УДК 612.143
ГРНТИ 76.29.51

PATHOPHYSIOLOGICAL COMPONENTS OF ARTERIAL HYPERTENSION. PROSPECTS FOR PREVENTION AND REHABILITATION

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DOI: 10.31618/asj.2707-9864.2020.1.42.41

ПАТОФИЗИОЛОГИЧЕСКИЕ КОМПОНЕНТЫ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ. ПЕРСПЕКТИВЫ ПРОФИЛАКТИКИ И РЕАБИЛИТАЦИИ

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Abstract. The article provides a theoretical analysis of the causes of arterial hypertension, describes a 3-month observation of the initial stage of the development of hypertension and experiments on non-drug normalization of blood pressure on a group of volunteers. We show that arterial hypertension is associated with spastic conditions of the intervertebral muscles in the lower thoracic spine, which leads to compression of sympathetic nerves that control the transport of water through the kidneys, which in turn upsets the balance of fluid circulation through the circulatory system.

Theoretical analysis and experimental data made it possible to formulate a hypothesis about the dominant role of disorders in the activity of the sympathetic part of the nervous system in the development of primary and persistent arterial hypertension. The possibility of prevention of arterial hypertension and non-drug rehabilitation of patients with this disease has been shown.

Key words: arterial hypertension, non-drug methods of treatment, rehabilitation, spine, muscles, kidneys.

Introduction

WHO experts believe that in 95% of cases the causes of primary arterial hypertension are unknown, and in 85% of cases the causes of persistent arterial hypertension are unknown [8]. Known causes of hypertension are chronic and acute inflammatory processes in the kidneys, which increase both upper and lower blood pressure. Another more rare condition is inflammation of the adrenal glands, which leads to an increase in pulse pressure - the difference between upper and lower pressure.

The multifactorial nature of this disease requires a systematic approach to studying the causes of high blood pressure, taking into account the following components: nervous (nervous regulation of the tone of blood vessels), hormonal (renin-angiotensin regulation of the tone of blood vessels), hydrostatic (changes in the volume of the circulatory system due to the elasticity of blood vessels) and hydrodynamic (balance of water transport through the circulatory system), as well as neurodystrophic processes in the autonomic nervous system and kidneys.

Russian doctor G.F. Lang believed that hypertension was not a disease, but a reversible functional disorder in the vascular tone regulation system [6]. G.F. Lang regarded hypertensive illness as "vascular neurosis." He saw the cause of the disease in the obvious impact of extreme external stimuli - conflict situations, emotional overloads. Thus, if the "vascular neurosis" is eliminated at the initial stage, then hypertension will not arise.

Currently, official medicine believes that the cause of hypertension is unknown, and hypertension itself, as a disease, is incurable. The patient must take medications to prevent dangerous consequences for the rest of his life.

A number of researchers have convincingly proven that emotional stress is one of the leading causes of arterial hypertension [6, 9]. Russian scientists were the first to present convincing evidence that the cause of the development of arterial hypertension is primary disorders of the nervous mechanisms of blood pressure control [6, 1, 7].

It has been shown that baroreceptors located in the aorta and carotid arteries are involved in the regulation

of blood pressure. Baroreceptors react with an increase in impulse activity to an increase in blood pressure and inform the vasoconstrictor nerve center of the medulla oblongata about pressure changes [2, 3, 10]. The frequency of baroreceptor impulses depends to a large extent on the rate of change in pressure and to a lesser extent on the level of blood pressure. The prolonged state of high pressure leads to adaptation of the baroreceptors to the pressure level.

From the standpoint of pathophysiology, the volume of the circulatory system changes insignificantly when the pressure rises due to the elasticity of the vessel walls, therefore, the main mechanism of pressure regulation is the change in the tone of the smooth muscles of the arterial walls. At the same time, pressure regulation mechanisms are divided into short-acting mechanisms (reaction time of the order of a few seconds), intermediate-acting mechanisms (tens of seconds and minutes), and long-acting mechanisms (tens of minutes and hours).

