significantly reduces the risk of cardiovascular complications, prolongs the life expectancy of patients, and alleviates the economic burden on the healthcare system.

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