Short-acting mechanisms are neural mechanisms. Signals from baroreceptors located in the aorta enter the hypothalamus [4, 5]. From the hypothalamus the signal goes along the sympathetic pathways of the vasomotor nerves and comes to the smooth muscles of the arteries and arterioles. Intermediate mechanisms of blood pressure regulation include changes in transcapillary metabolism and relaxation of the tension in the vessel wall. Both of these mechanisms are mechanisms aimed at reducing pressure.

A longer-acting mechanism that increases blood pressure is realized in the renin-angiotensin system. The renin-angiotensin system is a protective system for normalizing blood pressure in case of pathological decrease in blood pressure and / or blood volume (blood loss caused by trauma). This mechanism is also not relevant to arterial hypertension as it only works at low pressure and for a limited time.

Long-term mechanisms of blood pressure regulation include mechanisms that affect the relationship between intravascular blood volume and vascular capacity. It has been shown that a slight (by 2 - 3%) constant increase in the volume of fluid in the circulatory system when the sympathetic nervous regulation is turned off leads to an increase in blood pressure by almost 50%. Normally, an increase in pressure with an increase in the volume of fluid in the circulatory system is compensated by the activation of nervous vascular reflex mechanisms of short-term regulation, and excess fluid is excreted by the kidneys until the adaptation of nervous mechanisms to new conditions [13, 14].

Arterial hypertension progresses with age and lasts for years. There must be pathological factors that interfere with the powerful mechanisms of blood pressure stabilization. These factors persist for the rest of person's life, often shortening the lifespan and causing strokes and heart attacks.

Purpose of the study: Search for the causes of violations of the processes of stabilization of blood pressure and non-drug methods of normalization of blood pressure.

The contingent of people who participated in the research

The research involved 33 people - participants in the health improvement course with an average age of 43 ± 7 years. The group included 3 doctors who took part in the examinations.

Research methods

The participants underwent examinations of the condition of the muscular corset of the spine, which included: the study of the mobility of the motor segments of the spine by functional tests for lateroflexia - bends of the spine to the right and left, manual diagnostics of the state of the intervertebral muscles.

On the basis of functional tests and manual diagnostics, we revealed the presence of spastic conditions of the intervertebral muscles. As a rehabilitative treatment, the participants were given deep spinal muscle massage, which eliminated spastic conditions of the intervertebral muscles. Each participant underwent a massage session once a week (for 3 to 7 weeks) and performed a set of exercises for the spine. We studied the influence of gymnastics for the spine and also health jogging on one participant who had been regularly involved in jogging and gymnastics for 20 years. Blood pressure was measured right before the massage and 10 minutes after the massage with the Omron M2 Classic tonometer.

Results

In a clinical setting, for 3 months for one of the participans, we studied the development of arterial hypertension from the very beginning and used an experimental non-drug effect on the patient to normalize the blood pressure level. This is a 60-years-old patient (weight 74 kg, height 174 cm, no chronic kidney disease or any other chronic diseases for more than 20 years), who had excellent health, was engaged in jogging for 20 years, and had a stable pressure of 125/80 mmHg.

After prolonged stress, this participant had the blood pressure of 193/90 mmHg with a pulse of 57 - 60. Taking drugs that lower blood pressure, had no effect. We applied relaxation techniques based on Chinese chi kung, which lowered blood pressure in 3 days. The upper pressure dropped to 160 mmHg, and the lower pressure increased to 110 mmHg with a pulse of 100 - 110 at rest.

This pressure level was maintained for more than two weeks before the patient developed a sensation of back pain in the region of the 8th to 12th thoracic vertebrae. The patient underwent a massage session of the muscular corset of the spine. An hour after the massage, the pressure dropped from 160/103 mmHg. to the level of 137/86 mmHg., and after another 2 hours it was stable at 130/83 mmHg. This level was already the norm for the patient.

The patient continued to be in a state of chronic stress, and 2 weeks after the massage, the pressure returned to the level of 160 - 180 mmHg. We again performed 3 massage sessions with blood pressure control. In the first case, after the massage, the pressure decreased from 176/97 mmHg up to 136/83 mmHg. In the second case, after the massage, the pressure decreased from 160/97 mmHg up to 137/88 mmHg. In

the third case, after the massage, the pressure decreased from 159/100 mmHg up to 144/95 mmHg.

Three series of experiments were conducted with the patient:

1) Tibetan gymnastics for 8 days on the shore of the warm sea;

2) 7 experimental runs: each run in 3 stages of 1650 meters each at a speed of 10 km / h, and performing gymnastic exercises for the spine after each stage;

3) 10 experimental runs of 5 km per day at a speed of 10 km / h with Tibetan gymnastics exercises for the spine after running. Each series of experiments resulted in blood pressure normalization.

1. Rest with the daily Tibetan gymnastics "Five Tibetan Pearls" gradually led to the normalization of blood pressure. We quote the figures for daily monitoring (mmHg / hr): 160/100 - 100; 154/104 - 96; 158/90 - 94; 150/90 - 93; 152/91 - 93; 144/90 - 73; 134/82 - 75; 133/81 - 65. Indicators were measured at the same time and under the same conditions.

2. Experiments with a combination of running and Tibetan gymnastics were especially revealing. The average blood pressure at the beginning of the day for the first three days of the experiment was 141/89 mmHg, and at the end of the day 123/86 mmHg. Over the past three days, the average blood pressure at the beginning of the day was 126/83 mmHg, and at the end of the day - 129/81 mmHg.

An experimental run in 3 stages of 1650 meters each at a speed of 10 km / h and performing gymnastic exercises for the spine after each stage led, on average, to a decrease in the upper level of pressure from 150 to 135 mmHg and an increase in the lower pressure level from 88 to 91 mmHg.

Functional tests for the mobility of the motor segments of the spine and manual diagnostics showed that stress caused spastic conditions of the muscles of the spine in the lower thoracic region in the patient.

Massage of the muscular corset of the spine eliminated spastic conditions in the muscles. After jogging and gymnastics, the spastic states of the muscles disappeared. We have found that the condition of the muscular corset of the spine affects the regulation of blood pressure. Hypertonicity and spastic conditions of the intervertebral muscles in the lower thoracic spine lead to a persistent increase in blood pressure. A likely mechanism of this effect is the compression of the sympathetic nerves that control the transport of water through the kidneys.

Elimination of spastic conditions of the intervertebral muscles with the help of massage and gymnastics for the spine regularly led to the normalization of blood pressure.

For 6 months at the Research Institute of General Pathology and Pathophysiology, we studied the influence of health-improving factors on the value of blood pressure. We had 33 subjects - volunteers, among whom were persons suffering from arterial hypertension. We divided all subjects into three groups: persons with normal pressure, SBP 90 - 120 mmHg - 16 people, persons with prehypertension, SBP 120 - 140 mmHg - 11 people and persons with arterial hypertension, SBP more than 140 mmHg - 6 persons. For all of them, we applied deep spinal muscle massage, which removes muscle blocks in the muscular corset of the spine, 3 to 7 times.

In persons with normal blood pressure, immediately after the massage, the pressure decreased on average by less than 2 mmHg. Before massage: 108 ± 8.5 / 69.3 ± 7.2. After massage: 106.5 ± 12.2 / 69.5 ± 8.2 (N = 39).

In persons with high blood pressure, immediately after the massage, the pressure decreased on average by 6.8 mmHg. Before massage: 124.8 ± 9.1 / 77.5 ± 7.6. After massage: 118 ± 8.2 / 74.5 ± 6.0 (N = 39).

In persons with high blood pressure, immediately after the massage, the pressure decreased by an average of 9 mmHg. Before the massage, the pressure was 149 ± 11.8 / 86 ± 12.6 mmHg. After the massage, the pressure significantly decreased: 140 ± 12.7 / 87 ± 13.4 mmHg (N = 22).

Gymnastics for the spine led to a persistent decrease in pressure. Before the exercises, the pressure was 147 ± 14.4 / 91 ± 6.7 mmHg. Immediately after the exercises, the pressure rose by an average of 3 mm Hg. and reached 150 ± 17.7 / 88 ± 6.8 mmHg. After 15 minutes, it decreased by an average of 7 mmHg in relation to the initial and amounted to 140 ± 10/89 ± 7.4 mmHg (N = 13) and persisted for a long time (more than 2 hours).

Jogging led to a decrease in blood pressure by an average of 7 mmHg 10 minutes after the end of the run. The pressure before the start of the run was 141 ± 12.8 / 85 ± 6.42 mmHg (N = 9). After the end of the run, the pressure dropped to 134 ± 13.2 / 87 ± 7.3 mm Hg (N = 9). An hour later, the pressure dropped to 121 ± 9.8 / 80 ± 6.8 mmHg (N = 7) and remained so for up to several hours (4 - 6).

These observations show that arterial hypertension is associated with the condition of the muscular corset of the spine. All volunteers who took part in the study and had high blood pressure had problems with the spine. Elimination of spastic conditions in the intervertebral muscles led to the normalization of blood pressure in people with high blood pressure and a significant decrease in pressure in people with arterial hypertension. The effect of gymnastic exercises for the spine and jogging on blood pressure also confirms the existence of a neural component of hypertension. All these methods can be recommended as preventive and rehabilitative measures to combat arterial hypertension [11, 12].

Inflammatory processes in the kidneys - the second cause of persistent arterial hypertension

There are two more factors that lead to arterial hypertension.

These are inflammatory processes in the kidneys - pyelonephritis and inflammatory processes in the adrenal glands, leading to an increased production of adrenaline. These are the same 15% of cases known from the point of view of WHO experts as the causes of persistent hypertension. In the first case, with a high upper pressure, the lower pressure is also high, and the difference between them can be normal or reduced, i.e. 40 mmHg or less. In the second case, the lower pressure

is normal or slightly reduced, and the difference between the upper and lower pressure is 60 to 100 mmHg.

Such a big difference is caused by the powerful cardiac output under the influence of adrenaline, but the cause of the adrenaline release is not a stress, but the inflammatory process in the adrenal glands. This condition manifests itself as a sympatho-adrenal crisis. And until the inflammatory process in the adrenal glands disappears, the upper pressure will not decrease. There is a third option - simultaneous inflammation of the kidneys and adrenal glands. In this case, a high value of lower pressure and a large difference between the upper and lower pressure are possible. In both of these cases, it is necessary to eliminate the causes of the inflammatory process.

In our practice, we have encountered conditions characterized by a pressure of 193/100 mmHg, 208/110 mmHg and even 234/115 mmHg with a pulse below 70 beats per minute. These conditions were also reactions to stress, but they disappeared only after the elimination of inflammatory processes in the kidneys and adrenal glands. The cause of the inflammatory processes was the accumulation of metabolites in the blood, caused by the poor condition of the large intestine, and hypothermia of the kidney area was the provocateur.

In our health-improving activities, we have also encountered a combination of nervous and inflammatory processes. Another provocateur of a rise in pressure is a persistent pathological reflex caused by nervous overstrain or persistent neurosis. In the presence of an inflammatory process in the adrenal glands, a slight nervous tension is enough and the pressure rises dramatically to 200/100 mmHg, and more up to 234/110 mmHg. This rise in pressure is caused by an increased release of adrenaline and, as a consequence, an increase in myocardial contraction and an increase in cardiac output.

In the presence of an inflammatory process in the adrenal glands, a slight nervous tension is enough and the pressure rises dramatically to 200 mmHg and more. In this situation, it is necessary to eliminate not only the inflammatory process, but also neurosis and nervous tension caused by mental work. It is necessary to engage in physical activity and disconnect for a long time from intense mental activity.

Discussion

Analysis of the causes of arterial hypertension. Water transport through the circulatory system

Every day, up to 10 liters of fluid is absorbed into the circulatory system and excreted from it, which is almost 2 times the volume of blood in the circulatory system. This is up to 3 liters of water consumed with food, up to 6 liters of digestive juices produced by the: stomach (2.5 liters), pancreas (0.7 liters) and the proximal part of the small intestine (the first half of the small intestine, 2.5 liters). All these 10 liters are absorbed back into the circulatory system in the distal part of the small intestine and along the entire length of the large intestine.

From the intestinal wall, the blood passes through the liver and is pumped back into the bloodstream. Another way of injecting fluid from the intestine into the circulatory system is through the lymphatic system of the small intestine through the main lymphatic vessel into the subclavian vein (on average, up to 1 liter per day). In addition, the oxidation of carbohydrates in the body produces additional 0.5 liters of metabolic water. Some of the water is excreted from the body through respiration and sweat, but most of it is excreted by the kidneys. At the same time, the level of blood pressure remains stable. In fact, there is a “third circle of blood circulation” in the circulatory system - the circulation of fluids through the circulatory system.And whatever the blood pressure, and whatever the tone of the blood vessels, the "pumps" of the small and large intestines will still "pump" these 10 liters of fluid into the bloodstream. This volume of fluid from the circulatory system will be transported back to the gastrointestinal tract, and its excess will be excreted from the body through the kidneys. In this case, the question arises: what kind of system maintains the balance in the movement of 10 liters of fluid per day (200% of the volume) through the circulatory system? It is quite obvious that this is the metasympathetic nervous system of the kidneys controlled by the hypothalamus. With an increase in pressure by 1 mmHg excretion of water by the kidneys increases by 100%. The excretion of water by the kidneys can increase by 8 times even with a slight increase in blood pressure up to 10 mmHg [13]. This is what stabilizes blood pressure under the control of the hypothalamus. The denervated kidneys reduce their characteristic "pressure - speed of water transport" by 6 - 8 times [13].

The sympathetic nerves of the kidneys exit the spine at levels 9, 10, and 11 of the thoracic vertebrae. When muscle blocks appear in this part of the spine, compression of sympathetic nerves is possible, which, unlike motor and sensory nerves, do not have a strong myelin sheath. Compression of the sympathetic nerves that control the kidneys manifests itself similarly to denervation, and switches the kidneys to be controlled by their own metasympathetic nervous system; the kidneys continue to stabilize blood pressure, but at a higher level. In fact, we are dealing with functional partial denervation of the kidneys. This is what we see as the main reason of arterial hypertension.

We believe that the data we have obtained are sufficient for the formation of a hypothesis that needs to be tested in a clinical setting.

Hypothesis

Persons suffering from persistent arterial hypertension also have a stabilization of blood pressure, but at a higher level. Control over the level of pressure is carried out by the sympathetic division of the nervous system along the chain: baroreceptors, hypothalamus, sympathetic nerve paths passing inside and out of the spine in the region of thoracic vertebrae 9-11, sympathetic fibers of the spinal nerves, neurons of the sympathetic trunk, neurons of the celiac ganglion and metasympathetic nervous system of kidneys. Fibers of the sympathetic nerves do not have a strong myelin sheath and can be compressed as they pass between the stiff spasmodic muscles of the spine. When the sympathetic nerve fibers of the kidneys are compressed in the region of the 9-11 thoracic vertebrae,

the normal control of fluid excretion from the circulatory system is impaired. The meatsympathetic nervous system of the kidneys, which has a higher threshold for regulating the pressure of fluid transport, stabilizes the volume of fluid in the circulatory system, but already at a higher blood pressure. This, regulation at a higher level of blood pressure manifests itself as persistent arterial hypertension.

Rehabilitation measures to restore the sympathetic innervation of the kidneys (massage, gymnastics for the spine and good rest) are aimed at eliminating spastic conditions of the intervertebral muscles. They are able to prevent the development of hypertension at its initial stage. At later stages of the development of arterial hypertension, dystrophic processes in the sympathetic innervation and metasympathetic nervous system of the kidneys are very likely, which will not allow one to quickly defeat the state of arterial hypertension. However, this does not mean that rehabilitation measures will be useless. Massage of the muscular corset of the spine leads to a prolonged decrease in pressure from 7 to 15 mmHg. A regular and long-term healing effect on the muscular corset of the spine leads to the disappearance of muscle blocks and eliminates the compression of the sympathetic nerves emerging from the spine as part of the spinal nerves [12].

Conclusions.

1. Primary arterial hypertension is not a disease, but a reversible functional disorder in the sympathetic part of the nervous system, which regulates the excretion of fluid from the circulatory system through the kidneys.

2. Rehabilitation measures to eliminate spastic conditions in the intervertebral muscles and to restore the sympathetic innervation of the kidneys (massage, gymnastics for the spine and good rest) can prevent the development of hypertension at its initial stage.

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